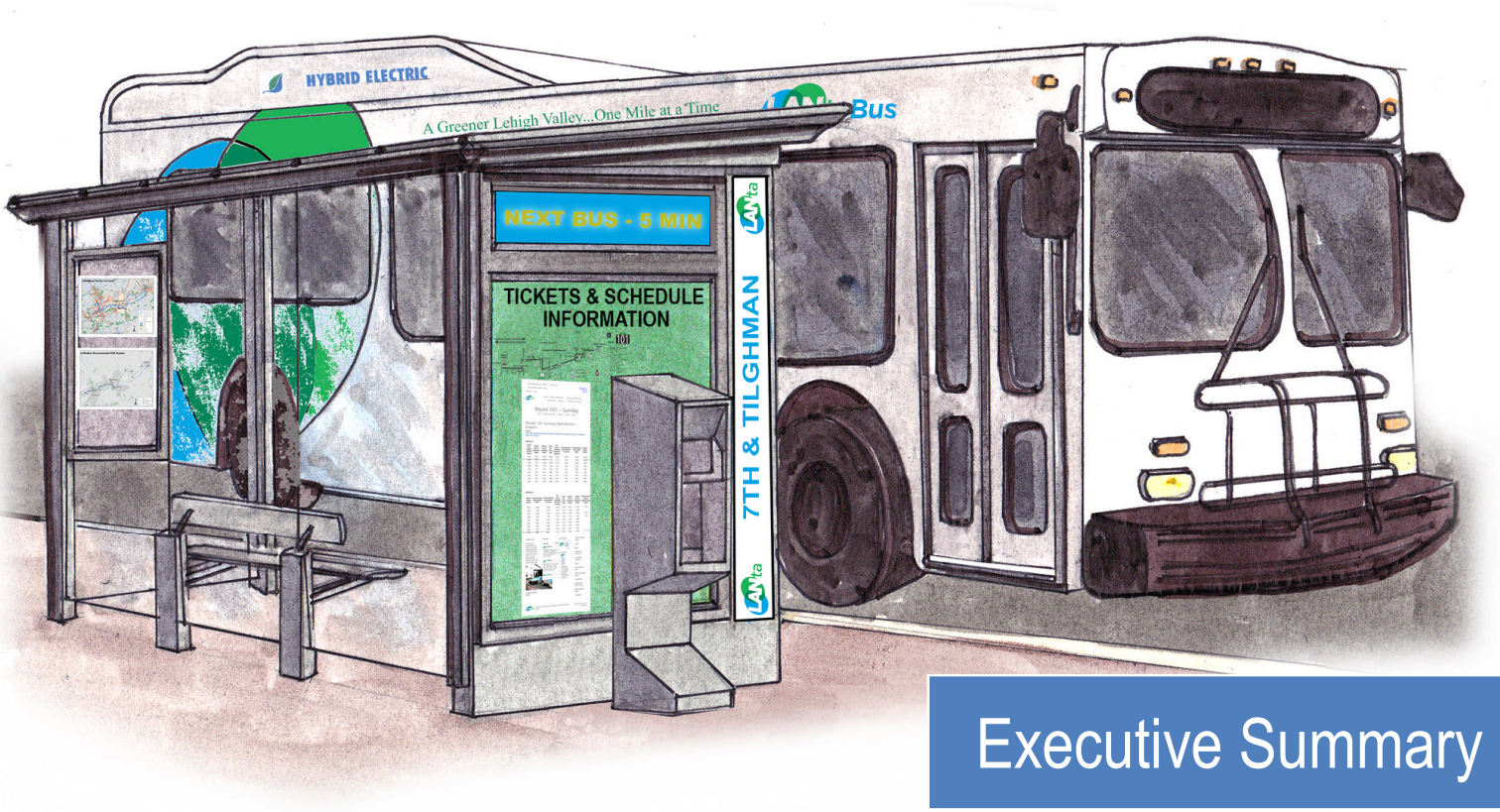
LEHIGH VALLEY ENHANCED BUS/BRT STUDY



Executive Summary

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Lehigh and Northampton Transportation Authority

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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.

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.

Documents

In addition to this Executive Summary, the Lehigh Valley Enhanced Bus/BRT Study includes five technical memoranda as follows:

- Technical Memorandum 1: Kickoff Meeting Summary Memo
- Technical Memorandum 2: Public Involvement Plan
- Technical Memorandum 3: Transportation Setting and Data Collection
- Technical Memorandum 4: Conceptual Service Plan
- Technical Memorandum 5: Conceptual Design

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.

Figure 1: Initial Eight Trunk Corridors

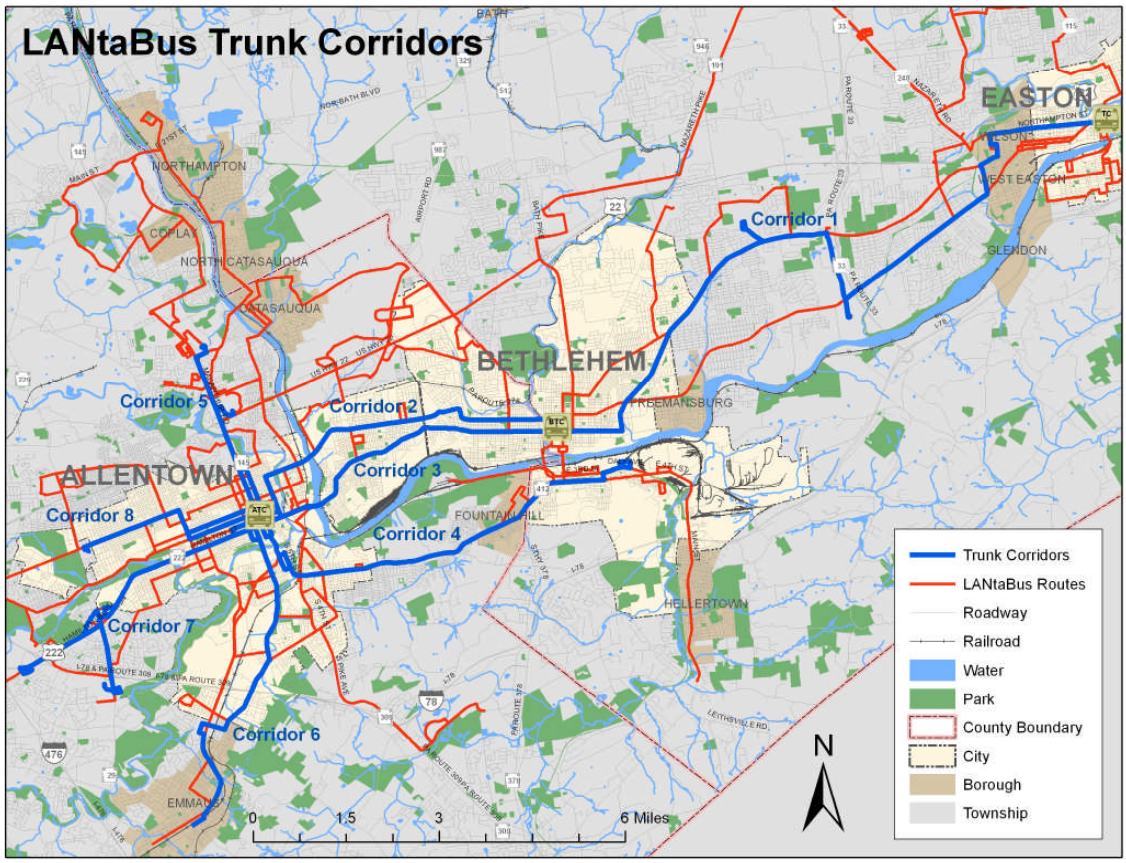
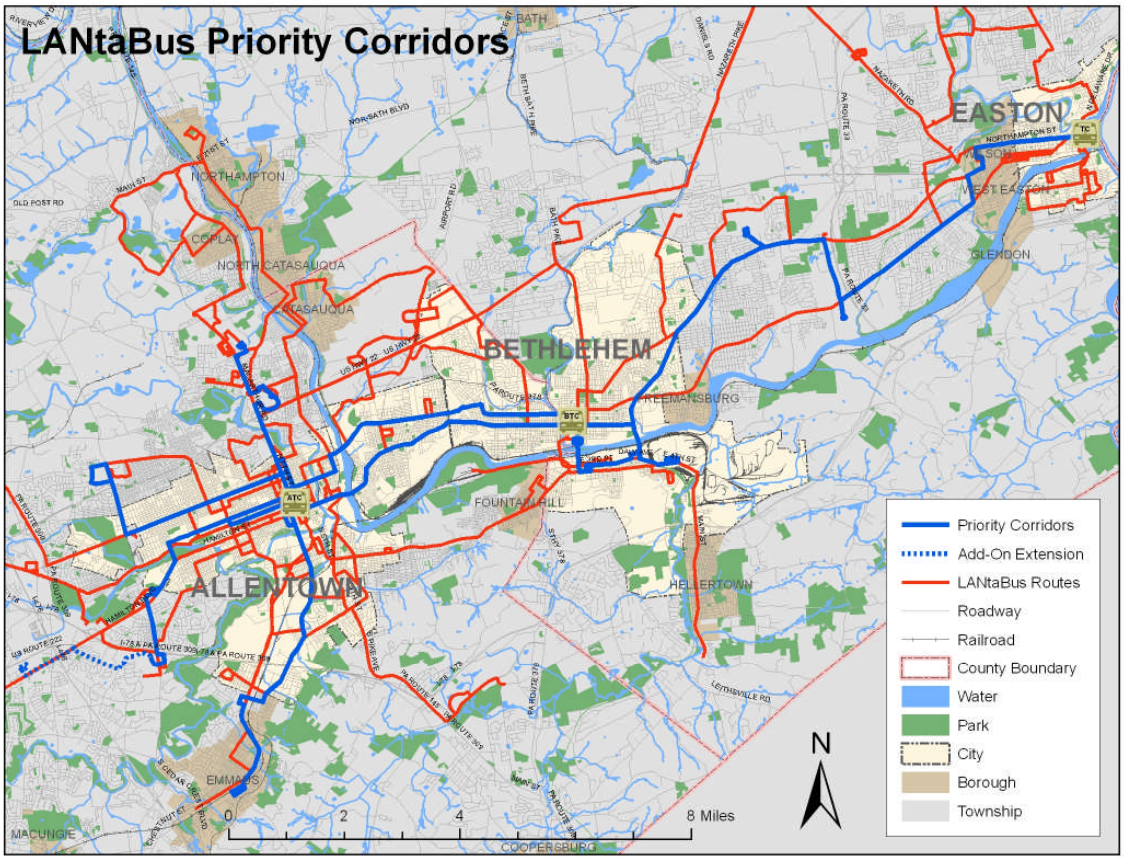


Figure 2: Four Priority Corridors



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, which for the purposes of this study will be referred to as "EBS 1" and "EBS 2", with official names to be determined by LANta upon development of branding for the system. EBS 1 would span between the Walmart on MacArthur Road in Whitehall Township and the Lehigh Valley Industrial Park (LVIP) VII on PA 412 in South Bethlehem, via MacArthur Road and the 6th/7th Street Couplet (PA 145), Hamilton Street, Hanover Avenue, West Broad Street, New Street, 4th/3rd Streets in South Bethlehem, and Daly Avenue. EBS 2 would span between Muhlenberg College in Allentown and the planned Easton Intermodal Transportation Center in Easton roughly via the Chew/Turner Street couplet, Hamilton Street, Hanover Avenue, West Broad Street, New Street, 4th/3rd Streets in South Bethlehem, the Minsi Trail Bridge, Stefko Boulevard, Easton Avenue, Emrick Boulevard, Freemansburg Avenue, 25th Street, and Northampton Street.

Figure 3 shows the recommended system as of Phase III of implementation (please refer to Technical Memorandum 5 and/or the final project report for the specifics of each phase), when service would be extended from South Bethlehem to Easton. The two EBS routes would operate as "limited-stop" services throughout much of the Lehigh Valley, meaning that they would stop approximately every half mile (rather than every two blocks) in order to help reduce travel times. However, EBS 2 east of the Sands Casino would initially operate as a local service, serving all stops, to be upgraded to limited-stop service in the future if demand warrants.

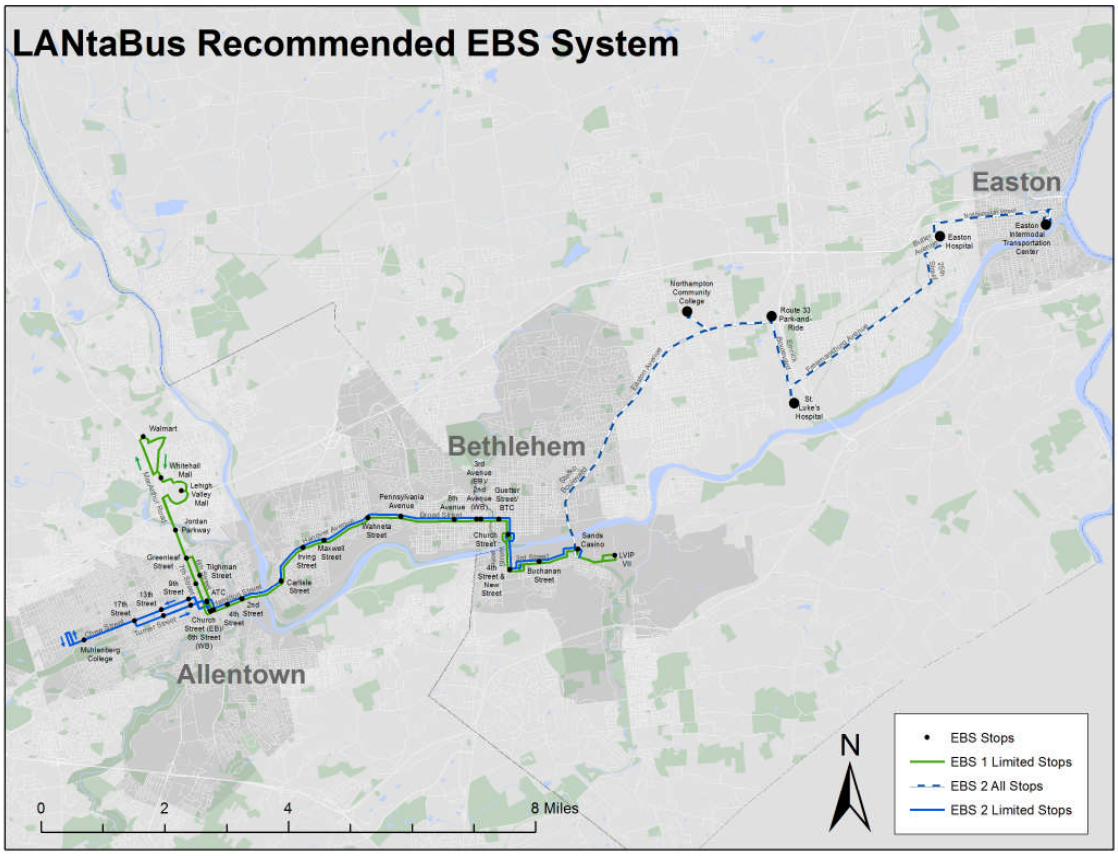
Transit Service Plan

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. "Convenient", in this case, refers to service operating seven days per week, as frequently as possible given existing and potential ridership, and for a maximum possible span of service. Thus, service on both proposed EBS routes would operate seven days per week, on approximately the longest span of service of LANtaBus's existing routes, from 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. Depending on the initial popularity of EBS 1, service might be extended to operate until midnight; however, for the purposes of this report, it will be assumed that service will operate until 11:00 PM.

On weekdays, EBS 1 would operate every 15 minutes during the peak periods, every 20 minutes off-peak, and every 60 minutes in the evening. EBS 2 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 EBS 1 and EBS 2 (between the ATC and the Sands Casino) 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 of service on EBS 1 and EBS 2—the routes would initially implemented at lower frequencies, then service would be increased in latter phases. At full build-out, the aforementioned span and frequencies would imply 54 trips per weekday in each direction on EBS 1 and 24 trips per weekday in each direction on EBS 2 (total of 78 weekday round-trips).

Also during the full build-out phase, on Saturdays service on EBS 1 would operate every 20 minutes between 8:00 AM and 6:00 PM, and hourly in the morning and evening; service on EBS 2 would operate every 60 minutes all day. On Sundays, service on EBS 1 would operate every 20 minutes, with service on EBS 2 every 60 minutes.

Figure 3: Recommended Enhanced Bus Service System



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.

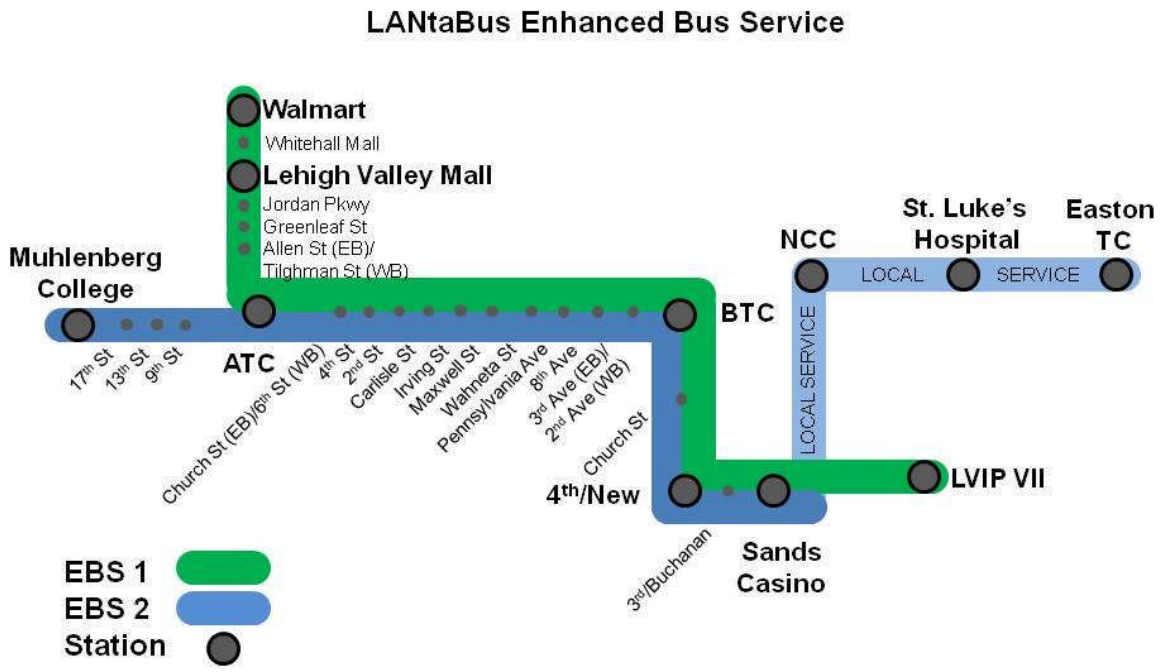
Phase I would commence as resources become available. For additional information on Phasing, please refer to Technical Memorandum 5: Conceptual Design or the final project report. Phasing of the EBS system can be summed up as follows:

- **Phase I** represents the "Minimum Operable Segment", as determined by the study team. This phase would include local service along the EBS 1 alignment (to be named "Route 100") between the Walmart in Whitehall Township and LVIP VII in South Bethlehem. This service would provide improved connections between Whitehall Township, Center City Allentown, Bethlehem and South Bethlehem. Adjustments would be made to local routes in Allentown, Bethlehem and Whitehall Township during this phase.
- **TSM (Transportation Systems Management)** represents a less-resource-intensive alternative to the full build-out of the EBS system. The TSM for this study would include the implementation of Route 100 and all improvements included in Phase I, as well as modifications to local LANtaBus services on Routes 101, 107 and 108 to improve connections between Allentown, South Bethlehem and Easton.
- **Phase II** would include upgrades to Route 100 to Enhanced Bus (EBS 1) service, as well as implementation of bus priority treatments along the EBS 1 corridor.
- **Phase III** would include the implementation of service on EBS 2, and additional priority bus treatments along the EBS 2 corridor in Allentown. This phase also includes the restructuring of local bus service between Bethlehem and Easton, and construction of bus lanes immediately adjacent to the Allentown Transportation Center.
- **Phase IV** would include frequency improvements on EBS 1 and EBS 2, reaching full build-out of the system in terms of both coverage and level of service.
- **Phase V** would include the upgrade of EBS 2 service within the City of Easton and Wilson Borough (east of Easton Hospital), including limited-stop service and the implementation of bus priority treatments, as well as improved frequency of service on Route 106 in Easton.
- **Phase VI** would include an upgrade to limited-stop service along EBS 2 between the Sands Casino and Easton Hospital. At this time, Route 101 would be re-instated to serve as an underlying local service for EBS 2 east of the Bethlehem Transportation Center.

Figure 4 shows a schematic of the recommended EBS system. All stops are shown along EBS 1 and the limited-stop portion of EBS 2. As this schematic represents Phase III/IV of implementation, service east of the Sands Casino on

EBS 2 is shown as local service. Along that segment, only a few major stops are shown.

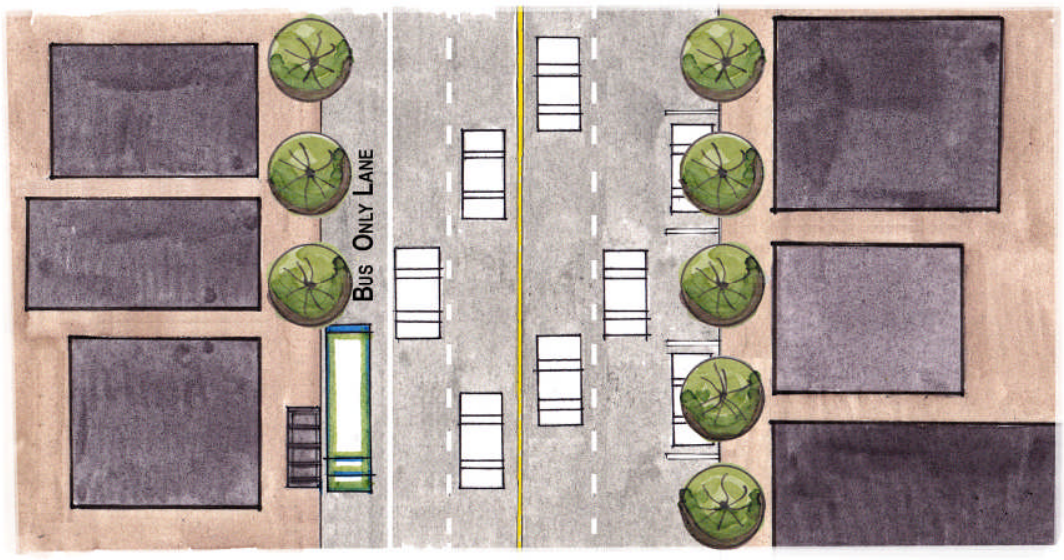
Figure 4: Schematic of Recommended Phase III/IV EBS System



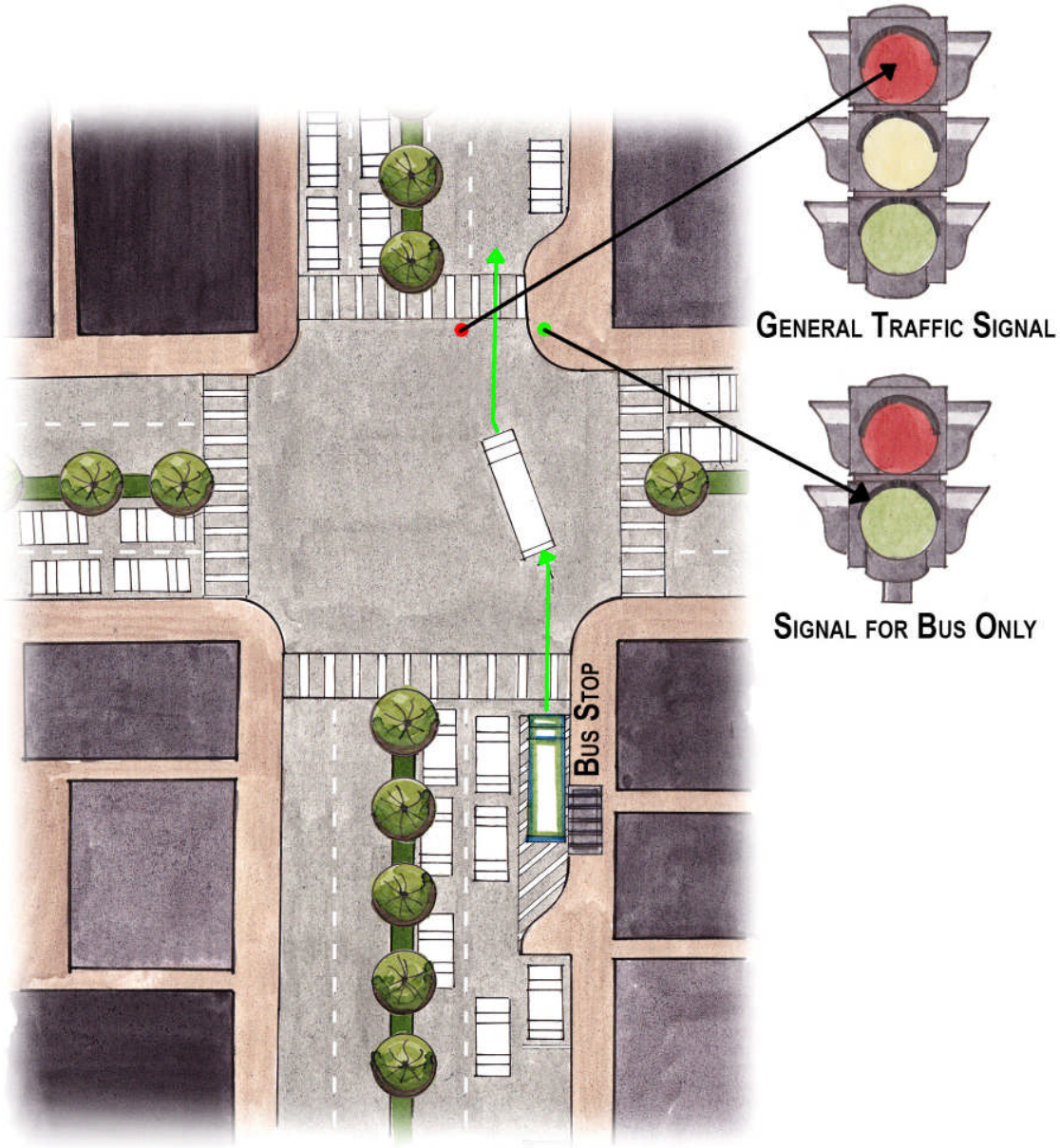
Running Way Treatments

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:

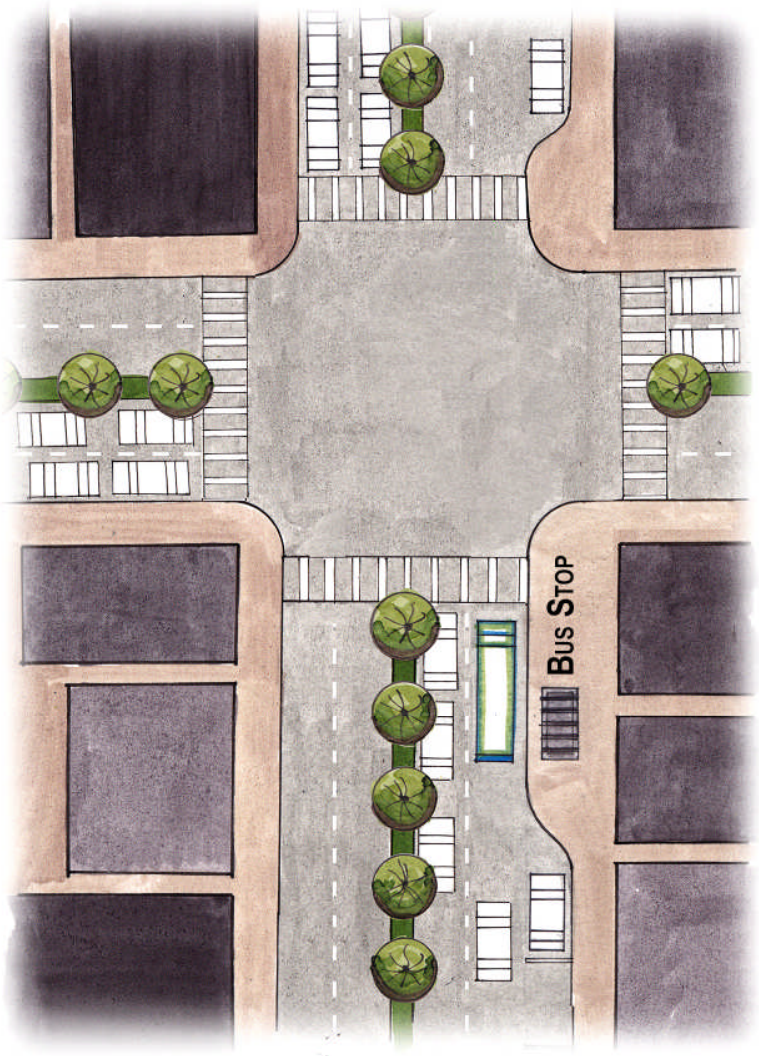
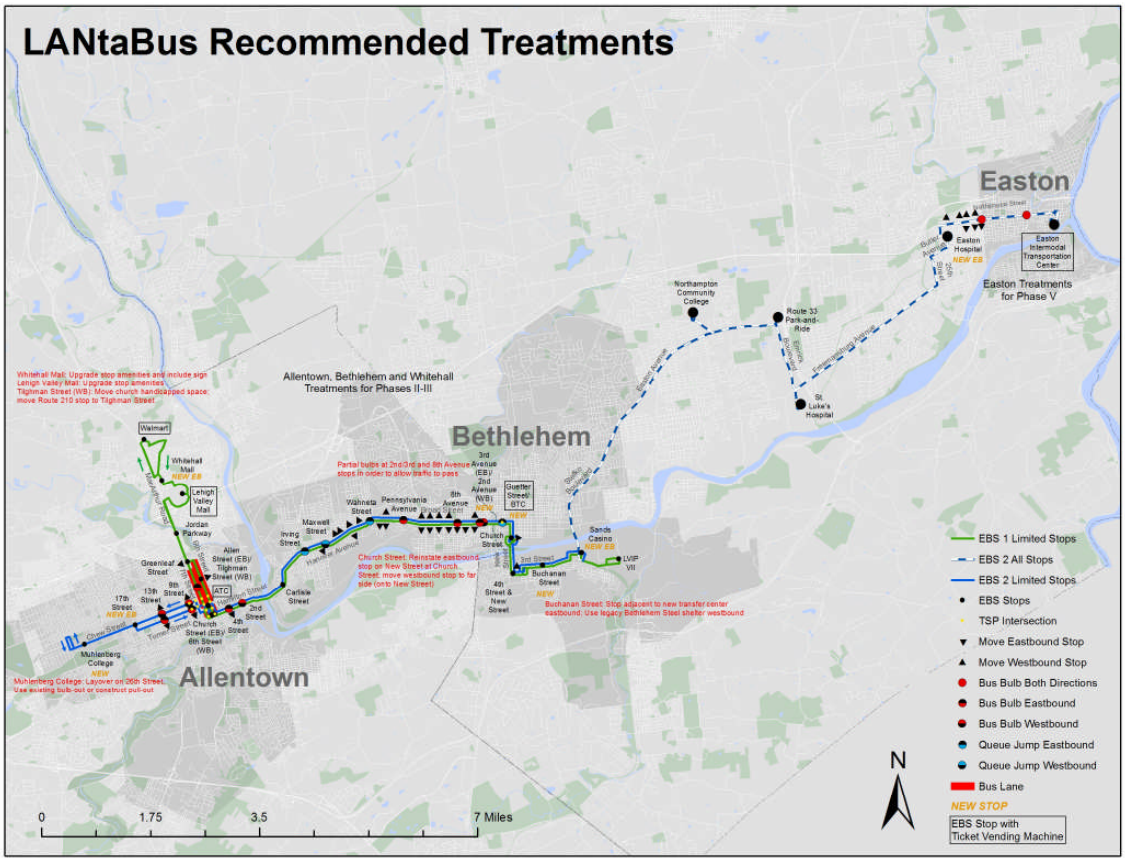


Figure 5 shows recommended priority treatments along the EBS 1 and EBS 2 corridors. Near-term treatments include bus bulbs, queue jumps and TSP, as well as moving near-side local stops to the far side in order to facilitate EBS service passing local bus service on narrow roadways. Bus lanes are a long-term option, and the lanes shown in the map on 6th and 7th Streets in Allentown would not be implemented until the number of buses per hour along those streets reaches a threshold point. Ticket Vending Machines (TVMs) are shown for major transfer centers—these machines would be used for purchase of fare cards/passes, and would not be dependent on the implementation of off-board fare collection.

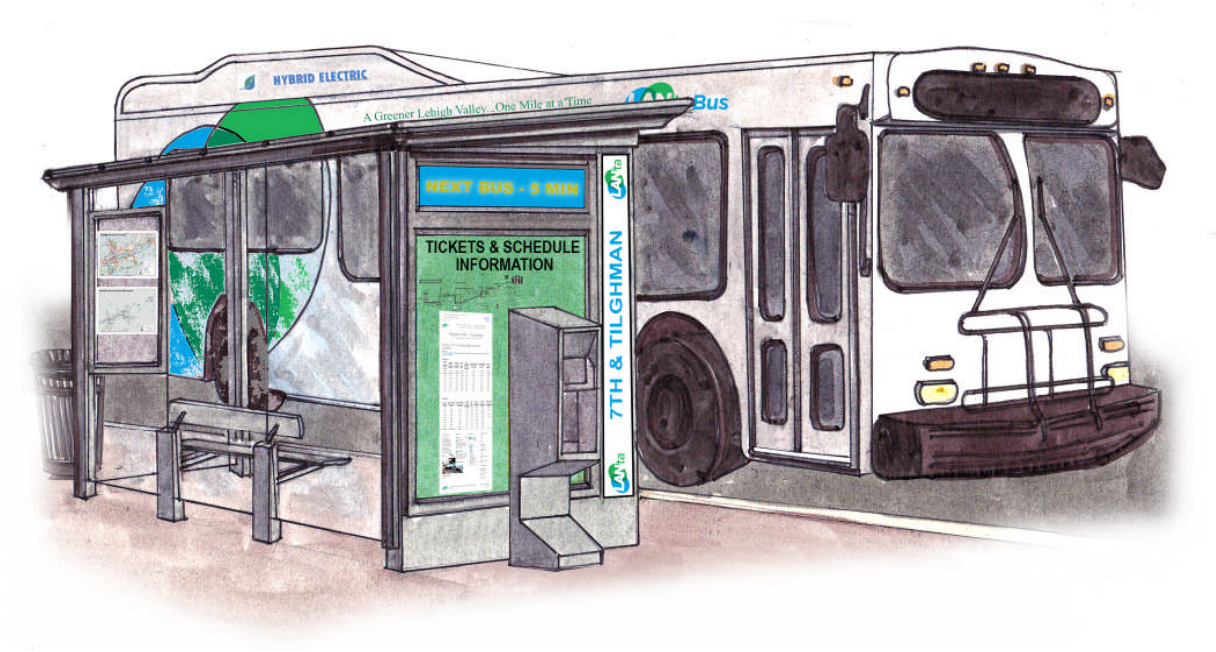
It should be noted that a black triangle is used to symbolize that a stop should be moved from its current near-side location to a far-side location. This symbol is used for different reasons both at local stops (to allow EBS service to pass local buses in the stops) as well as at limited stops (where moving the stop was deemed appropriate).

Figure 5: Recommended EBS Treatments



Stop/Station Design

All stations would be equipped with branded shelters, and would include benches, trash receptacles, a system map, a schedule for each route serving the stop, and a branded bus stop sign. Five stations—the ATC, BTC, EITC, Lehigh Valley Mall and Walmart—would also feature TVMs, where passengers can purchase LANtaBus fare media.



Vehicles

LANtaBus Enhanced Bus Service would utilize standard 42-foot, low-floor hybrid buses, as currently comprise the majority of new vehicle purchases for fixed-route LANtaBus service today. These buses cost approximately $600,000 each, and would be branded as appropriate for the EBS service.

Ridership

Ridership projections are based on existing stop-level ridership tabulated using manual Automatic Passenger Counter (APC) data from Fall 2011, shortly after implementation of the new route network proposed in Moving LANta Forward. Elasticity factors were applied to account for increased ridership due to frequency enhancements and travel-time savings. This methodology was used to calculate daily ridership from which approximate Saturday and Sunday ridership were inferred. These ridership projections do not take into account the land use changes proposed as a part of this study—if the density of development is increased along the corridors, then it can be assumed ridership would be impacted and would further increase accordingly.

Table 1 shows annualized ridership for the corridor, including all local routes (ridership reflects just those stops located along the Enhanced Bus Service corridor), each individual EBS route, both EBS routes combined, and a total for the corridor. Projections are shown for each phase.

Table 1: Annual Ridership Projections

Annual Phase	Local Routes Boardings	EBS 1 Boardings	EBS 2 Boardings	Total Corridor Boardings	Increase over Previous Phase	Increase over Current
Current	1,859,652	0	0	1,859,652	0	0
Phase I	1,908,726	455,124	0	2,363,850	504,198	504,198
TSM	1,953,256	432,303	0	2,385,558	21,708	525,906
Phase II	1,814,516	560,928	0	2,375,445	11,595	515,792
Phase III	1,505,534	517,663	431,186	2,454,382	78,938	594,730
Phase IV	1,367,097	648,231	474,067	2,489,396	35,014	629,744
Phase V	1,384,061	648,231	464,490	2,496,783	7,387	637,130
Phase VI	1,502,504	636,440	399,845	2,538,789	42,006	679,137

Operating Cost, Fare Revenue and Operating Subsidy

Table 2 shows proposed revenue hours and projected operating cost, fare revenue and subsidy for the proposed EBS system. Gross revenue hours for the new service were determined based on the estimated travel times for each route, combined with the proposed frequency. Net revenue hours incorporate the increase/decrease in revenue hours required to operate local service, based on the recommendations for adjustments to local service included in the implementation plan for each phase. Assuming an operating cost of $88.23 per revenue hour, operating cost was then calculated based on the proposed net revenue hours for each phase. Projected fare revenues were calculated based on the increase in projected total corridor ridership over current fare revenues and an average fare of $1.13 per passenger. The operating subsidy, or additional amount of funding required to operate the service, was calculated by subtracting the projected fare revenues from the projected operating cost.

Table 2: Projected Operating Cost, Fare Revenues, and Operating Subsidy

Phase	Gross EBS Revenue Hours	Revenue Hours Offset from Local Route Changes	Net Revenue Hours	Operating Cost of Implementing EBS Service and Local Route Changes	Increase in Corridor Ridership from Current	Increase in Corridor Fare Revenues from Current	Net Operating Subsidy of Implementing EBS Service
Current	0	0	0	$0	0	$0	$0
Phase I	19,355	-10,164	9,191	$810,918	504,198	$569,743	$241,175
TSM	19,355	-3,745	15,611	$1,377,320	525,906	$594,274	$783,046
Phase II	25,340	-10,164	15,176	$1,338,968	515,792	$582,845	$756,123
Phase III	48,374	-19,129	29,245	$2,580,321	594,730	$672,045	$1,908,276
Phase IV	66,687	-19,139	47,548	$4,195,175	629,744	$711,611	$3,483,565
Phase V	66,280	-17,297	48,983	$4,321,727	637,130	$719,957	$3,601,769
Phase VI	65,048	-6,552	58,496	$5,161,121	679,137	$767,425	$4,393,696

Capital Plan

The following Table 3 summarizes the capital costs needed for LANta to implement Enhanced Bus Service as recommended in this study. Costs are broken out by item and by phase. Bus lane mileage is assuming the conversion of existing roadway to curbside bus lanes. Most costs were determined based on those included in the Transit Cooperative Research Board's TCRP Report 118: Bus Rapid Transit Practitioner's Guide and adjusted to 2012 prices using the online Consumer Price Index (CPI) calculator. The total capital cost of implementation is $11,738,275.

Table 3: Capital Cost Estimates by Phase

Phase	Queue Jumps	Curb Lanes	Bus Bulbs	Off-Board Fare Machines	Shelters	Vehicles	Transit Signal Priority	Total
Unit Cost	$12,500 (per location)	$83,350 (per mile)	$55,550 (per bulb)	$72,200 (per machine)	$12,000 (per location)	$600,000 (per vehicle)	$37,000 (per intersection)	
Units								
Phase I	0	0	0		40		0	
TSM*	0	0	0	0			0	
Phase II	4	0	7	4	0		9	
Phase III	0	0.2	4	1	12	1	4	
Phase IV	0	0	0	0	0	10	0	
Phase V	0	0	4	0	4	1	0	
Phase VI	0	1.3	0	0	18	3	0	
Total Units	**4**	**1.5**	**15**	**4**	**74**	**17**	**13**	
Cost								
Phase I	$0	$0	$0	$0	$480,000	$0	$0	$480,000
TSM*	$0	$0	$0	$0	$0	$0	$0	$0
Phase II	$50,000	$0	$388,850	$288,800	$0	$0	$333,000	$1,060,650
Phase III	$0	$16,670	$222,200	$72,200	$144,000	$600,000	$148,000	$1,203,070
Phase IV	$0	$0	$0	$0	$0	$6,000,000	$0	$6,000,000
Phase V	$0	$0	$222,200	$0	$48,000	$600,000	$0	$870,200
Phase VI	$0	$108,355	$0	$0	$216,000	$1,800,000	$0	$2,124,355
Total Cost	**$50,000**	**$125,025**	**$833,250**	**$361,000**	**$888,000**	**$9,000,000**	**$481,000**	**$11,738,275**

*Not included in the total

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.

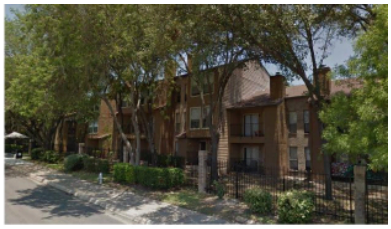
Land Use Considerations

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

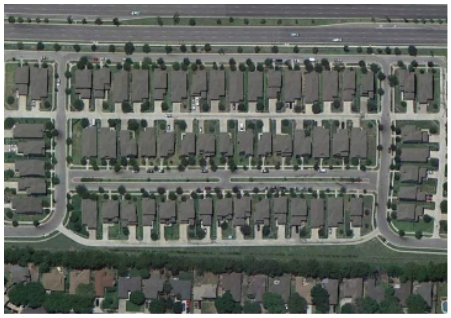
Residential Density 15-30 du/ac

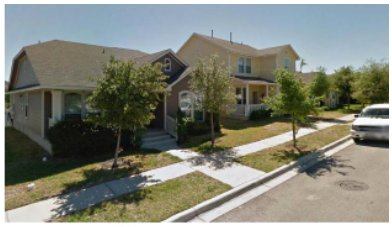


3 Story Walk-Up Apartments - Surface Parked

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



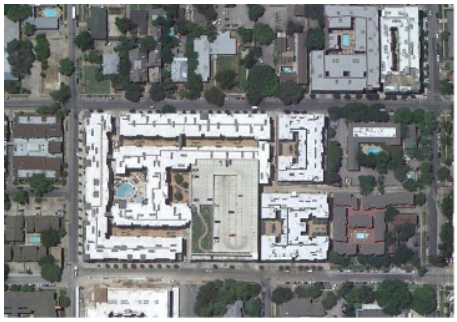


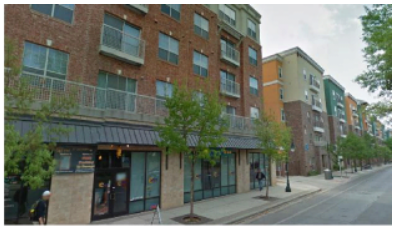
Small Lot Single-Family - Alley-Served

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

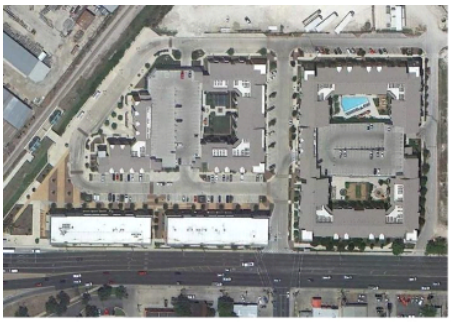




4 Stories of Apartments over 1-Story of Ground Level Retail - Garage-Parked

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

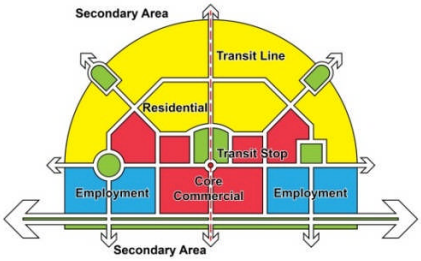
Activity Density (Population plus Employment per acre)	Development Density/Intensity*	Supportable Transit Service (Type & Frequency)
20-40	15-30 DU/A 0.25-1.00 FAR	Bus Rapid Transit 10 min peak
10-20	7-15 DU/A Less than 0.25 FAR	Enhanced Bus 15 - 30 min peak
0-10	0-7 DU/A	Local Bus 30 - 60 min peak and 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

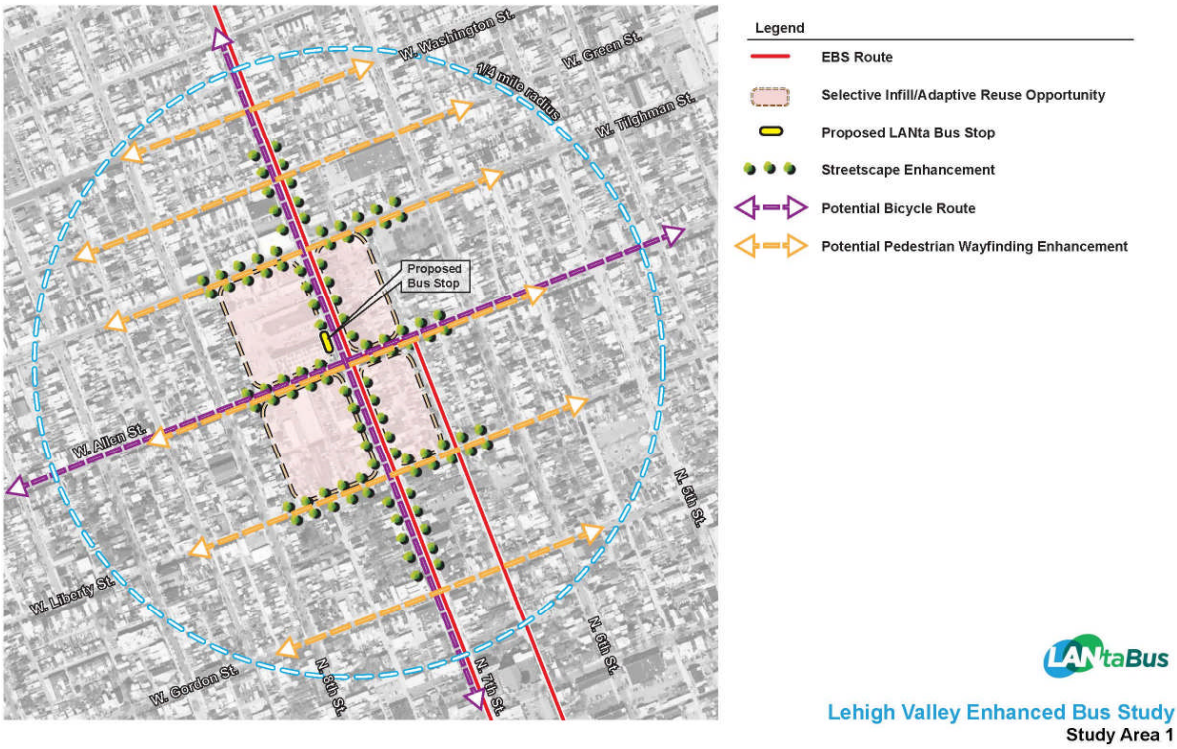


Figure 9: Urban Location Rendering

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

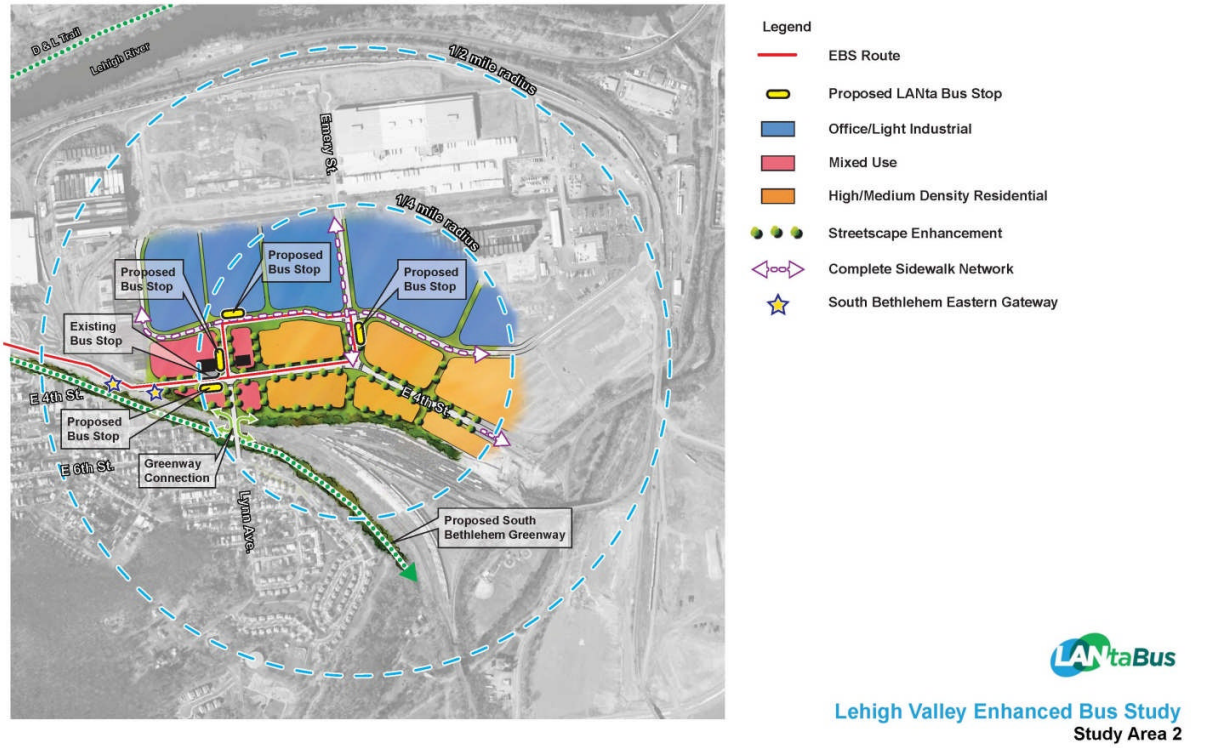


Figure 11: Suburban Location Rendering

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

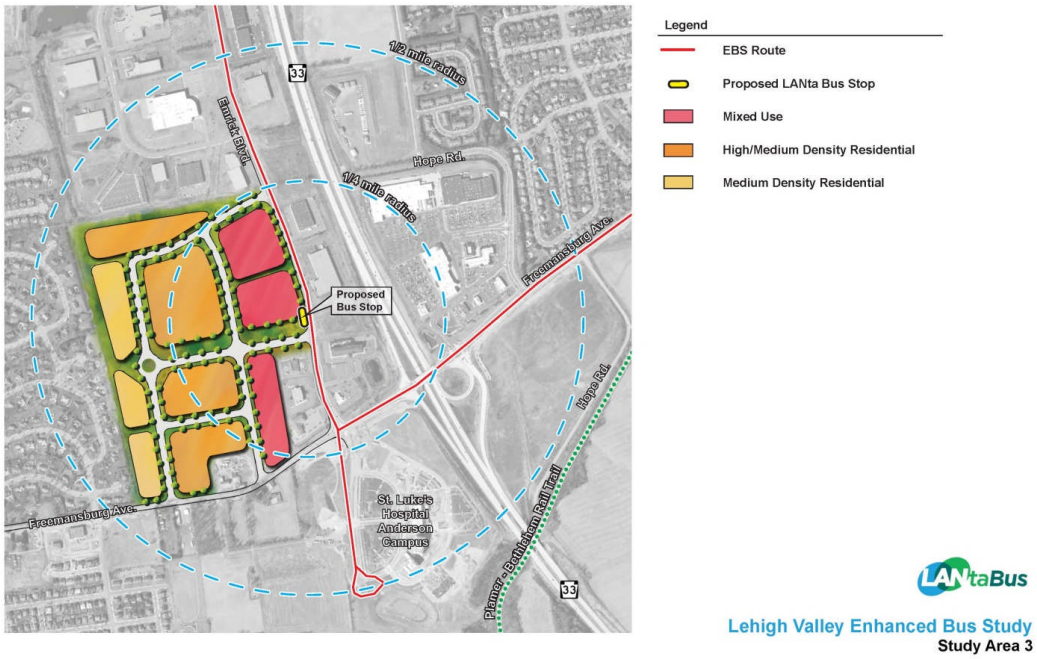


Figure 13: Rural/Developing Location Rendering

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.