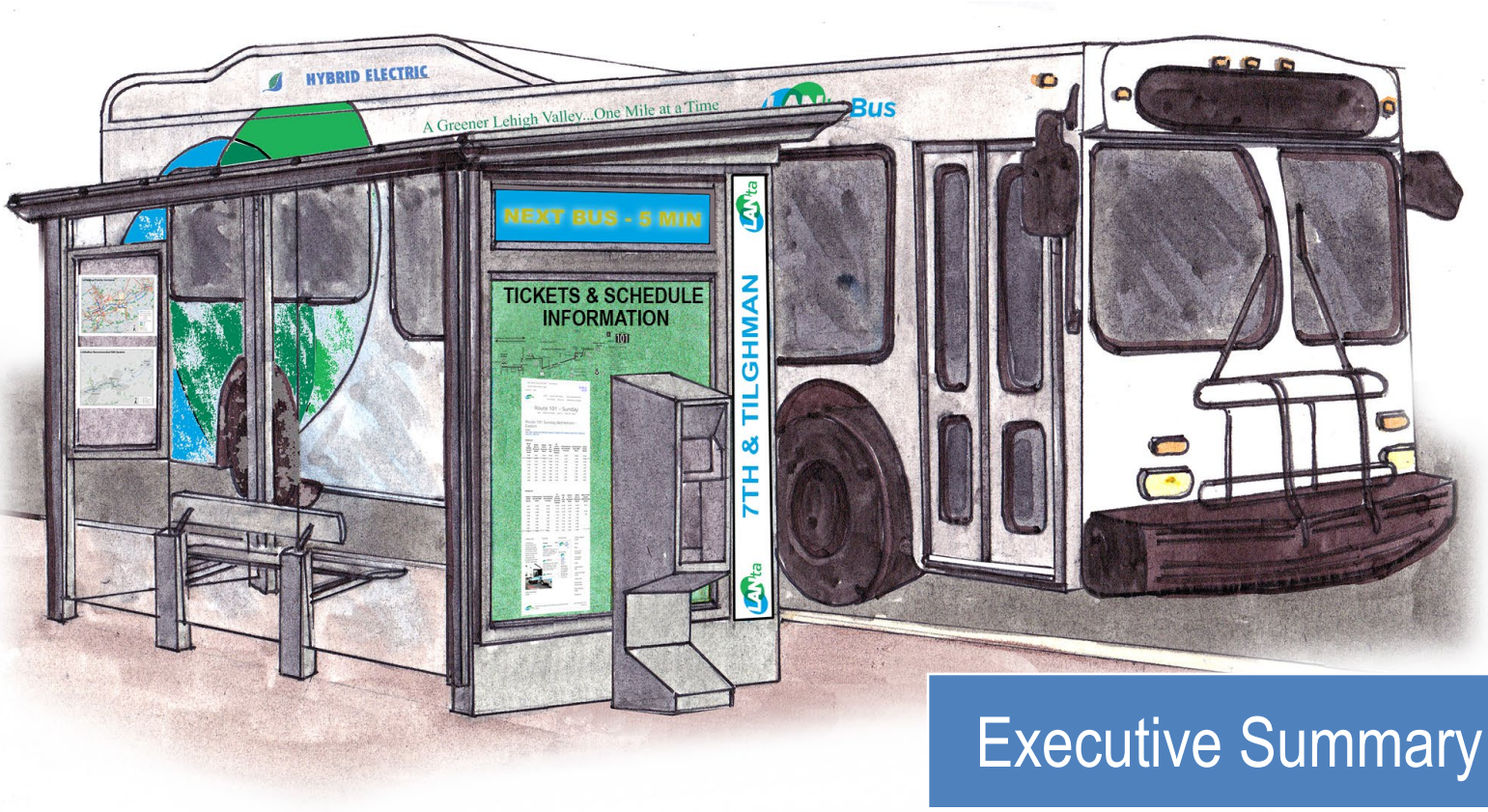
LANTA ENHANCED BUS SERVICE STUDY



Executive Summary

Prepared for:
Lehigh and Northampton Transportation Authority

Prepared by:
AECOM
HDR Engineering
Taggart Associates

Prepared March 3, 2014

Updated July 28, 2022

EXECUTIVE SUMMARY

Moving LANTA Forward

On August 29, 2011, the Lehigh and Northampton Transportation Authority (LANTA) implemented a fully re-designed route network, a key component of Moving LANTA Forward, a twelve-year strategic vision for public transportation in the Lehigh Valley. Moving LANTA Forward was completed in accordance with both the bi-county Comprehensive Plan – The Lehigh Valley 2030, which prioritized congestion reduction, suburban growth management, establishment of a link between land use and transportation decisions, revitalization of urban centers and preservation of agricultural land, and the LANTA Strategic Plan 2004-2015, which established a part of LANTA's mission to "support desired economic and environmental goals". The Service Plan of Moving LANTA Forward included four elements:

1. Core Service Improvement Plan;
2. Service Coverage Expansion Plan;
3. Enhanced Bus/Bus Rapid Transit Plan; and
4. Rail Modes Planning.

To further the planning of element 3, the Enhanced Bus/Bus Rapid Transit Plan, LANTA commissioned this study, which includes the preparation of a conceptual enhanced bus/bus rapid transit service plan, identification of regional goals and objectives for the service, analysis of demand and potential benefits within each corridor, identification of a "trunk" corridor or corridors, development of a conceptual design plan for the corridor(s), and a final implementation plan which together may be considered as an application to the FTA for the Very Small Starts program.

LANTA spent the following few years performing additional scoping exercises, determining the official name and branding for the project (EBS), establishing necessary funds to establish baseline service, and developing an implementation plan. This document was updated in order to incorporate the results of these activities and to establish the plan for implementation.

In March of 2021 LANTA began the implementation phase.

GOALS AND OBJECTIVES OF ENHANCED BUS SERVICE

The Problem Statement

The following are the goals and objectives of Enhanced Bus Service (EBS) in the Lehigh Valley, as determined by the study team with input from the LANTA Board and the Study Advisory Committee. Input from the series of public meetings was also considered and incorporated. The broad program goals for the development of Enhanced Bus Service in the Lehigh Valley include:

- Benefit current riders;
- Expand the transit market – attract new and choice riders;
- Promote revitalization of the Valley's urban core;
- Maximize productivity (riders per hour); and
- Be financially feasible.

In accordance with these goals, all potential enhanced bus corridors were evaluated utilizing the aforementioned criteria to identify a recommended implementation corridor for more detailed planning. It was also recognized that the Problem Statement this study would therefore address is:

> *In response to growth in population and vehicle traffic in the Lehigh Valley, implementation of Enhanced Bus Service would encourage sustainable growth and revitalization of the region's urban cores as well as growth in transit use rather than private vehicle use.*

Corridor Selection Process

In the initial phase of the Lehigh Valley Enhanced Bus/BRT Study, eight corridors of the LANTABus system were selected to be "trunk corridors" for further analysis. These corridors represent many of the busiest segments of the existing LANTABus system, connecting the downtowns of Allentown, Bethlehem and Easton with many of the most popular trip generators in the Lehigh Valley, such as major employment areas, hospitals, shopping districts, university districts, park-and-ride facilities and entertainment destinations. While most of the corridors are centered on Allentown where bus ridership is the strongest, three corridors connect Allentown with Bethlehem and one corridor connects Bethlehem with Easton. The eight selected trunk corridors are shown in Figure 1.

These trunk corridors were further developed to show comparative boardings and alightings, productivity and transit mode share. The corridors were then combined and reconfigured into four priority corridors, including those portions of the eight trunk corridors primarily with the highest ridership and thus the best candidates for implementation of Enhanced Bus Service. Each priority corridor connects several major generators and/or high-ridership areas and impacts more than 3,000 passengers. Figure 2 shows the extent of the four priority corridors chosen.

The priority corridors were evaluated based on a set of eight criteria, designed to reflect the goals and objectives of the Enhanced Bus Service as determined at the outset of the study and which would thus address the Problem Statement. The corridors were then ranked for each criterion, aggregated, then given an overall score and rank. Criteria included: travel time savings, net gain in passenger trips, transit-supportive land-use potential, productivity (passengers per revenue hour), total cost of the project, financial effectiveness (subsidy per passenger) and total corridor ridership. The corridors selected as a result of this project were then developed into full service, financial and capital plans.

In 2019, the Lehigh Valley Planning Commission issued the report, *FutureLV: The Regional Plan*, which highlighted changes in land uses of regional significance across the Lehigh Valley. Particularly of note is the explosive growth of warehousing and light industry in areas north of Easton and west of Allentown. These changes in land use called for additional scoping of the corridors in 2019 and 2020.

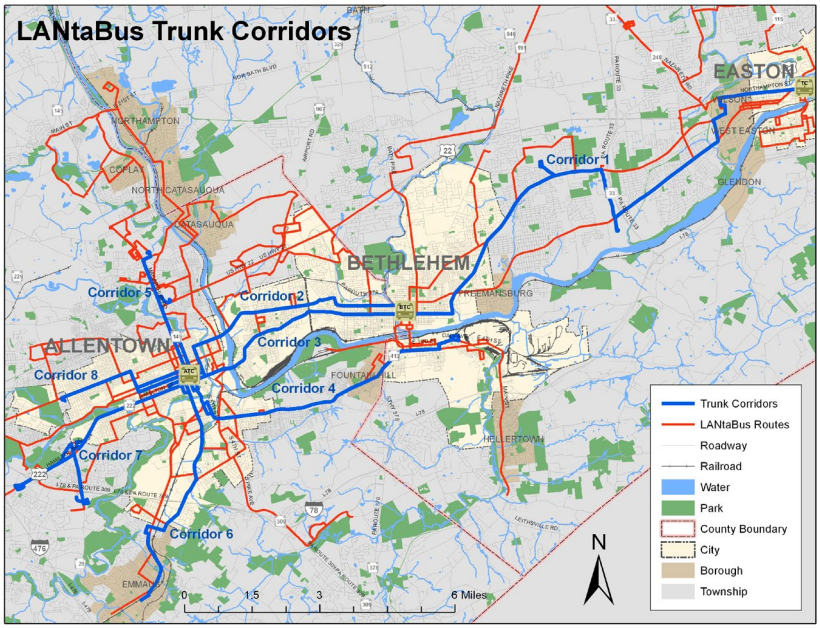


Figure 1: Initial Eight Trunk Corridors

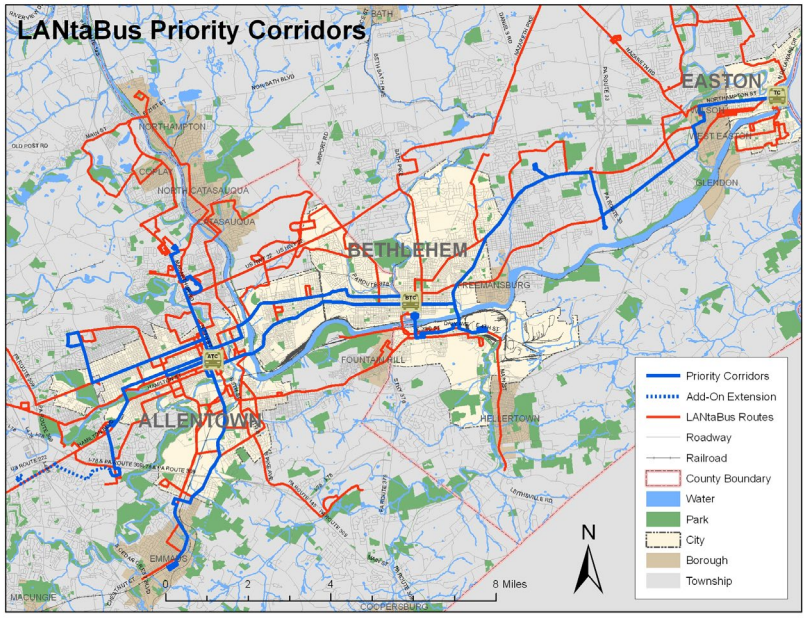


Figure 2: Four Priority Corridors

Public Involvement

A public involvement plan enriches the planning process by obtaining key input from key community members and stakeholders in a project. The public involvement process for this study was broken down into four major components:

1) **Advisory Committee Meetings** – A project Advisory Committee was assembled early on in the study, comprised of representatives from LANTA, the Lehigh Valley Planning Commission, PennDOT, the local municipalities, and leaders of key stakeholder groups. Six meetings were held where the Consultant Team and LANTA staff presented to the Advisory Committee and answered questions and obtained input.

2) **Board Workshops** – Three workshops were held with the consultant team, LANTA staff and the LANTA Board in order to provide the Board with an opportunity to comment and provide guidance to the consultant team.

3) **Public Open Houses** – Approximately midway through and again near the end of the study Public Open Houses were held in Allentown, Bethlehem and Easton in order to provide an opportunity for the public to comment on the initial ideas (first round of meetings) and proposals (second round of meetings) presented by the study team.

4) **Stakeholder Meetings** – After the initial plans for the recommended EBS corridors had been developed, the study team consulted with representatives from the Cities of Allentown, Bethlehem and Easton, as well as Whitehall Township and PennDOT, to determine the feasibility of the recommended improvements and Enhanced Bus treatments along each corridor.

Selected Corridors

Upon review of the Priority Corridors, it was determined that an amalgamation of the some of the strongest corridors would provide service to many of the Lehigh Valley's densest neighborhoods and most heavily used stops/popular destinations. A recommended Enhanced Bus Service (EBS) "system" was developed, consisting of two routes that serve the densest portions of the Lehigh Valley—both with respect to land use and to ridership—as well as link the Valley's three cities. This system would be implemented in phases, which are further outlined in Technical Memorandum 5: Conceptual Design and included in the final project report.

The recommended EBS "system" includes two routes, originally referred to as "EBS 1" and "EBS 2", and rebranded in 2021 to be EBS "Green Line" and "Blue Line" respectively.

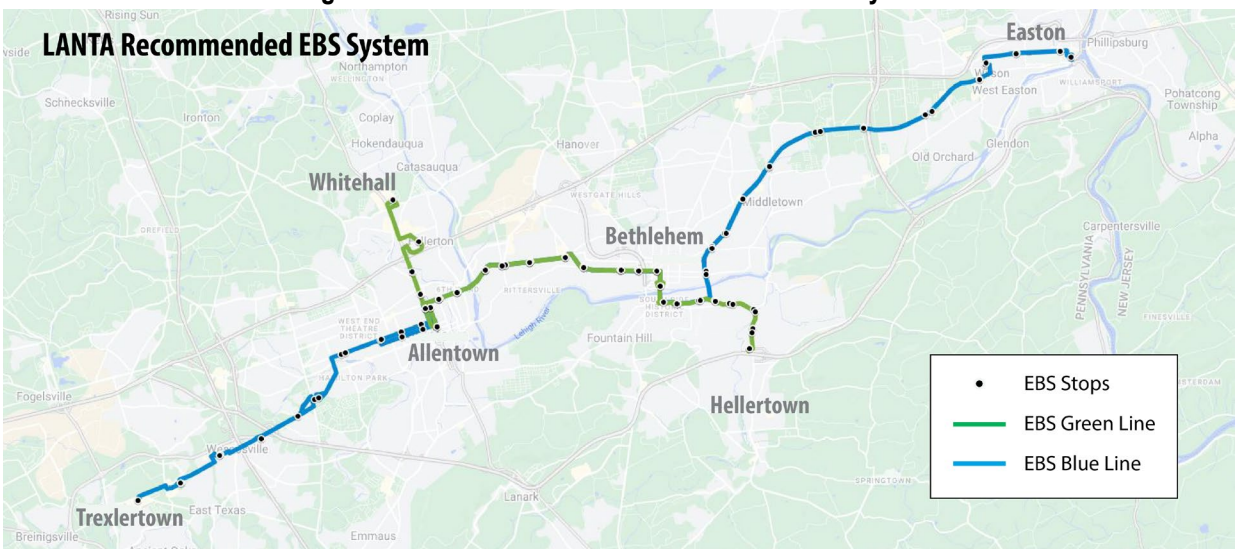
- The Green Line is a 14.1 mile line serving the core urban areas of Allentown and Bethlehem. This line connects shopping in Whitehall Township to Southside Bethlehem via center city Allentown and downtown Bethlehem.
- The Blue Line is a 26.8 mile line connecting the entire valley east to west from the emerging jobs center in Trexlertown / Breinigsville all the way to downtown Easton.
- Both lines share a 6 mile core alignment along Union Blvd and West Broad Street connecting to destinations like Coca-Cola Park, Airport Rd, and the Lehigh Shopping Center.

Figure 3 shows the recommended full EBS System buildout, with approximate stop locations.

A number of changes were made to the proposed alignments between the 2014 and 2021, following additional scoping. These changes include:

- Expansion of the Blue Line to Trexlertown in response to growing demand in the US-222 corridor.
- Streamlining the Blue Line in the Easton area to operate more directly along William Penn Hwy to increase speeds, lower end-to-end travel times, and increase productivity.
- Realigning the Core between Allentown and Bethlehem to Union Blvd & Broad Street in response to event traffic in downtown Allentown and to better access job and entertainment destinations along Union.

Figure 3: Recommended Enhanced Bus Service System



Transit Service Plan

The recommended EBS system includes two routes, which are designed to be as convenient and reliable as possible, as well as to serve the portions of the Lehigh Valley with the greatest demand for bus service. Service on both proposed EBS routes would operate seven days per week, from approximately 5:00 AM to 11:00 PM on weekdays, 6:00 AM to 11:00 PM on Saturdays, and 10:00 AM to 6:00 PM on Sundays. These service spans are subject to change based on demand.

On weekdays, the Green Line would operate every 15 minutes during the peak periods, every 20 minutes off-peak, and every 60 minutes in the evening. The Blue Line would operate every 30 minutes during the peak, and every 60 minutes off-peak and during the evening. The combined frequency along segment common to both Blue & Green Lines (between the ATC and Southside Bethlehem) would be every 10 minutes during the peak periods, every 15 minutes off-peak, and every 30 minutes in the evening. It should be noted that these frequencies would not be achieved at the initial implementation Phases.

Phasing

Implementation of the full Enhanced Bus System at once would be an expensive proposition, requiring a large amount of capital expenditure on new vehicles and priority treatments, as well as a large increase in operating costs all at once. Therefore, in order to create more financially feasible changes, as well as to encourage steady ridership growth, implementation is broken out into six phases. Each phase would last approximately one to two years, allowing LANTA service planners the ability to analyze impacts incrementally. Subsequent phases would only be implemented when resources are available.

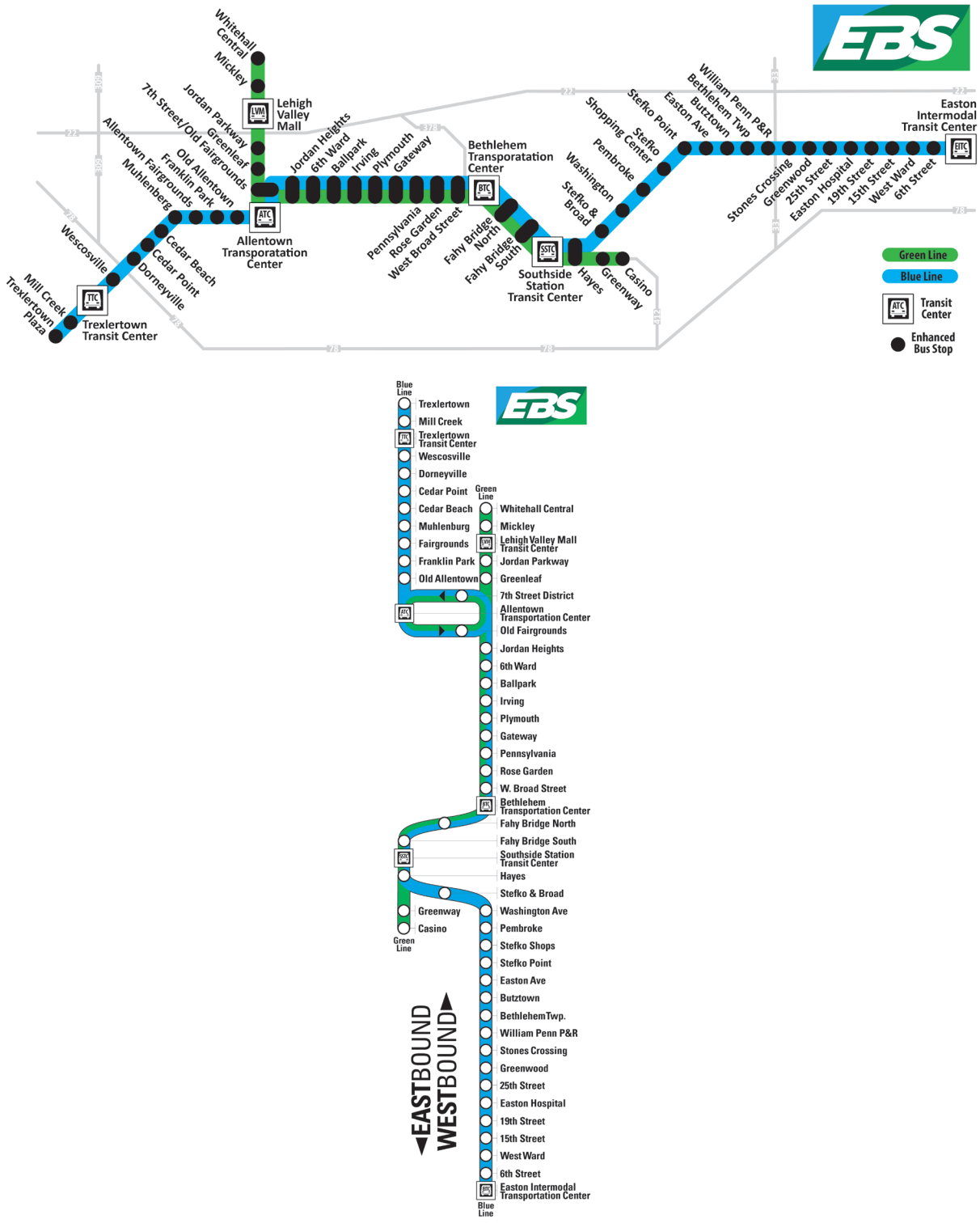
Modifications to existing local LANTABus routes will occur throughout the plan's implementation. These modifications were designed to minimize the number of stops at which the frequency of service would be reduced, as well as to avoid the occurrence where existing riders lose service. Modifications were tailored to demand levels, focusing resources where they are most needed as possible while continuing to maximize coverage of the LANTABus service area.

Buildout of the EBS system will generally be completed in Phases. Each Phase will be implemented as resources become available:

- **Phase I** represents the "Minimum Operable Segment", as determined by the study team. This phase includes the combining of LANTA Routes 101 & 322 along the Blue Line corridor as Route 101, introducing limited stop service to the Core alignment between Allentown and Bethlehem. Route 102 maintains local, underlying service. Routes in the Easton area are redesigned to better connect with the new Route 101 alignment.
- **Phase II** includes the introduction of Route 100 along the Green Line corridor. Routes in the Allentown area are redesigned to better connect with the new Route 100 alignment. Some local stop segments remain to mitigate adverse impacts to riders.
- **Phase III** includes final alignment adjustments and service increases to allow for full limited stop service across the system. Route 101 will be renamed Blue Line and Route 100 will be renamed Green Line at this time. Route numbers 100 and 101 will be retired but may be reused for local services at a later date if needed.
- **TSM (Transportation Systems Management)** represents a less-resource-intensive alternative to the full build-out of the EBS system. The TSM phase is intended to maintain service levels and schedules for a multi-year period in order to bolster EBS service as a reliable and permanent fixture. During the TSM phase, the EBS system will be promoted as a new service type for the region. Alignment and schedule changes to other LANTA routes may be made to meet changing needs across the region, but the Blue and Green Lines should remain consistent. The TSM phase marks a shift from Operational to Capital improvements on EBS.
- **Phase IV** includes capital improvements to all EBS station stops. Stop improvements will be made based on individual neighborhood feedback. This phase may be implemented over a multi-year period in concurrence with the TSM phase.
- **Phase V** includes implementation of on-street optimizations including bus lanes, signal timing adjustments, Traffic Signal Priority, and other improvements identified in project engineering documents.
- **Phase VI** would include frequency improvements on the Blue and Green Lines, reaching full build-out of the system in terms of both coverage and level of service. Expansion of service to Hellertown is possible at this time, based on additional scoping. This phase requires the construction of a new garage facility to accommodate additional fleet requirements for full service.

Figure 4 shows a schematic representations of the recommended EBS system during the TSM phase.

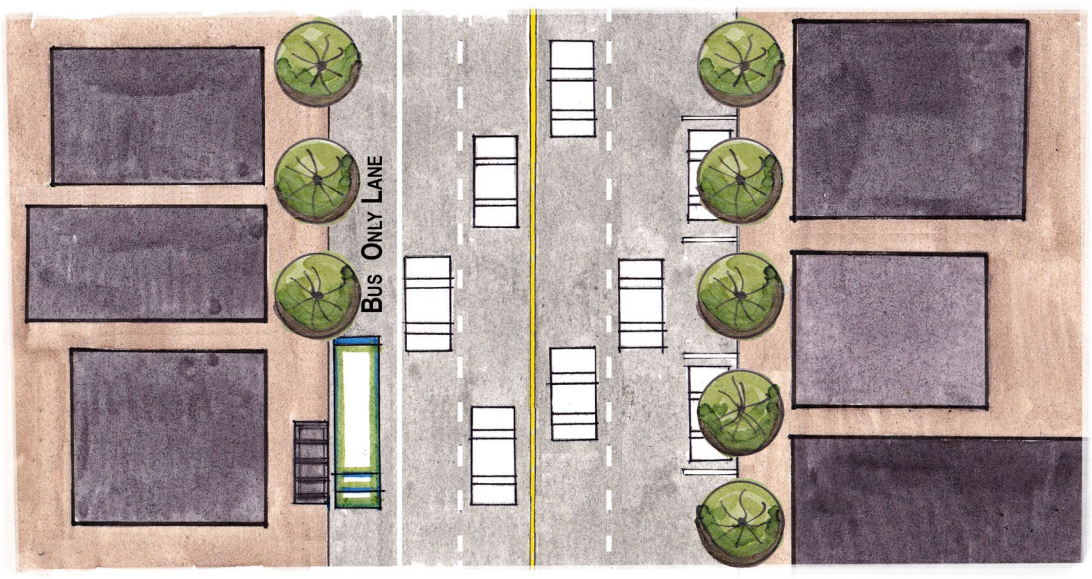
Figure 4: Horizontal and Vertical Schematics of Recommended TSM Phase EBS System



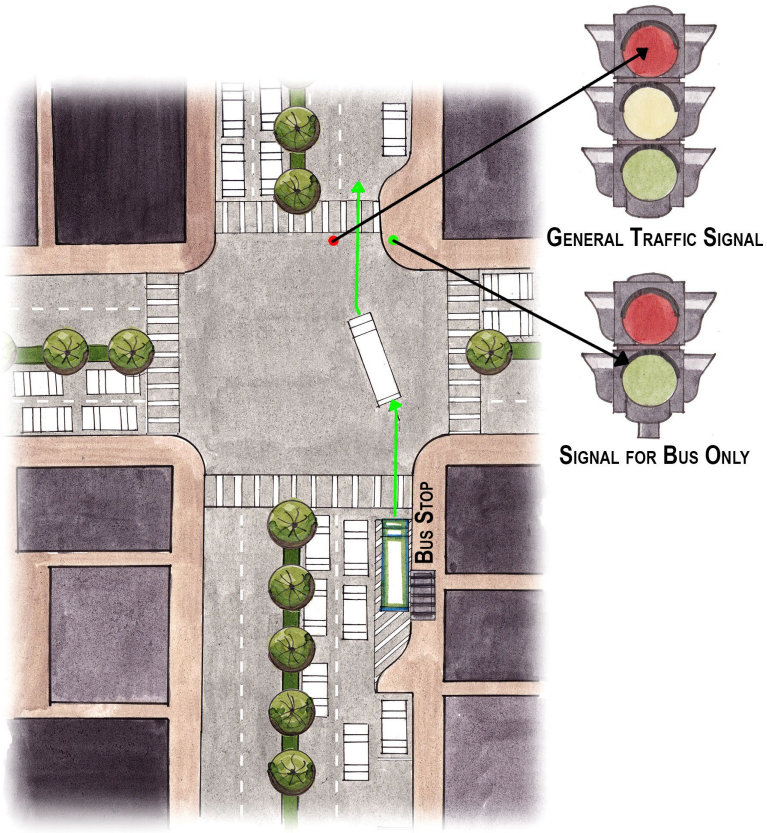
Running Way Treatments

Running way treatments adjust the streetscape to be more accommodating to bus service, either by improving the pedestrian environment or by allowing buses to more easily or more quickly navigate the route, thus improving overall reliability. The following running way treatments were considered for LANTABus Enhanced Bus Service:

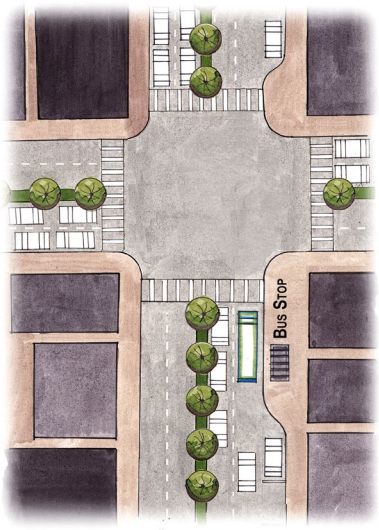
- **Off-Board Fare Collection** – fare payment at machines prior to boarding
- **Moving Bus Stop Locations** – moving local bus stops to locations that allow limited-stop buses to pass
- **Signal Optimization** – adjustments to traffic signal phases to decrease travel times for buses
- **Transit Signal Priority (TSP)** – signals that are triggered by proximate buses to stay green longer or change to green sooner
- **Bus Lanes** – lanes used exclusively by buses all or part of the day:



- **Queue Jumps** – lanes/signals that allow buses to bypass traffic queued at signals:

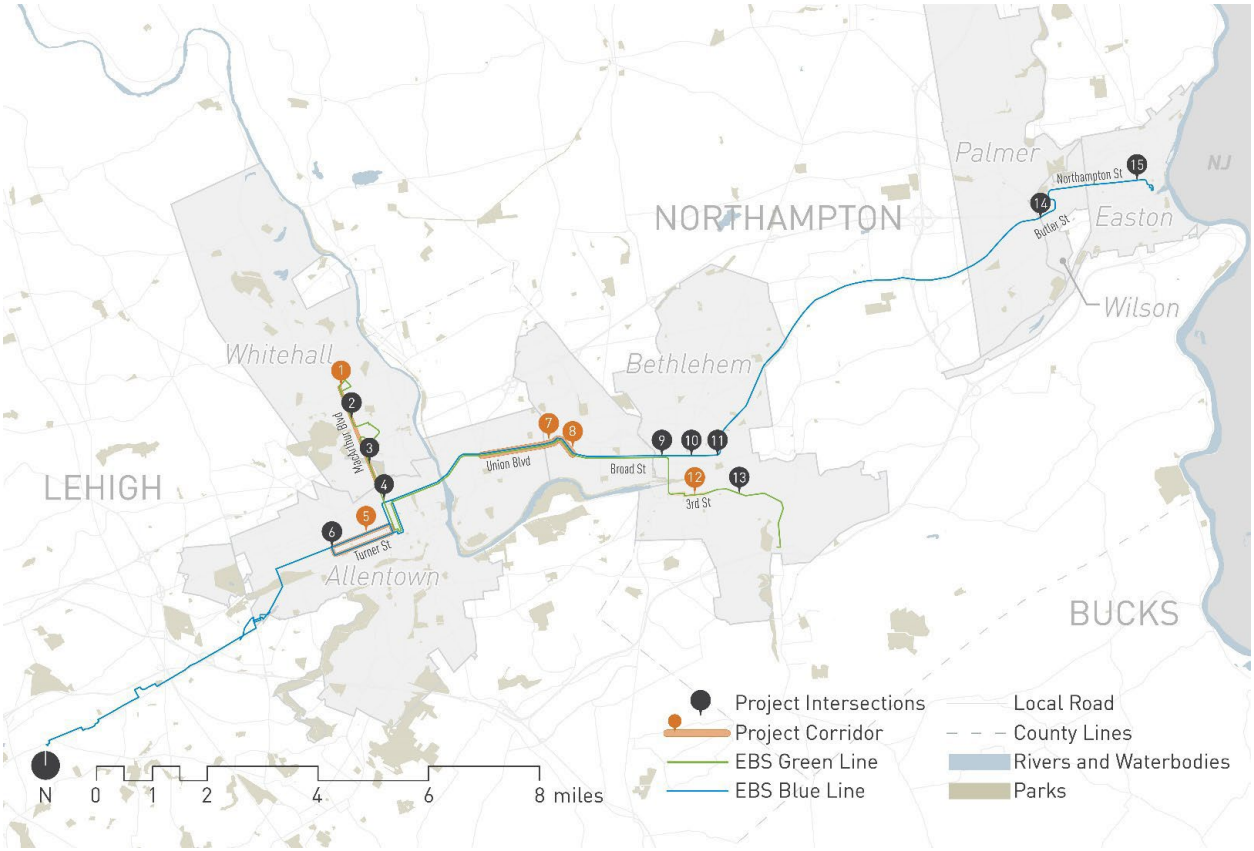


- **Bus Bulbs** – sidewalk expansion across the parking lane to the travel lane to provide enhanced passenger amenities and allow buses to remain in the travel lane at stops:



In July 2022, PennDOT and LANTA completed the Transit First study to identify recommended on-street improvements that can be individually implemented as funding and coordination allows. These projects are to be implemented in Phase V over the multi-year TSM phase of the project.

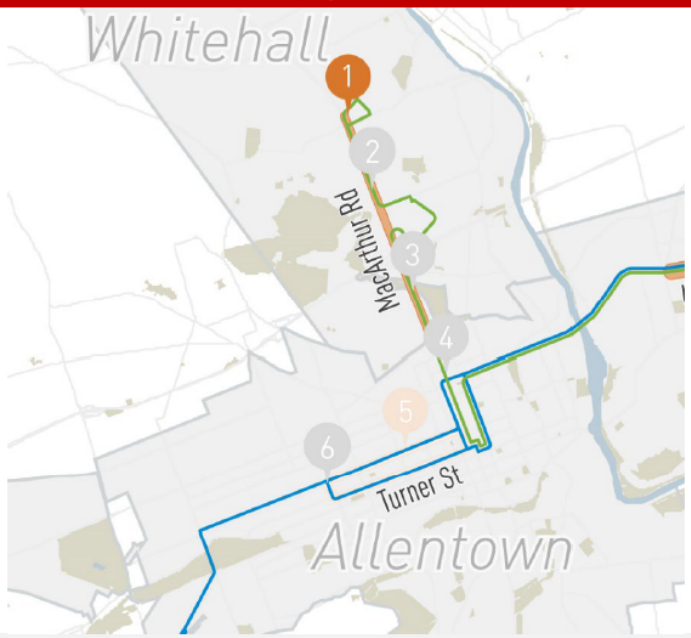
Figure 5: Recommended EBS Treatments

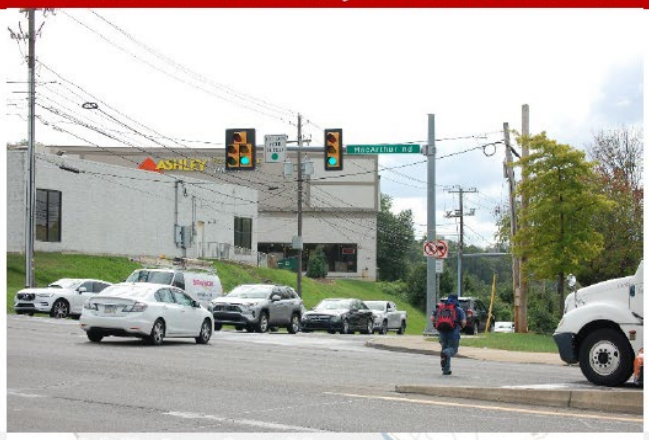
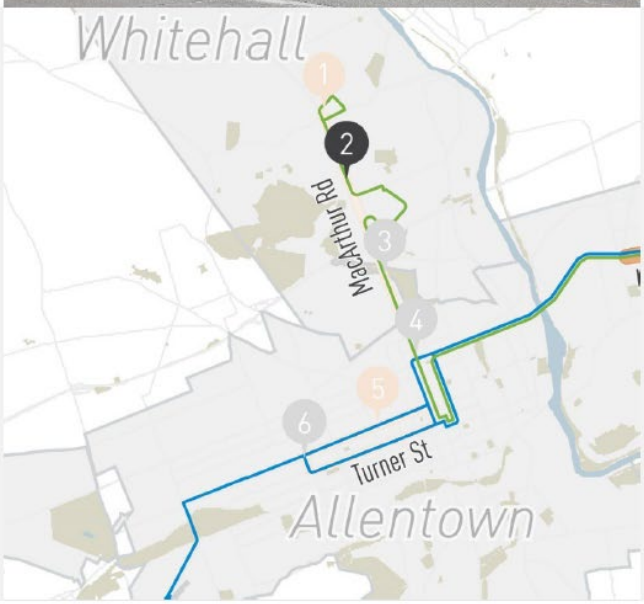


Fifteen projects are included across the region. These are classified as Intersection improvements and Corridor improvements.

The following pages outline the individual projects and assumptions. Each project will be pursued individually, in coordination with local municipalities and governing bodies.

Some projects may be combined to better coordinate implementation.

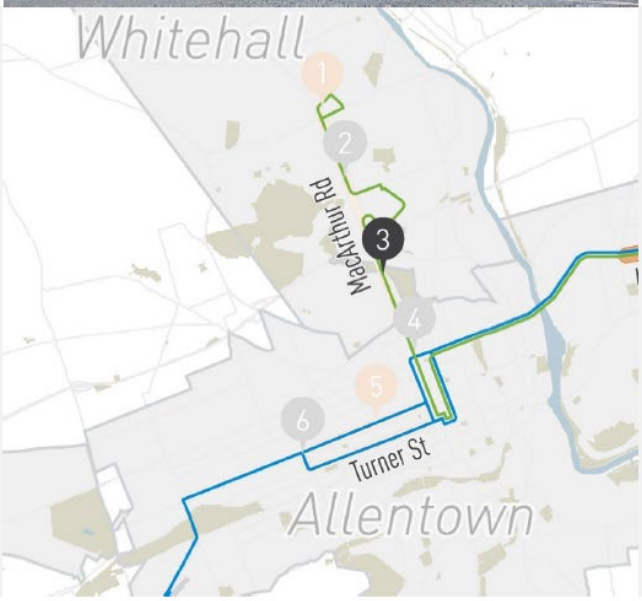
Project Number	#1 – MacArthur Rd (Royal Ave to W Whitehall St)
Location	
Municipality	Whitehall Township and City of Allentown
Station Name/ Corridor	No Existing Stops - Green Line
Project Type	• Bus lanes
Project Description	• Install bus lanes from Royal Ave to W Whitehall St
Benefits	• Reduces travel times and delays and increases reliability • Reduces transit delays due to traffic congestion
Action Items	• Develop conceptual design alternatives and a preferred alternative for bus lanes • Determine bus lane markings paint type • Complete maintenance agreement with PennDOT District 5 during design process • Conduct traffic analysis to determine feasibility of bus lane configurations (e.g., repurposing travel lanes, widening, or mixed-flow operations) • Identify environmental "red flag" issues • Conduct detailed survey for base map and utilities • Determine project financial feasibility and implementation plan • Coordinate with PennDOT on the diverging diamond interchange project to ensure the selected bus lane concepts can be integrated into the project • Conduct a study to evaluate the feasibility for different bus lane options
Capital Cost Estimate	• Side Running Bus Lane Option: $2,467,353.00 • Center Running Bus Lane Option: $28,799,614.00 • *Assumptions: Pavement markings only*
Benefit Estimate	• $4,264,998/year in Travel Time Savings

Project Number	#2 – MacArthur Rd and Mickley St (Northern Intersection)
Existing Condition	
Location	
Municipality	Whitehall Township
Station Name/ Corridor	No Existing Stop - Green Line
Project Type	• New Bus Stops • Pedestrian Crossing

Project Number	#2 – MacArthur Rd and Mickley St (Northern Intersection) – Continued

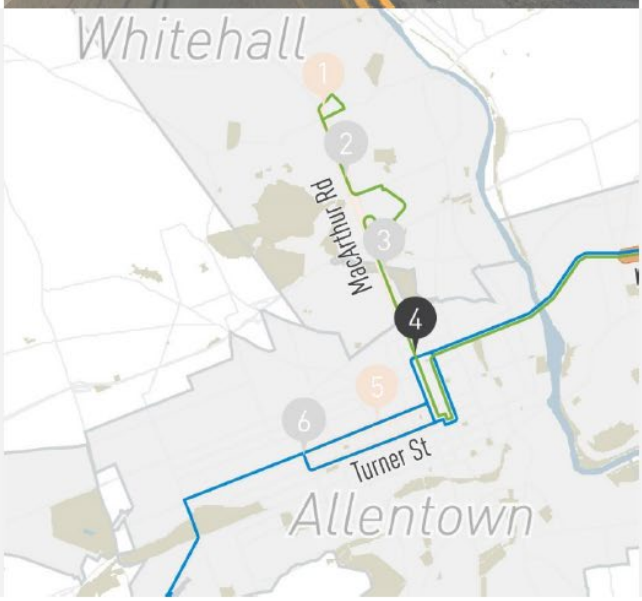
Project Description	• Install new bus stops on MacArthur Rd
	  ○ Northbound – Far side stop
	  ○ Southbound – Near side stop
	• For the northbound and southbound stops, install full size shelter with all amenities including the following:
	  ○ Realtime signage
	  ○ Unique branding
	  ○ Ticket vending machines
	  ○ Lighting
	  ○ Benches
	  ○ Bicycle Parking
	• Install concrete pads
	• Install high visibility crosswalk
	  ○ On the northern side across MacArthur Rd
	• Install pedestrian countdown timers, pushbuttons, and accessible signals
	• Install curbs and curb ramps adjacent to crossing
	• Modify signal timing to accommodate pedestrian crossing
	• Remove concrete median

Benefits	• Increases walkability, connectivity, safety across MacArthur Rd • Increases rider convenience and comfort
Action Items	• Identify preferred bus stop design concept through engineering as well as community/stakeholder/municipal outreach • Complete maintenance agreement with PennDOT District 5 during design process • Coordinate with PennDOT planned signal and pedestrian improvements • Coordinate with PennDOT on bus lanes options
Capital Cost Estimate	• Side Running Bus Lane Option: $471,038.02 • Center Running Bus Lane Option: $1,636,800.00 • *Assumptions: Only one crosswalk proposed across MacArthur Rd*
Benefit Estimate	• N/A

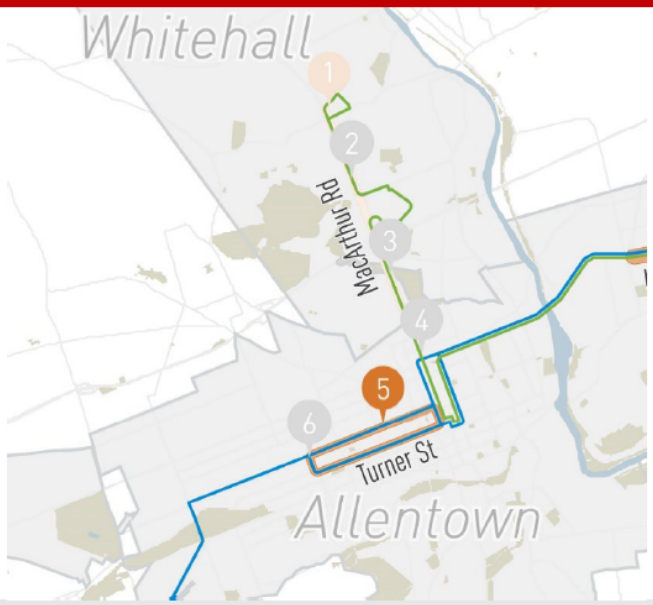
Project Number	#3 – MacArthur Rd & Jordan Pkwy
Existing Condition	
Location	
Municipality	Whitehall Township
Station Name/ Corridor	Jordan Parkway - Green Line
Project Type	• Bus Stop Enhancement

Project Description	• Install smaller-scale shelters/benches or SolStops at existing stop locations with:
	  ○ Realtime signage
	  ○ Unique branding
	  ○ Lighting
	  ○ Bench
	• Install concrete pads

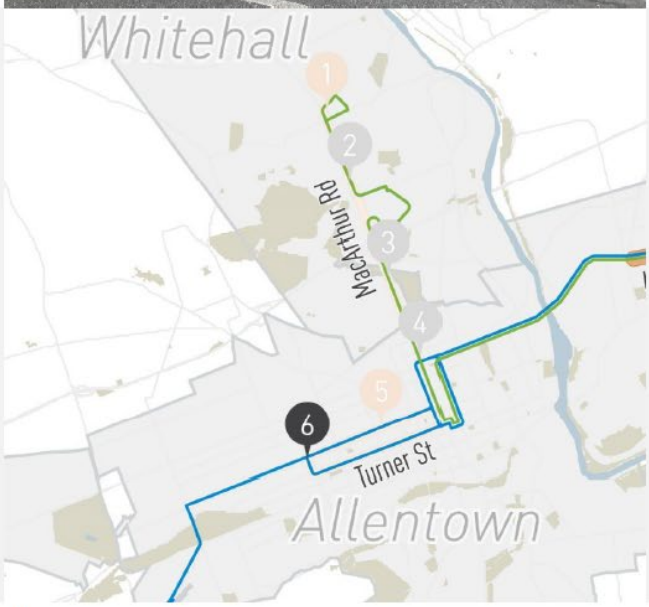
Project Number	#3 – MacArthur Rd & Jordan Pkwy - Continued
Action Items	• Identify preferred bus stop design concept through engineering as well as community/stakeholder/municipal outreach • Complete maintenance agreement with PennDOT District 5 during design process • Develop preliminary engineering cost estimate based on bus stop siting, architecture/amenities, horizontal station base elements • Acquire permit for any change in access to traffic • Coordinate with PennDOT on bus lane options
Capital Cost Estimate	• Side Running Bus Lane Option: $52,884.61 • Center Running Bus Lane Option: $1,636,800.00 • *Assumptions: Minimal impact on privately owned property*
Benefit Estimate	• N/A
Action Items	• Identify preferred bus stop design concept through engineering as well as community/stakeholder/municipal outreach • Complete maintenance agreement with PennDOT District 5 during design process • Develop preliminary engineering cost estimate based on bus stop siting, architecture/amenities, horizontal station base elements • Acquire permit for any change in access to traffic • Coordinate with PennDOT on bus lane options
Capital Cost Estimate	• Side Running Bus Lane Option: $52,884.61 • Center Running Bus Lane Option: $1,636,800.00 • *Assumptions: Minimal impact on privately owned property*
Benefits	• Increases rider convenience and comfort

Project Number	#4 – Tilghman St and 7th St
Existing Condition	
Location	
Municipality	City of Allentown
Stop/Station Name/ Corridor	Blue Line/Green Line
Project Type	• Transit Signal Priority • Dedicated Left Turn Signal
Project Description	• Install or upgrade existing signal controller that is compatible with transit signal priority at the following signal: ○ Tilghman St and 7th St • Install a signal head with a dedicated left turn signal • Update signal timing to include a dedicated left turn signal phase to protect left hand turns from Tilghman St onto 7th St
Benefits	• Reduces transit travel times • Improves schedule adherence • Improves transit efficiency • Increases road network efficiency • Increased safety and reduces crashes

Project Number	#4 – Tilghman St and 7th St – Continued
Action Items	• Develop TSP Concept of Operation (Con-Op) and feasibility analysis of opportunities and constraints relating to signal controller, traffic/multimodal operations, and bus stop locations • Conduct market research for TSP vendors (e.g., Request for Information, vendor outreach/interview) based on Con-Op • Develop Request for Proposal for TSP vendor and additional contractor in support of design and installation
Capital Cost Estimate	• Side Running Bus Lane Option: $52,884.61 • Center Running Bus Lane Option: $1,636,800.00 • *Assumptions: Minimal impact on privately owned property*

Project Number	#5 – Chew St and Turner St from 7th St to 17th St
Location	
Municipality	City of Allentown
Stop/Station Name/ Corridor	Corridor – Blue Line
Project Type	• Transit Signal Priority
Project Description	• Install transit signal priority at the following signals: o Chew St and 7th St o Chew St and 8th St o Chew St and 9th St o Chew St and 10th St o Chew St and 12th St o Chew St and 13th St o Chew St and 14th St o Chew St and 15th St o Chew St and 17th St o Turner St and 7th St o Turner St and 8th St o Turner St and 9th St o Turner St and 10th St o Turner St and 11th St o Turner St and 12th St o Turner St and 13th St o Turner St and 14th St o Turner St and 15th St o Turner St and 17th St
Benefits	• Reduces transit travel times • Improves schedule adherence • Improves transit efficiency • Increases road network efficiency

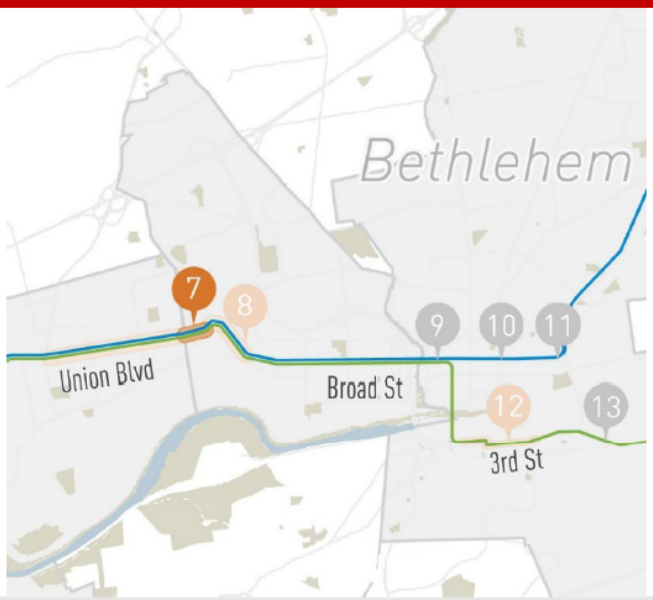
Project Number	#5 – Chew St and Turner St from 7th St to 17th St – Continued
Action Items	• Develop TSP Concept of Operation (Con-Op) and feasibility analysis of opportunities and constraints relating to signal controller, traffic/multimodal operations, and bus stop locations • Conduct market research for TSP vendors (e.g., Request for Information, vendor outreach/interview) based on Con-Op • Develop Request for Proposal for TSP vendor and additional contractor in support of design and installation
Capital Cost Estimate	• $ 596,422.63

Project Number	#6 – Chew St and 17th St
Existing Condition	
Location	
Municipality	City of Allentown
Stop/Station Name/ Corridor	Fairgrounds – Blue Line
Project Type	• Bus Stop Enhancement • Bus Stop Relocation

Project Number	#6 – Chew St and 17th St – Continued

Project Description	• For the eastbound stop, reconfigure small parking area into concrete plaza waiting area for customers
	• Relocate westbound stop further back from intersection
	• For the eastbound and westbound stops, install full size shelter with all amenities including the following (see rendering on page 28):
	  ○ Realtime signage
	  ○ Unique branding
	  ○ Ticket vending machines
	  ○ Lighting
	  ○ Benches
	  ○ Bicycle Parking
	• Install concrete pads
	• Coordinate with the City of Allentown on the future mobility hub concept, including potential bike share station

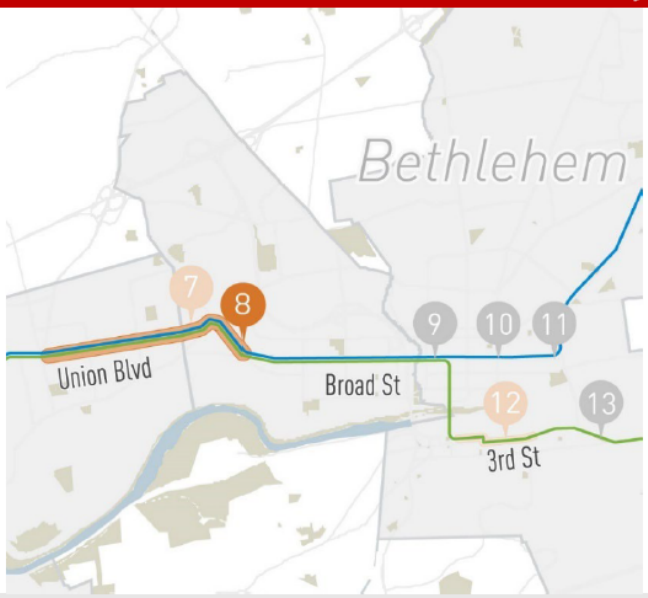
Benefits	• Increases rider convenience and comfort • Increases waiting area capacity during fairgrounds events
Action Items	• Identify preferred bus stop design concept through engineering as well as community/stakeholder/municipality outreach • Coordinate with Allentown on future mobility hub concept • Complete maintenance agreement with PennDOT District 5 during design process • Investigate drainage to determine treatment needed for existing inlet in parking lot • Contact property owner (hospital) about acquisition of land or lease arrangement for bus stop
Capital Cost Estimate	• $594,481.47 • *Assumptions: new bus plaza will use the entire existing parking lot, minimal impact to drainage, new ADA curb ramps at all four corners, hospital is willing to have bus stop on grounds*
Benefit Estimate	• N/A

Project Number	#7 – W. Union Blvd between Club Ave and Eaton Ave
Location	
Municipality	City of Allentown and City of Bethlehem
Stop/Station Name/ Corridor	Corridor/ Gateway – Blue Line
Project Type	• New Bus Stop • Enhanced Bus Stop • Pedestrian Crossing

Project Description	• Install new bus stop on W. Union Blvd
	  ○ Eastbound, across from existing stop at Giant
	• Install full size shelters with all amenities, including the following:
	  ○ Realtime signage
	  ○ Unique branding
	  ○ Ticket vending machines
	  ○ Lighting
	  ○ Benches
	  ○ Bicycle parking
	• Install concrete pads
	• Install high visibility crosswalk near existing westbound stop on W. Union Blvd between Club Ave Eaton Ave
	• Connect crosswalk to existing bus stop with new sidewalk
	• Install pedestrian crossing treatment, signals, and signage recommended by study (rectangular rapid flashing beacon (RRFB), pedestrian hybrid beacon, or other potential treatment such as a HAWK signal if it becomes legally permissible in Pennsylvania)

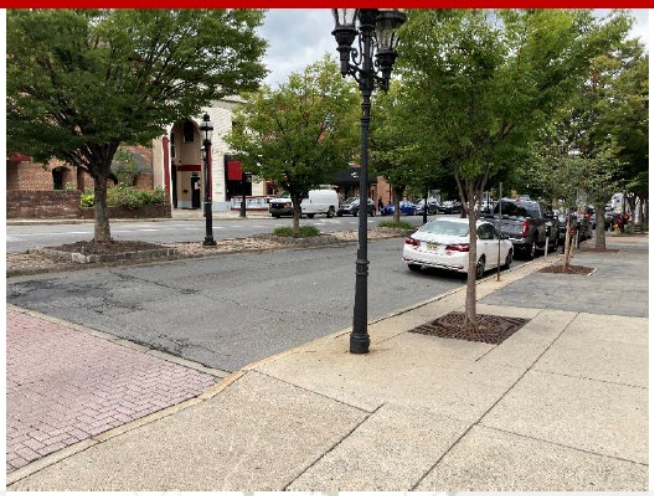
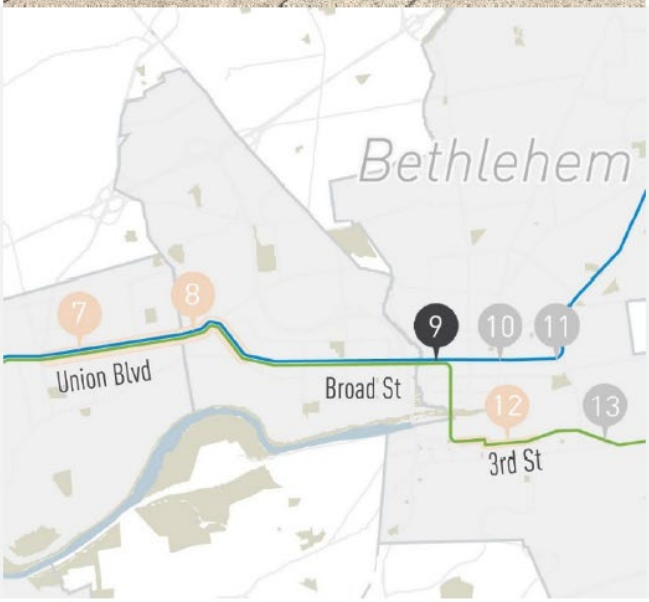
Benefits	• Increases walkability, connectivity, and safety crossing W. Union Blvd • Increases rider convenience and comfort

Project Number	#7 – W. Union Blvd between Club Ave and Eaton Ave – Continued
Action Items	• Identify preferred bus stop design concept through engineering as well as community/stakeholder/municipal outreach • Complete maintenance agreement with PennDOT District 5 during design process • Identify final bus stop location/crosswalk location based on stopping sight distances for midblock crossings, including possibly extending median island for pedestrian refuge. • Contact property owner (gas station) about acquisition of land for bus stop • Further studies on types of pedestrian crossing treatment
Capital Cost Estimate	• $381,360.46 • *Assumptions: Retrofit existing median with pedestrian facilities, minimal impact to privately owned property*
Benefit Estimate	• N/A

Project Number	#8 – W. Union Blvd from Sherman St to W. Broad St/Pennsylvania Ave
Location	
Municipality	City of Bethlehem and City of Allentown
Stop/Station Name/ Corridor	Corridor – Blue Line/Green Line
Project Type	• Transit Signal Priority • Signal Optimization

Project Description	• Install transit signal priority at the following signals:
	  ○ W. Union Blvd and Sherman St
	  ○ W. Union Blvd and Club Ave
	  ○ Eaton Ave and Pennsylvania Ave
	  ○ W. Union Blvd and Pennsylvania Ave
	  ○ Pennsylvania Ave and W. Broad St

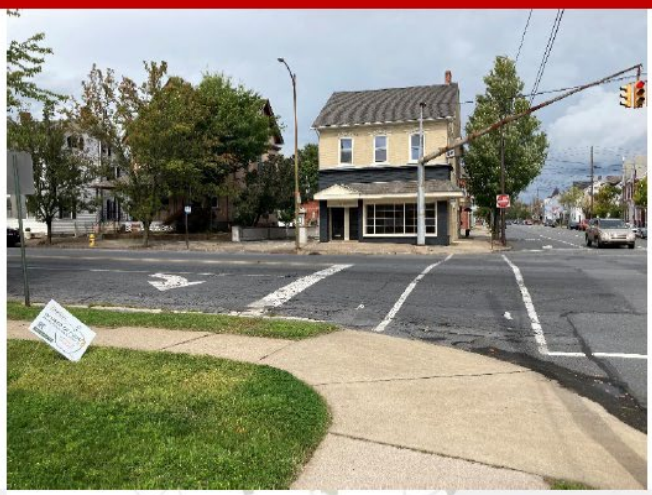
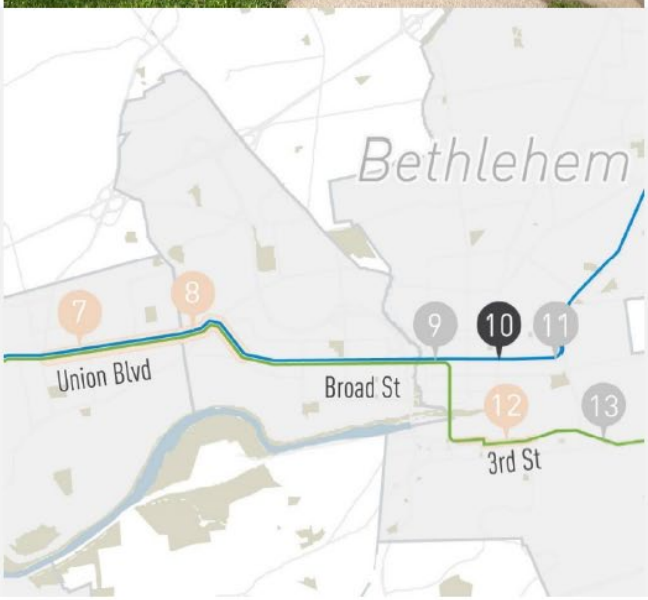
Benefits	• Reduces transit travel times • Improves schedule adherence • Improves transit efficiency • Increases road network efficiency
Action Items	• Develop TSP Concept of Operation (Con-Op) and feasibility analysis of opportunities and constraints relating to signal controller, traffic/multimodal operations, and bus stop locations • Conduct market research for TSP vendors (e.g., Request for Information, vendor outreach/interview) based on Con-Op • Develop Request for Proposal for TSP vendor and additional contractor in support of design and installation
Capital Cost Estimate	$304,474.38
Benefit Estimate	• $435,186/year in Travel Time Savings

Project Number	#9 – W. Broad St and Guetter St
Existing Condition	
Location	
Municipality	City of Bethlehem
Stop/Station Name/ Corridor	Bethlehem Transportation Center (BTC) – Blue Line
Project Type	• New Bus Stops • Roadway Repurposing

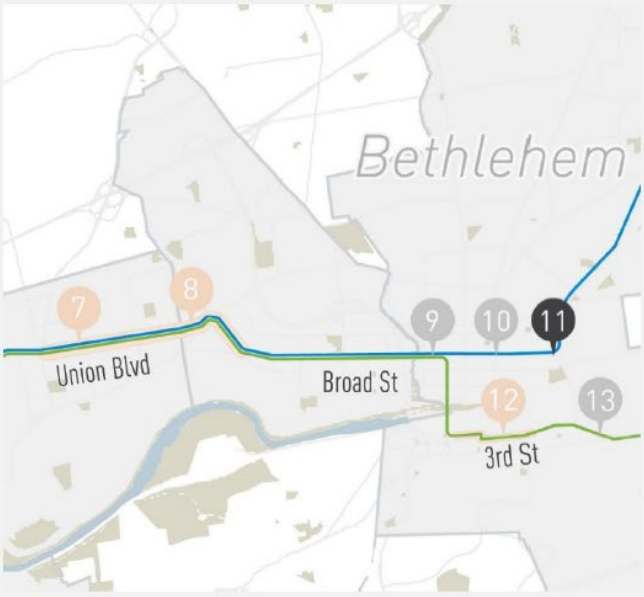
Project Number	#9 – W. Broad St and Guetter St – Continued

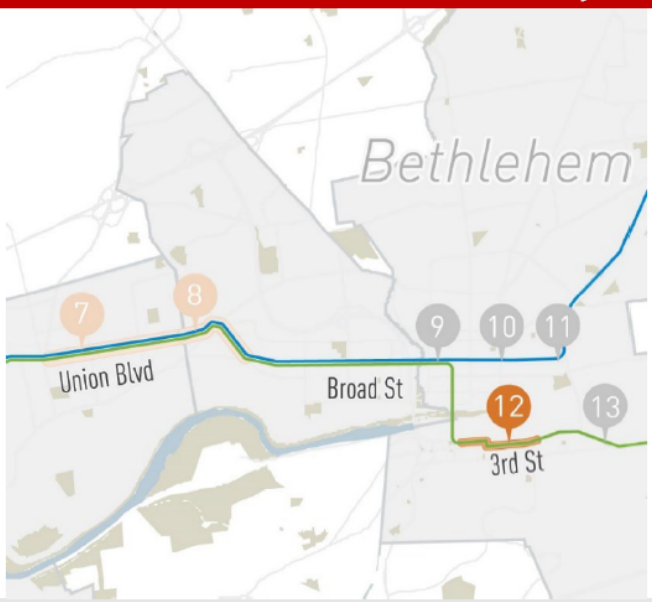
Project Description	• Install bus stops on W. Broad St, near BTC to allow EBS to remain on W. Broad St
	  ○ Eastbound – Near side stop
	  ○ Westbound – Far side stop
	• Install full size shelter with all amenities, including the following:
	  ○ Realtime signage
	  ○ Unique branding
	  ○ Ticket vending machines
	  ○ Lighting
	  ○ Benches
	  ○ Bicycle parking
	• Install concrete pads
	• Repurpose existing roadway to accommodate the following:
	  ○ Bus Bulbouts/Curb Extensions
	• Bike lanes

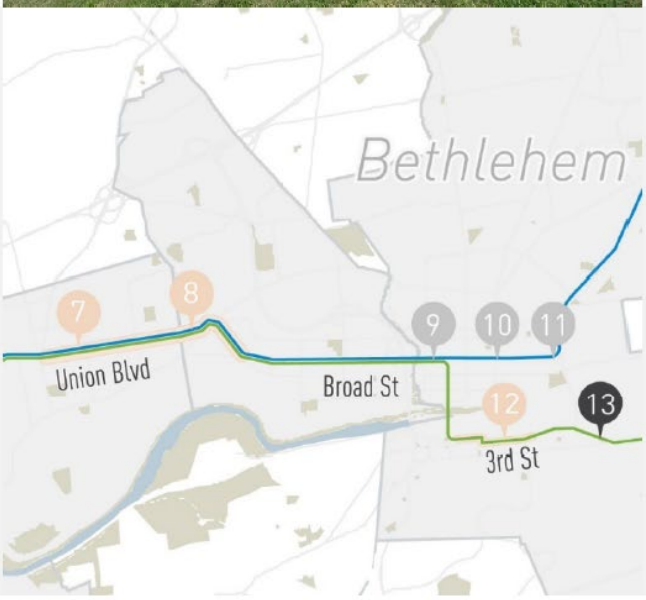
Benefits	• Increases rider convenience and comfort • Reduces transit travel times • Improves schedule adherence • Improves transit efficiency
Action Items	• Identify preferred bus stop design concept through engineering as well as community/stakeholder/municipal outreach • Coordinate with City on design and construction of bike lanes and bus bulbouts/curb extensions to reduce costs • Complete maintenance agreement with PennDOT District 5 during design process
Capital Cost Estimate	• $446,282.77 • *Assumptions: Minimal impact to privately owned property*
Benefit Estimate	• N/A

Project Number	#10 – W. Broad St and Linden St
Existing Condition	
Location	
Municipality	City of Bethlehem
Stop/Station Name/ Corridor	Linden St – Blue Line
Project Type	• Bus Stop Enhancement

Project Description	• Install full size shelters with all amenities, including the following:
	  ○ Realtime signage
	  ○ Unique branding
	  ○ Ticket vending machines
	  ○ Lighting
	  ○ Benches
	  ○ Bicycle parking
	• Install concrete pads
	• Coordinate with median extension to Broad and Linden St

Project Number	#11 – W. Broad St and Stefko Blvd
Existing Condition	
Location	
Municipality	City of Bethlehem
Stop/Station Name/ Corridor	Stefko Blvd and Broad St – Blue Line
Project Type	• Bus Stop Enhancement (east bound only) • Pedestrian Improvements
Project Description	• For eastbound stop, install SolStop • Install accessible pedestrian signals
Benefits	• Increases rider convenience and comfort • Increases walkability, connectivity, and safety across Broad St and Stefko Blvd
Action Items	• Identify preferred bus stop design concept through engineering as well as community/stakeholder/municipal outreach • Complete maintenance agreement with PennDOT District 5 during design process

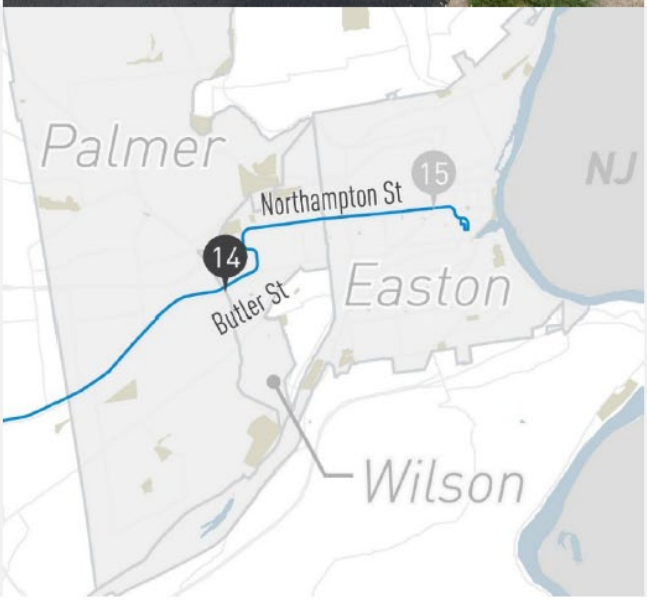
Project Number	#12 – Columbia St and Polk to 3rd St and Daly Ave
Location	
Municipality	City of Bethlehem
Station Name/ Corridor	Corridor - Green Line
Project Type	• Transit Signal Priority
Project Description	• Install transit signal priority at the following signals o Columbia St, 2nd St, and Adams St o 3rd and Polk St o 3rd St and Filmore St o 3rd between Pierce St and Buchanan St o 3rd St and Founders Way
Benefits	• Reduces transit travel times • Improves schedule adherence • Improves transit efficiency • Increases road network efficiency
Action Items	• Develop TSP Concept of Operation (Con-Op) and feasibility analysis of opportunities and constraints relating to signal controller, traffic/multimodal operations, and bus stop locations • Conduct market research for TSP vendors (e.g., Request for Information, vendor outreach/interview) based on Con-Op • Develop Request for Proposal for TSP vendor and additional contractor in support of design and installation
Capital Cost Estimate	$342,649.25
Benefit Estimate	• $240,085/year in Travel Time Savings

Project Number	#13 – Daly Ave and Wind Creek Blvd/Sands Blvd
Existing Condition	
Location	
Municipality	City of Bethlehem
	Wind Creek – Green Line
Project Type	• Bus Stop Relocation • Bus Stop Enhancement

Project Number	#13 – Daly Ave and Wind Creek Blvd/Sands Blvd – Continued

Project Description	• Relocate westbound bus stop at Daly Ave and Stefko Blvd to Daly Ave and Wind Creek Blvd/Sands Blvd for closer access to Wind Creek Bethlehem Hotel and additional ROW area
	• Relocate eastbound bus stop in front (near side) of South Bethlehem Greenway to connect to existing sidewalk
	• Install SolStop at eastbound stop and extend concrete sidewalk to create a small waiting area between existing sidewalk and curb to provide ADA accessibility
	• Install full size shelter for westbound stop with all amenities, including the following:
	  ○ Realtime signage
	  ○ Unique branding
	  ○ Ticket vending machines
	  ○ Lighting
	  ○ Benches
	  ○ Bicycle parking
	• Install concrete pads

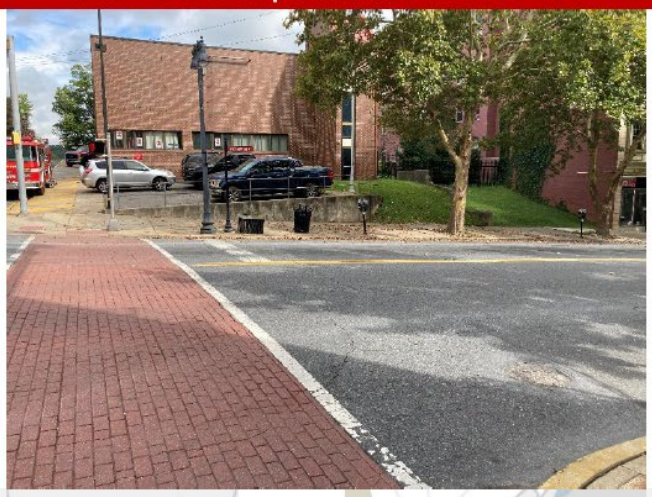
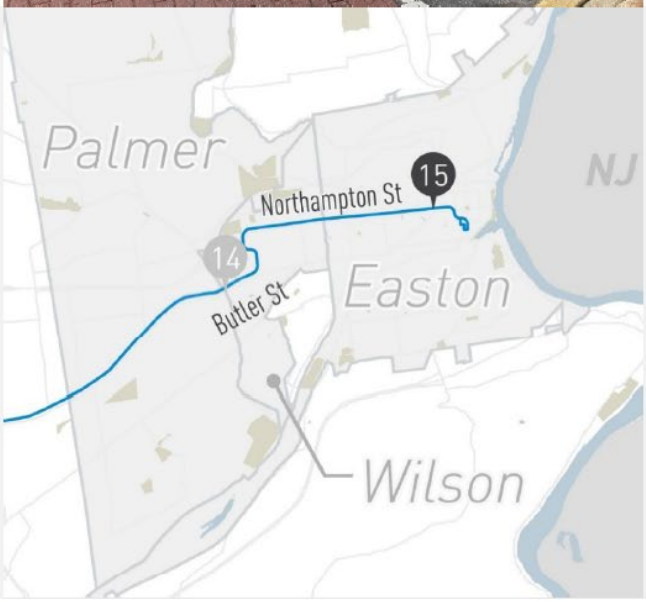
Benefits	• Increases rider convenience and comfort • Provides ADA accessibility
Action Items	• Identify preferred bus stop design concept through engineering as well as community/stakeholder/municipal outreach • Complete maintenance agreement with PennDOT District 5 during design process
Capital Cost Estimate	• $255,655.34 • *Assumptions: Can install a SolStop in park, bus stop in middle of intersection will not impact traffic flow more than typical bus stop*
Benefit Estimate	• N/A

Project Number	#14 – 25th St and Butler St
Existing Condition	
Location	
Municipality	• Wilson Borough
Stop/Station Name/ Corridor	• 25th St and Butler St – Blue Line
Project Type	• Bus Stop Relocation • Bus Stop Enhancement • Roadway Repurposing • Transit Signal Priority

Project Number	#14 – 25th St and Butler St – Continued

Project Description	• Relocate bus stop on Butler St/William Penn Hwy
	  ○ Eastbound – Far side stop
	• Install bus bulbout/curb extension for westbound stop
	• Install full size shelter for westbound stop with all amenities including the following:
	  ○ Realtime signage
	  ○ Unique branding
	  ○ Ticket vending machines
	  ○ Lighting
	  ○ Benches
	  ○ Bicycle parking
	• Install concrete pads
	• For westbound approach, remove striping pavement markings and install left turn and through lane pavement markings adjacent to each other to repurpose roadway for bus bump out. Consider adding narrower bump out for each direction to reduce impact to intersection alignment
	• Install transit signal priority at 25th and Butler St

Benefits	• Increases rider convenience and comfort • Reduces transit travel times • Improves schedule adherence • Improves transit efficiency • Increases road network efficiency
Action Items	• Identify preferred bus stop design concept through engineering as well as community/stakeholder/municipal outreach • Complete maintenance agreement with PennDOT District 5 during design process • Identify environmental "red flag" issues • Develop TSP Concept of Operation (Con-Op) and feasibility analysis of opportunities and constraints relating to signal controller, traffic/multimodal operations, and bus stop locations. • Conduct market research for TSP vendors (e.g., Request for Information, vendor outreach/interview) based on Con-Op • Develop Request for Proposal for TSP vendor and additional contractor in support of design and installation
Capital Cost Estimate	• $582,358.40 • *Assumptions: bump outs will not impact geometry of the intersection beyond the eastern leg, minimal impact to privately owned property*
Benefit Estimate	• N/A

Project Number	#15 – Northampton St/Walnut St/6th St
Existing Condition	
Location	
Municipality	• City of Easton
Stop/Station Name/ Corridor	• Northampton St/Walnut St/6th St - Blue Line
Project Type	• Bus Stop Relocation • Bus Stop Consolidation • Bus Stop Enhancement • Roadway Repurposing • Install curb extension

Project Number	#15 – Northampton St/Walnut St/6th St – Continued

Project Description	• Relocate bus stops on Northampton St
	  ○ Eastbound – Far side stop
	  ○ Westbound – Near side stop
	• Consolidate bus stops on Walnut St to Northampton St stops
	• Install full-size shelters with all amenities, including the following:
	  ○ Realtime signage
	  ○ Unique branding
	  ○ Ticket vending machines
	  ○ Lighting
	  ○ Benches
	  ○ Bike parking
	• Install concrete pads
	• Repurpose existing roadway (parking lanes) to accommodate bus bulbouts/curb extensions

Benefits	• Increases rider convenience and comfort • Reduces transit travel times • Improves schedule adherence • Improves transit efficiency • Improves pedestrian safety
Action Items	• Identify preferred bus stop design concept through engineering as well as community/stakeholder/municipal outreach • Complete maintenance agreement with PennDOT District 5 during design process
Capital Cost Estimate	• $459,757.27 • *Assumptions: Minimal impact to privately owned property combining bus stops will not impact bus route timing*
Benefit Estimate	• N/A

TRANSIT SUPPORTIVE LAND USE FOR THE RECOMMENDED ENHANCED BUS CORRIDOR

Introduction

As envisioned, the Enhanced Bus service network would represent a significant increase in the level of transit service available in the Lehigh Valley. As stressed in LANTA's *Moving LANTA Forward* strategic plan and LANTA's outreach efforts, the feasibility of any transit expansion in the Lehigh Valley depend heavily on the counties and municipalities employing transit supportive development practices in land use and economic development decisions. The Enhanced Bus/Bus Rapid Transit Study included a detailed analysis of land use and land use regulations along the various potential corridors. This analysis was an input into the selection of the recommended corridor. The study includes detailed recommendations for land use conditions and practices along the recommended corridor. While LANTA's *Transit Supportive Land Use for the Lehigh Valley* document provides recommendations for how municipalities in the Lehigh Valley in general can promote transit supportive development in their communities. The recommendations developed as part of the Enhanced Bus/Bus Rapid Transit Study provides recommendations specific to the recommended Enhanced Bus corridor. These recommendations call for greater densities and more intensive uses of parcels than the recommendations for the Valley in general. It will be necessary for all development along the recommended Enhanced Bus corridors to be transit-supportive in nature but will need to vary in terms of intensity and design based on the context of the area.

The following sections provide a summary of the recommendations. The full analysis is included in the full Enhanced Bus/Bus Rapid Transit Study – Conceptual Plan document. The EBS study focus emphasized a new transit corridor from Allentown to Easton. In that sense, the land uses *along* the corridor need to have equal weight to specific strategic locations. The rationale behind this is that ridership is a *function of land use.* Ridership is more likely to increase if the entire corridor has land use types, densities and intensities that are transit-supportive. Then the strategic transit-supportive opportunity locations serve as *an added "bonus"* to the corridor's ridership production. They work hand-in-hand.

Land Use Considerations

Communities are often concerned about the "density issue" – that land use types must be "higher" than what already exists. The earlier land use analysis showed that transit-supportive densities (residential) and intensities (commercial/office) already exist in the Lehigh Valley. *The true issue is whether the location of these transit supportive land use plans and zoning districts are* ***properly located to induce ridership****.*

Taking a look at national practices can be helpful for communities work in concert with LANTA to provide more robust, reliable and attractive bus service. To help illustrate the land use types along the corridor and at strategic locations, a series of examples is presented. The examples represent the type and mix of uses that are compatible with current development type, scale and intensity in the Valley.

Figure 6: Transit-Supportive Residential Densities

Residential Density 15-30 du/ac

3 Story Walk-Up Apartments - Surface Parked

This density range, properly located along the EBS corridor begins to add riders to the system. Typical uses are attached single family, townhomes and garden apartments

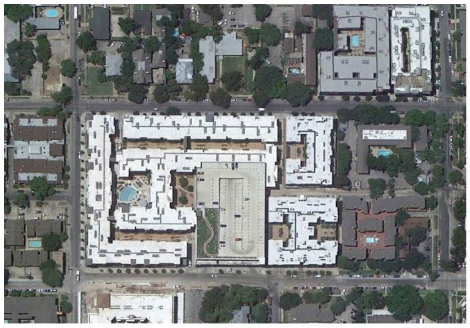
Residential Density 7-15 du/ac

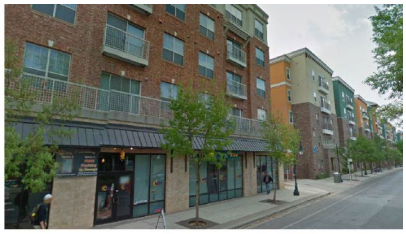
Small Lot Single-Family - Alley-Served

This density range is the entry density for transit-supportive development. It generally includes attached single family, townhomes and garden apartments

Figure 7: Transit-Supportive Mixed-Use Intensities

Mixed-use Intensity > 1.0 FAR

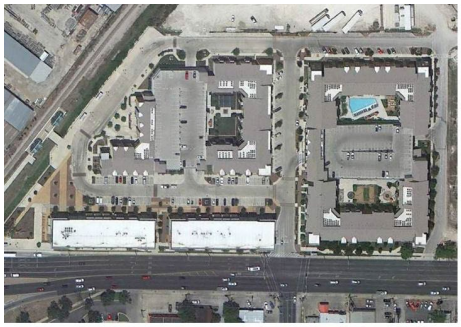




4 Stories of Apartments over 1-Story of Ground Level Retail - Garage-Parked

In the Lehigh Valley, these slightly higher intensity thresholds might appear in more urban segments of the corridor. They would be located at the strategic transit-supportive locations.

Mixed-use Intensity 0.25 - 1.0 FAR



3 Story Apartments/2-Story Commercial - Surface and Garage Parked

This is the entry intensity range that corresponds to more standard small commercial footprints. If the mix included residential, the density range is in the 15-30 du/a.

THE CONNECTION BETWEEN ACTIVITY DENSITY INDEX AND TRANSIT SERVICE

In addition to the illustrated land use densities and intensities, there is a supporting concept of the Activity Density Index. The Index provides a basis for identifying areas with the potential to support enhanced transit service and where enhanced transit service can best advance local planning and economic development objectives. Activity densities are defined as the sum of an area's population and employment divided by acreage.

Based on industry research, an Activity Density Index was developed to assist LANTA and local governments make decisions regarding transit service types, alignments, station locations. The Activity Density Index shown below provides information relating the Activity Index and development densities and intensities to supportable levels of planned transit service. The Activity Densities are presented in ranges to reflect the variation in findings regarding the relationship between development intensities and the provision of sustainable, cost effective transit service.

Table 4: Activity Density Index

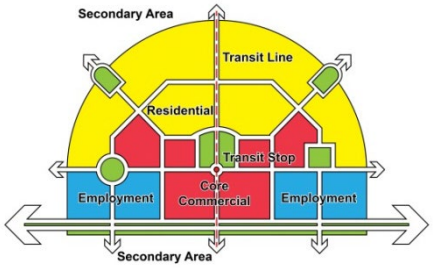
Activity Density (Population plus Employment per acre)	Development Density/Intensity*	Supportable Transit Service (Type & Frequency)
20-40	15-30 DU/A 0.25-1.00 FAR	Bus Rapid Transit 10 min peak
10-20	7-15 DU/A Less than 0.25 FAR	Enhanced Bus 15 - 30 min peak
0-10	0-7 DU/A	Local Bus 30 - 60 min peak and demand response. Within this category, LANTA's LANTABus Service Planning and Performance Guidelines prescribe the level of local service appropriate for various conditions

Source: HDR
*FARs or Floor Area Ratios are used as a measure of the intensity non-residential development. The ratio is generated by dividing the building area by the parcel area.

Transit-Supportive Fundamental Precepts

For successful transit-supportive benefits, there are six fundamental premises to guide and inform communities and their planning:

- Take advantage of all local assets and opportunities
- Affect regional and local settlement patterns
- Give attention to the corridor and identify strategic stop locations
- Concentrate highest mixed use activity at strategic stops
- Respect environmental, historic and cultural resources
- Secure a sustainable future for the corridor and each community



General Guidelines for Transit-Supportive Development

Building on the premises, the following set of Guidelines can help communities begin to fashion a transit-supportive program strategy based on their scale, character, historic context and position within the corridor. The Guidelines fall into three categories and sub-guidelines:

- Supportive Land Use - *Locate and concentrate a mix of complementary land uses that support ridership and offer a compact, walkable development pattern near the stop.*
- Mobility and Connectivity - *Develop a full auto, transit, pedestrian, and bicycle mobility network that connects the transit stop to activity centers and neighborhoods.*
- Memorable Community Design - *Employ urban design techniques to enhance the stop areas as memorable places, as well as making them attractive, safe and convenient.*

The application of the Guidelines will vary from urban to suburban to rural/developing locations, as well as the visions and plans for individual communities.

Examples of Transit-Supportive Locations

To provide examples of what this development may look like in the Lehigh Valley, three locations along the identified EBS corridors were selected throughout the Valley. Each is located at key intersections or interchanges, and together they reflect a variety of conditions and potentials for establishing a transit supportive environment along the EBS corridors. The purpose of this document is to illustrate the potential for new development types that are community-compatible and transit-supportive. To illustrate applicability across jurisdictions, three transit-supportive "types" are presented – **urban, suburban and rural/developing**.

Following are prototypical examples that relate to the three transit-supportive location types – Urban, Suburban and Rural/Developing. ***The intent of each is to illustrate the type of opportunity that can be applied to similar location types within the Lehigh Valley.***

URBAN LOCATION

The urban strategic transit-supportive development location, the block on 7th Street between Allen Street and Tilghman Street Allentown focuses on how generally built-up urban locations can be more transit-supportive. The interaction between transit and land use mix, building forms, street patterns, vehicular access and pedestrian accommodation is critical. Urban locations, such as the one that centers on 7th Street between Allen Street and Tilghman Street, are excellent areas for selective treatments that can enhance ridership. Following is a set of Opportunities and Issues that may be representative of other similar urban locations in the Lehigh Valley.

Opportunities

- The characteristics of this typical urban location are:
  - LANTA currently exists so its presence is a known service
  - There is a well-developed grid network with small block sizes that allows for pedestrian circulation
  - Existing land uses exhibit diversity with retail/shopping, services and denser residential types
  - Buildings demonstrate an urban scale and character
  - Existing buildings are candidates for adaptive reuse
  - Selective vacant areas can be infill candidates
  - On-street parking is typical
- Transit-supportive zoning is in place
- Potential for a supporting pedestrian and bicycle network.

Issues

- There are limited locations for enhanced transit stops
- Gaps in the urban fabric create lack of visual continuity
- Auto access points interrupt pedestrian flow and safety
- Complementary streetscape and urban design features are limited

The urban location example focuses more on limited enhancements – but oriented to making the location functional, attractive and accessible. The location currently has a standard bus stop, so the emphasis is on an enhanced shelter and supporting facilities. There can be infill or adaptive reuse options, depending on the nature and character of the area. Using the General Design Guidelines listed previously; ones that are particularly applicable to the urban example are highlighted. As an urban example, the diagram reflects the ¼ mile walk shed with:

- Mix land uses
- Highlight pedestrian routes
- Consider a supporting bike lane
- Wayfinding and safety
- Streetscape amenities
- Provide on-street parking

- Consider the option of selective infill and adaptive reuse and
- Avoid building design that has dead or blank walls

Figure 8: Urban Location - Allentown

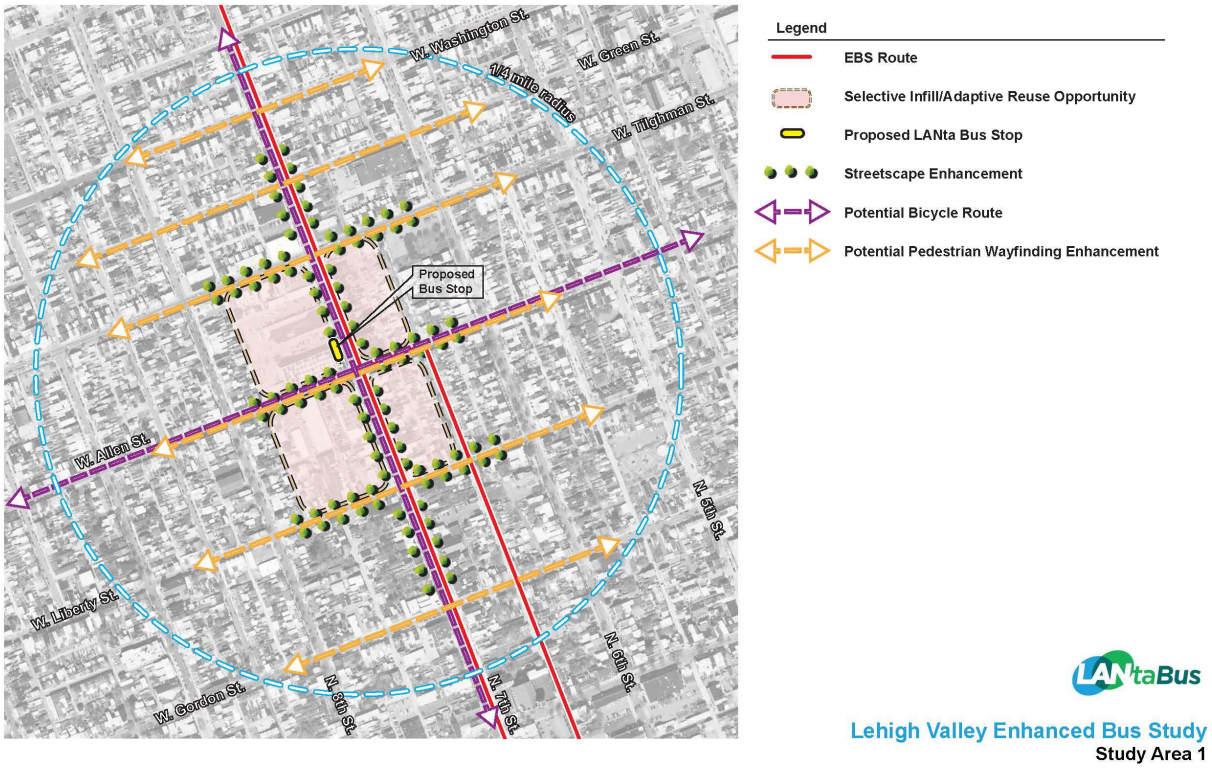


Figure 9: Urban Location Rendering

SUBURBAN LOCATION

The suburban strategic transit supportive development location is located at the Lehigh Valley Industrial Park VII at the intersection of 4th Street and Lynn Avenue. Unlike the urban site, this suburban location is larger in scale with significant development potential. The location abuts the Sands Casino and Resort, providing another destination for riders. This location could incorporate a single use or offer a range of uses. The more robust the mix of uses, the higher the ridership potential. The most productive uses are office, multi-family residential, hospitality, and destination retail/entertainment. Following is a set of Opportunities and Issues that may be representative of other similar suburban locations in the Lehigh Valley.

Opportunities

- It is a known site and currently served by transit
- There are sidewalks in place within the park
- Office and retail components (south side of the park) support ridership
- Multiple vacant parcels that can support further transit-supportive development
- The street grid allows for easy transit circulation
- Potential for other transit-supportive uses, depending on any use limitations/restrictions
- Supports development potential in adjacent neighborhoods

Issues

- Principal industrial-type (non-office) uses are not transit-supportive due to low employee to square foot ratios
- Lack of high density residential hinders greater transit attractiveness

A typical suburban location is one that has a mix of uses in a more office/industrial park setting. Because the patterns in these locations are larger scale, more than one EBS stop might be appropriate. Too, if a site is associated with a special condition, such as an entry to a community gateway, transit can help focus attention by adding an additional source of access and activity. The application of selected guidelines is:

- Mix land uses and consider multi-family housing
- Employ 15-30 units per acre for residential and intensities from .5 FAR
- Complete sidewalks and highlight pedestrian routes
- Incorporate supporting bike lanes
- Include wayfinding and safety features
- Add streetscape amenities
- Consider adding on-street parking
- Front buildings on the street whenever possible
- Locate buildings on corners to highlight key intersections
- Co-locate a stop with a civic space

Figure 10: Suburban Location - Bethlehem

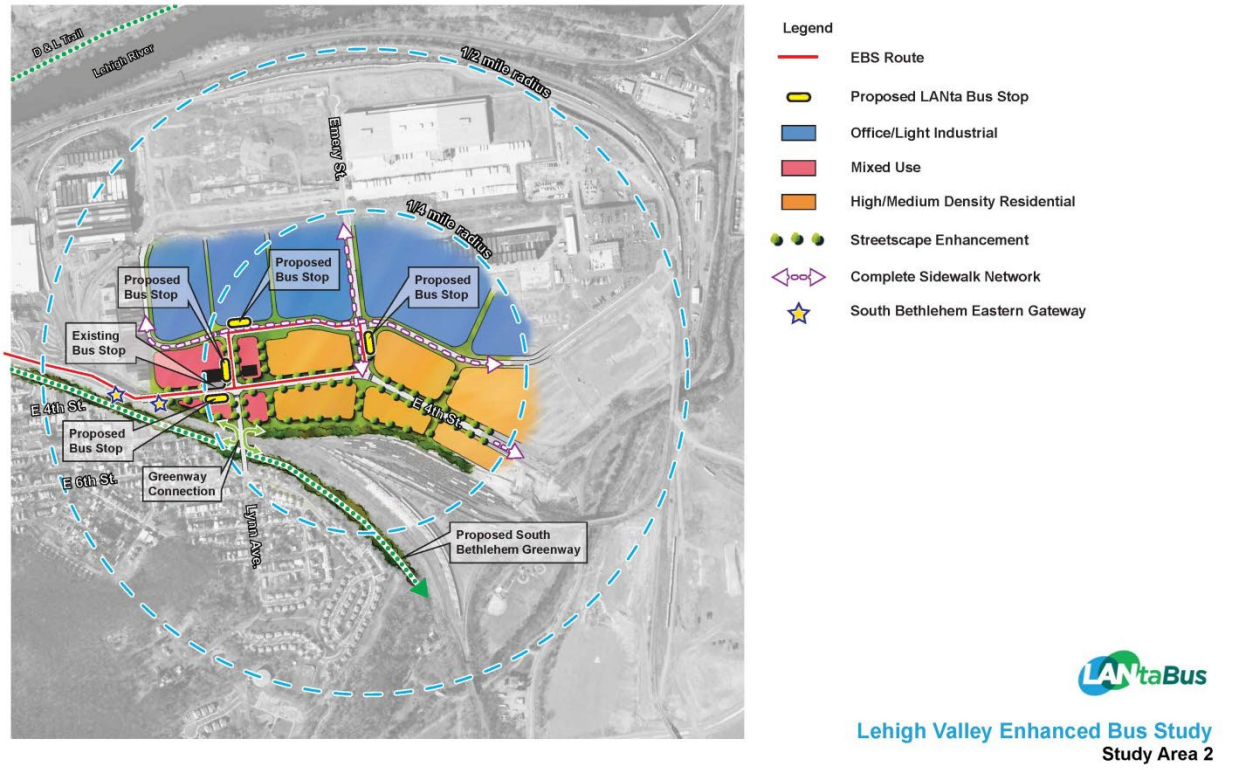


Figure 11: Suburban Location Rendering

RURAL/DEVELOPING LOCATION

Moving farther away from the two urban centers of Allentown and Bethlehem, there is a long stretch of rural and sporadically located opportunity areas. One of these locations is at the interchange of Route 33 and Freemansburg Avenue, where the transit route turns toward Easton. This is an emerging "mid-way" location that has multiple development opportunities and several key anchors in place. These include a developing office park on Emrick Blvd, the St. Luke's Hospital Anderson Campus and a shopping center just east of Route 33. Bethlehem Township has transit supportive-development planned and zoned in place on all four corners:

- Mixed Use/Light Industrial Office campus (northwest)
- Hospital Health Care Village (southwest)
- Commercial Enhancement (northeast)
- Town Center (southeast)

Future opportunities for such sites are dependent on proactive planning by the communities along the route. Following is a set of Opportunities and Issues that may be representative of other similar rural/developing locations in the Lehigh Valley.

Opportunities

- The location is strategic, since it is mid-way between urban centers on a stretch of the corridor that generally has lower development patterns
- Has development opportunities on multiple parcels
- One or more key anchors are in place
- Strategically located stops can give access to all four key locations

Issues

- Road configuration can divide the major parcels
- Large, adjacent single family subdivisions affect land use compatibility at the edges
- The rate of development is the unknown factor and can influence ridership potential

This transit-supportive example represents an opportunity where a community has a vision for an emerging area. These locations are important for LANTA, because the addition of land uses can mean enhanced ridership potential. Too, when development is already taking place, it is easier to create a destination and center of activity. In the case of location three, there is a significant vacant parcel with mixed use zoning. Such a location can serve as a model at other potential stops, even if the site is smaller. New patterns that are more transit-supportive are possible. The application of selected guidelines for this type is:

- Co-locate a stop with a civic space
- Mix land uses and consider multi-family housing
- Employ 7.5-15 units per acre against lower density development and 15-30 units per acre for residential and intensities from .5 FAR in the core
- Have a complete sidewalk network and highlight pedestrian routes
- Incorporate supporting bike lanes
- Wayfinding and safety

- Add streetscape amenities
- Consider adding on-street parking
- Place off-street parking to the rear or side of buildings
- Front buildings on the street whenever possible and hold intersection corners with buildings to highlight entry points

Figure 12: Rural Location

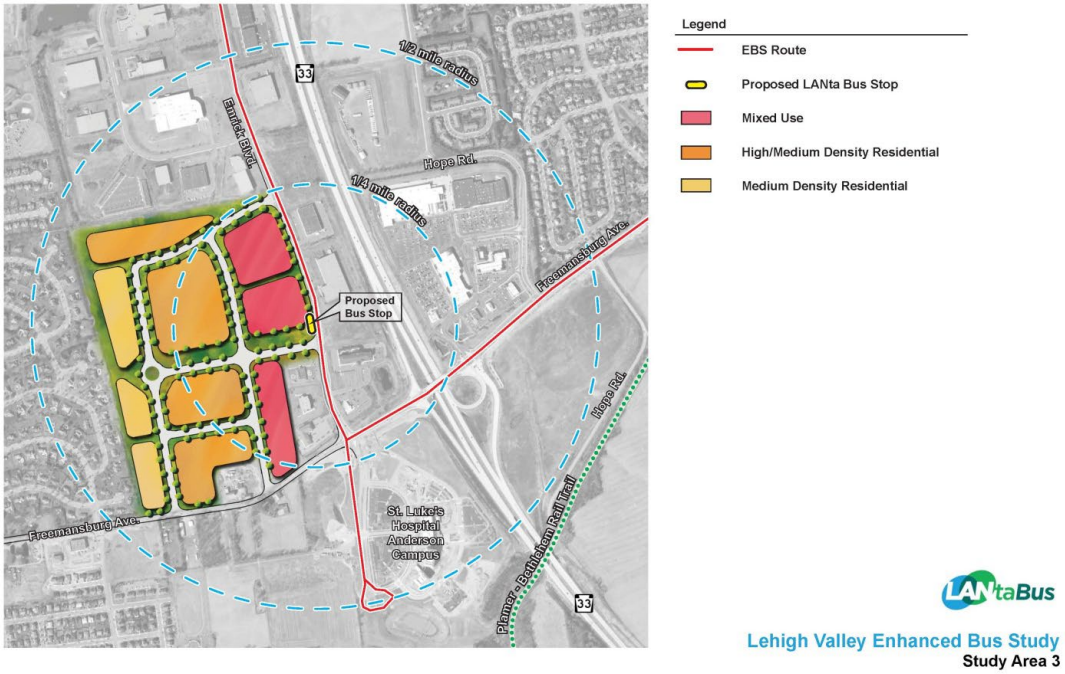


Figure 13: Rural/Developing Location Rendering

CONCLUSION

In May 2014, the LANTA Board of Directors officially adopted the Lehigh Valley Enhanced Bus/Bus Rapid Transit Study. LANTA recognizes the program set forth in the Enhanced Bus/Bus Rapid Transit Plan represents an aggressive expansion program. The Authority is committed to moving forward on all elements of the plan, subject to available resources. LANTA, in accordance with the Memorandum of Understanding with the Lehigh Valley Planning Commission, will support and work towards the improvement of land uses along the corridors identified in the study to promote sufficient density and site development characteristics that support the expanded transit services. This is in full recognition that the achievement of the Enhanced Bus/Bus Rapid Transit Plan is subject to changing regional development patterns to promote such changes.