

EASTERN CORRIDOR TRANSIT STUDY

Final Report

December 17th, 2003



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For



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1 EXECUTIVE SUMMARY

1.1 INTRODUCTION

Port Authority of Allegheny County (PAAC) and the Southwestern Pennsylvania Commission (SPC), along with the Westmoreland County Transit Authority (WCTA), jointly undertook a transportation planning project, known as the Eastern Corridor Transit Study (ECTS), to identify public transportation needs and community concerns in a study area bounded by the Golden Triangle in downtown Pittsburgh on the west, the eastern suburbs and Westmoreland County on the east, the Allegheny River on the north and the Monongahela River on the south. The ECTS study area is illustrated in **Exhibit 1-1**.

The ECTS study area encompasses some of the most diverse land uses in Southwestern Pennsylvania including inner city, urban and rural areas. The study area includes thriving activity centers such as downtown Pittsburgh, the university campuses and medical complexes in Oakland, the Pittsburgh Technology Center, the business and commercial district in Monroeville, and rapidly growing areas along Routes 22 and 30 in Westmoreland County. However, the area also includes once thriving communities such as the Turtle Creek Valley, Braddock, Rankin, McKeesport, Jeannette, and to a lesser extent the City of Greensburg that have lost population and employment, but are looking toward renewed economic growth in the future.

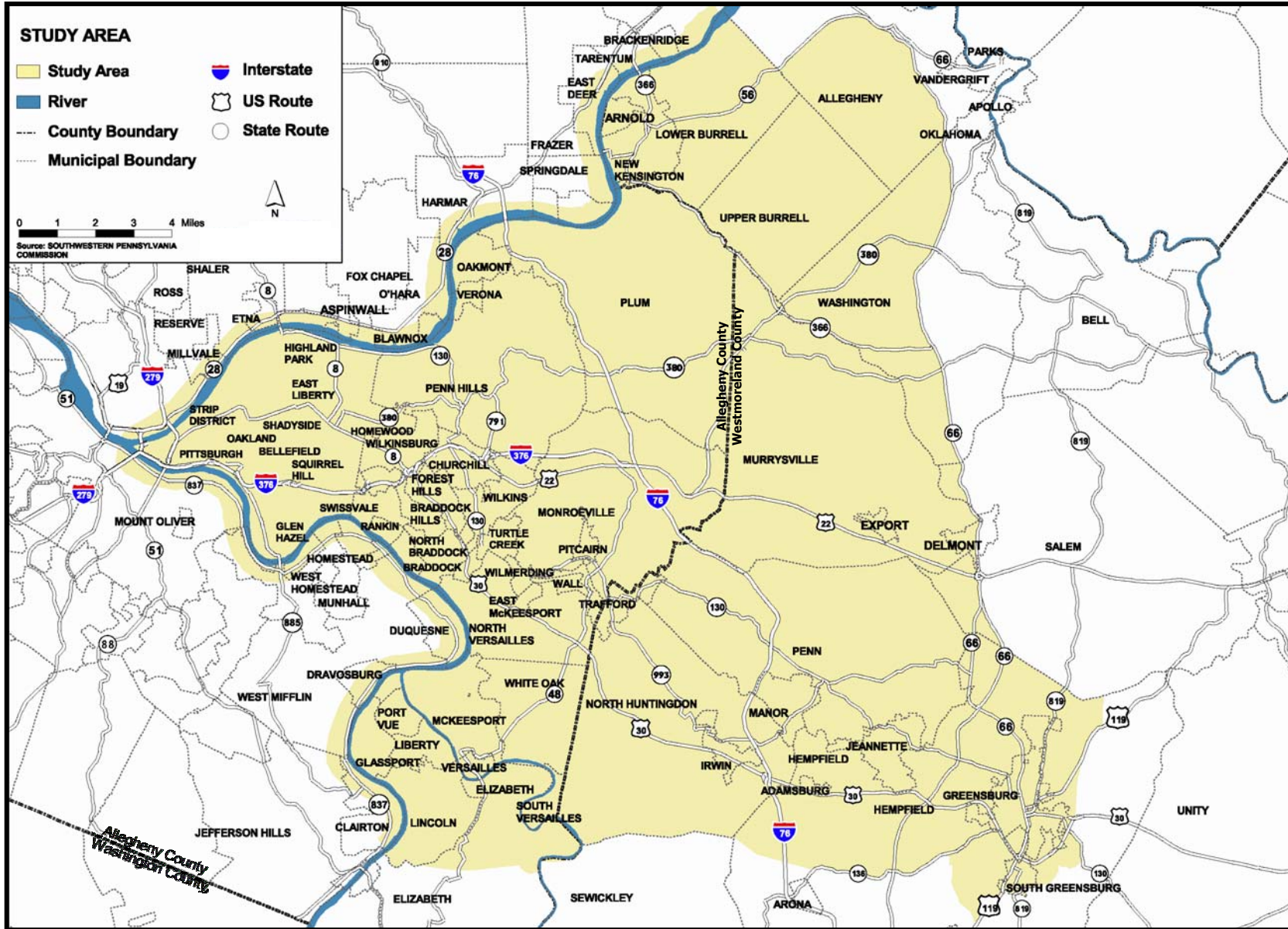
The study is intended to provide information for local decision-makers to understand how new public transportation facilities or improvements to existing facilities would satisfy transportation and community needs in the study area.

Prior to ECTS, the region had undertaken several recent transportation planning and investment efforts for the region both as a whole and with specific initiatives to the west, south and north of the region including:

- Airport Multi-Modal Major Investment Study
- Strategic Regional Transit Visioning Study (20/20 Vision)
- Pennsylvania High Speed Maglev Project
- Mon-Fayette Expressway Draft Environmental Impact Study
- Spine Line Corridor Study
- North Shore Connector Light Rail
- East Busway Extension to Swissvale

Although the East Busway extension provided a recent investment in the east, no future major improvements are proposed in SPC's Long Range Plan for the Eastern Corridor over the next 20 years. As a result, regional stakeholders including PAAC, SPC, WCTA, City of Pittsburgh, Allegheny County and Westmoreland County initiated a transportation planning effort, the Eastern Corridor Transit Study, to identify the sectors of the study area where the next set of public transportation improvements could address the transportation and community needs in the study area.

Exhibit 1-1: Study Area

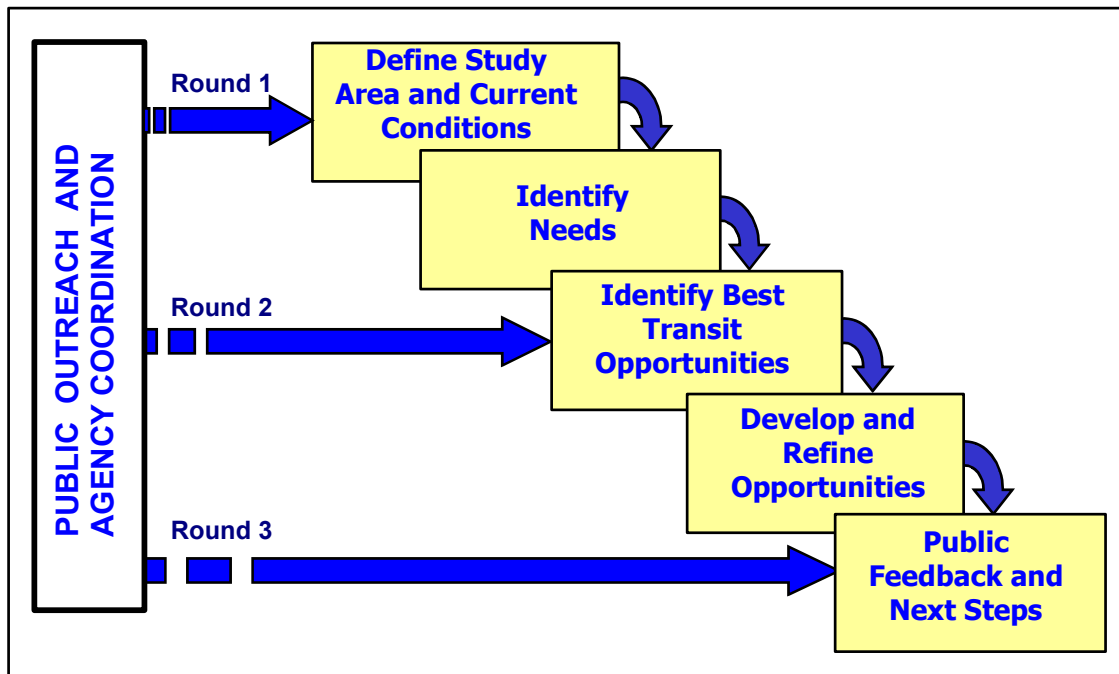


1.2 STUDY PURPOSE AND PROCESS

The purpose of ECTS was to identify the needs in the study area in concert with an extensive public outreach campaign that would ultimately identify transit opportunities, build on existing resources, support economic development, and provide a reasonable probability for moving forward to the next phases of project development. The overall objective of ECTS was not to recommend any one specific public transportation investment or corridor, but rather to provide pertinent information, conclusions and next steps to enable local and regional stakeholders and decision-makers to draw conclusions to identify the best opportunities for improved public transportation investments over the next 20 years.

ECTS followed a step-by-step approach to identifying needs and public transit opportunities to lay the foundation for subsequent analysis that could include a detailed Alternatives Analysis (AA) and Draft Environmental Impact Statement (DEIS) Analysis. The study first set out to establish the context of the study area and its boundaries, followed by identification of existing conditions and needs, development and definition of specific transit opportunities, and an implementation strategy for moving forward. Throughout this process, the study sought constant input and guidance from the general public and regional stakeholders through public outreach activities that included open house meetings, corridor working groups, targeted outreach to interested parties, and tailored coordination with elected officials representing the study area. Feedback from the public outreach effort was the primary source for the development of transportation and community needs and related goals and objectives that guided the study from beginning to end. The study process is illustrated in **Exhibit 1-2**.

Exhibit 1-2: Study Process



1.3 PREVIOUS STUDIES AND SUGGESTED CORRIDORS

Several studies and plans within the region and the ECTS study area that have been completed in the recent past or are ongoing include:

- **Airport Multi-Modal Corridor Project (AMM MIS)** – A Major Investment Study of the Parkway West (I-279) and Routes 22, 30 and 60 corridor between the City of Pittsburgh and Pittsburgh International Airport sponsored by PAAC, SPC, PENNDOT, the City of Pittsburgh, Allegheny County and the Allegheny County Airport Authority. Final recommendations included widening of the Parkway West, extension of Bus Rapid Transit (BRT) beyond the West Busway, investments in interchanges, tunnels and safety improvements, and implementation of a light rail line between the airport and Pittsburgh.
- **Strategic Regional Transit Visioning Study (20/20 Vision)** – Initiated in 2001 with the goal of developing a regional framework for public transportation investments over a nine-county area, the study sought to identify transit strategies and policies to help communities achieve their development and growth goals. The study identified corridors for development of transit systems, determined need for short-term improvements, examined potential applications of technology and considered implementation strategies.
- **Pennsylvania High-Speed Maglev Project** – Ongoing Environmental Impact Statement (EIS) for a 54-mile high-speed magnetic levitation transportation system from the Greensburg area to the Pittsburgh International Airport with intermediate stations located in Monroeville and downtown Pittsburgh.
- **Mon/Fayette Expressway (DEIS)** – Ongoing DEIS of a 65-mile toll road facility from Pittsburgh, through the Monongahela River Valley and western Fayette County, to Interstate 68 in West Virginia, just east of Morgantown. Included in the SPC financially constrained LRP.
- **Spine Line Corridor Study** - Completed in 1993 to study bus and light rail alternatives for improved transit in an eight-mile corridor between downtown Pittsburgh and Squirrel Hill, Oakland, Hill/Midtown and several North Side neighborhoods. A follow-up major investment study (MIS) began in 1995 but was cancelled in 1996 at the direction of the PAAC Board of Directors.
- **Initial Phase Alternatives Analysis** - Completed in 1982 for various alternatives within nine specified corridors, including several that have been identified as part of this study, such as the East Busway, rapid transit in the Spine Line Corridor, and a busway along a partial stretch of the AVR extending into Etna.
- **East Busway Extension** - Environmental Assessment Study for the Phase I Martin Luther King, Jr. East Busway Extension Project, completed in 1995. Three alternatives were studied including the No-Build, Transportation System Management and extension of the East Busway to Swissvale (opened in June 2003).
- **OTAK Study** - Commissioned by the Turtle Creek Council of Governments and composed of two related studies: the East Light Rail Transit Community Design Report which examined Transit Oriented Design (TOD) ideas and the review of the East Busway Light Rail Conversion/Extension Cost Estimates which examined the costs to convert the East Busway to light rail.

Based on these studies and related public outreach initiatives, several corridors within the study area were suggested candidates for major transit investments. The following corridors served as initial guidance in developing the study corridors and alternatives for further definition and evaluation:

- **Allegheny Valley Corridor** – Approximately 23 miles long from downtown Pittsburgh to New Kensington via the communities of Lawrenceville, Oakmont and Verona.
- **East Busway Corridor** – Approximately 23 miles long from downtown Pittsburgh to Penn Hills, paralleling the East Busway through Swissvale, along railroad rights-of-way via the communities of Braddock, Turtle Creek, Pitcairn and Monroeville with a spur to McKeesport.
- **Parkway East (I-376) and Route 22 Corridor** – Approximately 27 miles long from downtown Pittsburgh to Murrysville in Westmoreland County paralleling the East Busway, Parkway East and Route 22 via the communities of Wilksburg, Churchill and Monroeville.
- **Spine Line Corridor** – Approximately 8 miles long from downtown Pittsburgh through Oakland to Squirrel Hill and Homestead either in an at-grade or subway alignment.
- **Norfolk Southern Corridor** – Approximately 31 miles long from downtown Pittsburgh to Greensburg, paralleling the East Busway and continuing to Braddock then through the communities of Trafford, North Huntingdon, and Jeannette.
- **Monongahela Valley Corridor** – Approximately 25 miles long from downtown Pittsburgh to the communities of McKeesport, Clairton, and Versailles paralleling the Monongahela and Youghiogheny rivers and the CSX and Norfolk Southern railroads.

1.4 PUBLIC OUTREACH AND AGENCY COORDINATION

An extensive public outreach and agency coordination process was designed and implemented to cover the large and diverse study area with the goal of establishing a sound purpose and needs statement that would serve as the foundation for all subsequent study tasks. In total, approximately 150 meetings were conducted during the course of the study as illustrated in **Exhibit 1-3**.

Exhibit 1-3: Public Outreach Meetings

Type of Meeting	Number of Meetings
Corridor Working Groups	10
Open Houses	13
Targeted Outreach	86
Public Officials Briefing	14
Station Design Meetings and Workshops	8
Agency Coordination Meeting (ACM)	3
Steering and Technical Committees	16
Total Meetings	150

The study team employed a number of different strategies throughout the duration of the study via three rounds of direct public outreach that included:

- **Corridor Working Groups** - Five geographically-based focus-type groups for the City of Pittsburgh, Allegheny Valley, Eastern Suburbs, Monongahela Valley and Westmoreland County that were instrumental in developing transportation needs and opportunities.
- **Open House Meetings** – Public meetings in an open house format that afforded the public the opportunity to have one-on-one contact with study team members to answer any questions and record their comments on different phases of the study.
- **Station Design Meetings and Workshops** - A series of station design meetings and workshops were held across the corridor to gather information and develop ideas on the relationship between transit planning and community development culminating in station design workshops that focused on typical development types in the study corridor and appropriate transit facilities that could fit into the fabric of the community.
- **Targeted Outreach** – Focused outreach to community organizations, employers, institutions, planning and advocacy groups and special populations in an effort to round out public participation throughout the study area. The study team conducted 90 targeted outreach meetings during the course of the study.
- **Public Officials Briefings** - Federal, state, county and municipal officials were invited and briefed during the first hour of each open house meeting and during a special session in June 2002 held at the David L. Lawrence Convention Center in Pittsburgh.
- **Agency Coordination Meetings (ACM)** – Federal and state Environmental Resource and Transportation Agencies were formally briefed three times during the study process on needs, transit opportunities and evaluation of opportunities and next steps.
- **Steering and Technical Committees** – A Steering and Regional Stakeholders Committee (SRSC) and Project Technical Committee (PTC) were organized at the outset of the study, met regularly and were comprised of participating planning and transportation agencies, city and county representatives (e.g. PAAC, SPC, WCTA, Federal Transit Administration (FTA), PENNDOT, City of Pittsburgh, Allegheny County), key community stakeholders and general public representatives (Steering Committee only).

The three rounds of public outreach were specifically related to key milestones of the study process. The identification and determination of needs was the focus of Round 1, development of transit opportunities to meet the needs was the focus of Round 2 and input on the final list of transit opportunities and next steps in the project development and implementation process was the focus of Round 3. This outreach process was supplemented by project newsletters and an interactive website sponsored by PAAC with links to other project sponsors including SPC and WCTA.

1.5 STUDY AREA NEEDS

The transportation and community needs of the study area were developed primarily through the public outreach process, specifically the corridor working groups and first round of open houses, technical analyses, and agency coordination. A Statement of Needs was developed and documented for the study to guide all subsequent phases of analysis:

- 1. Improve Transit Choices in the Study Corridor** with better service through downtown Pittsburgh, transit options that extend beyond the corridor, additional park & ride facilities and improved connections and access to areas such as Oakland, Pittsburgh International Airport, Monroeville and the Waterfront (Homestead).
- 2. Improve the Quality of Service and Amenities at Station Stops and Transfer Points** with more frequent and flexible transit services, improved comfort at station facilities, greater efficiency in links between suburbs and urban areas and more detailed, user-friendly information on existing transit services.
- 3. Preserve, Protect and Utilize Existing Transportation Resources** by preserving rail rights-of-way for future transit uses, utilizing existing opportunities such as the AVR for near term transit needs and seeking ways to speed current bus services through dedicated lanes and/or prioritized movements on existing highways.
- 4. Enhance Environmental Quality** with environmentally-friendly vehicles, the use of existing rights-of-way to minimize future land impacts, attractive designs of transit stops and stations that enhance surrounding communities and investments in pedestrian and bicycle facilities along existing and planned transit investments.
- 5. Reduce Congestion with Effective Transit Solutions** by introducing viable alternatives to the automobile, thus reducing the need for increased roadway capacities and facilities.
- 6. Coordinate Transit and Community Planning to Enhance Economic Development and Quality of Life** by improving coordination between community and transit planning efforts, identifying opportunities for enhanced economic development through public/private partnerships and improving existing transit facilities to establish them as assets to the communities they serve.
- 7. Develop a Transit Network that Conveniently and Continuously Links People and Activity Centers** by exploring an integrated transit system through downtown Pittsburgh, identifying through-services on existing busway facilities, and improving access to areas such as Pittsburgh's Hill District to eliminate transfers and reduce congestion in downtown Pittsburgh.

Study needs formed the basis for the development of transit opportunities (Build alternatives and Transportation System Management (TSM) alternatives), their evaluation and next steps.

1.6 LONG LIST OF ALTERNATIVES

Twenty-nine transit alternatives were developed in five corridors (shown in **Exhibit 1-4**) based on the identified transportation and community needs and the previously suggested list of investment corridors. The alternatives are illustrated in **Exhibit 1-5**, which provides a general description of each including the name, mode, endpoints, and primary right-of-way (e.g. railroad, roadway). Alternatives that are highlighted indicate those that were moved forward to the Short List of Alternatives. In some cases, the length and endpoints changed with the refinement of the alternative during the subsequent Short List phase of analysis.

Exhibit 1-4: Long List Corridors

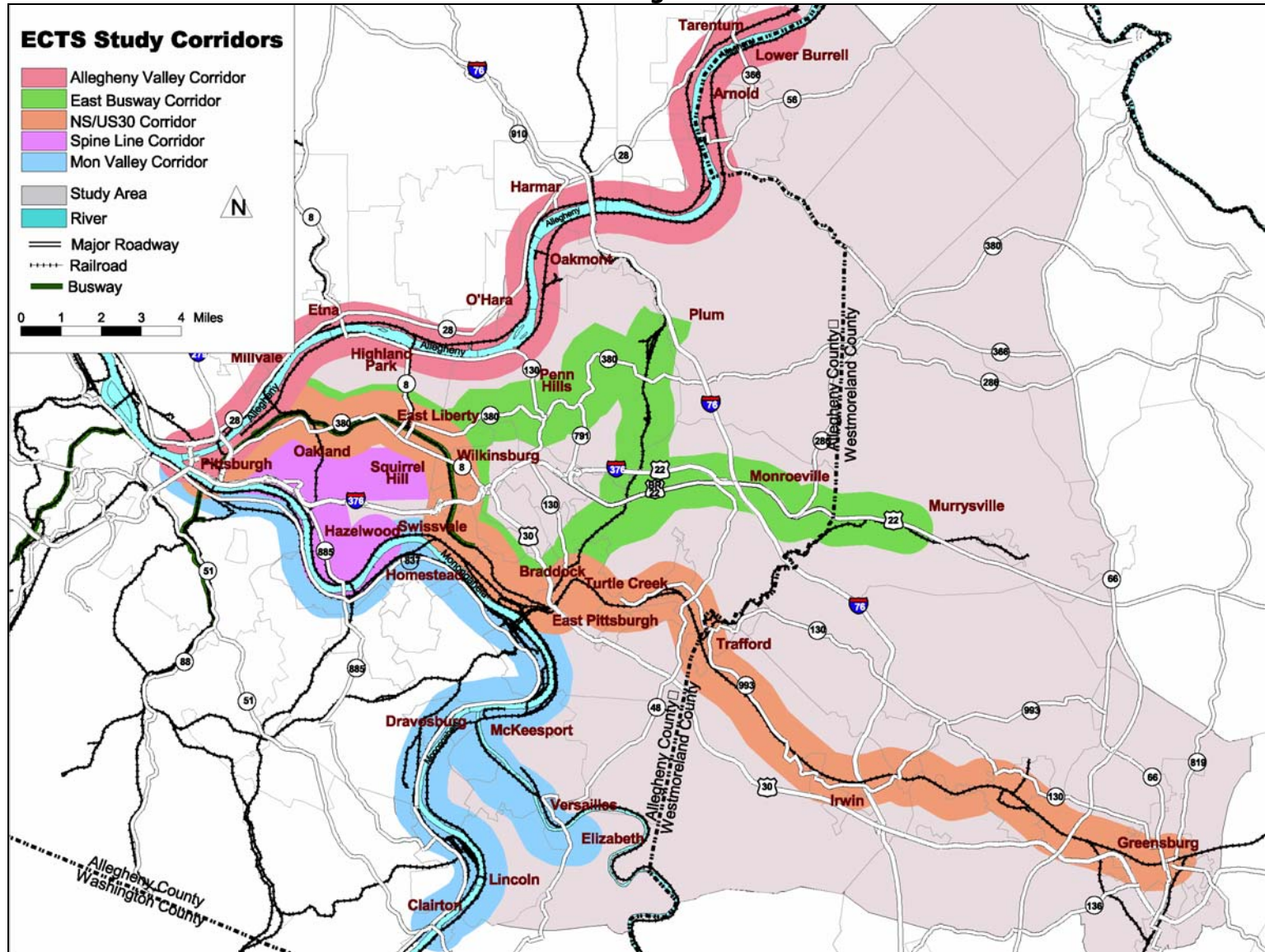


Exhibit 1-5: Long List of Alternatives

	Alt.	Mode	From	To	Primary Right-of-Way
Allegheny Valley Corridor	AV1	Commuter Rail	Downtown Pittsburgh	Lower Burrell	AVR
	AV2	Commuter Rail	Downtown Pittsburgh	Tarentum	AVR and Norfolk Southern Conemaugh
	AV3	Commuter Rail	North Shore	Tarentum	Norfolk Southern Conemaugh
	AV4	Light Rail	Convention Center	Lower Burrell	AVR
	AV5	Light Rail	Convention Center	Tarentum	Norfolk Southern Conemaugh
	AV6	Light Rail	Convention Center	Tarentum	AVR and Norfolk Southern Conemaugh
	AV7	Busway	East Busway at E. Liberty	Tarentum	Norfolk Southern Conemaugh
	AV8	Busway	East Busway at E. Liberty	Lower Burrell	AVR
East Busway Corridor	EB1	Light Rail	Downtown Pittsburgh	Oakland and Plum	NS and Union RR
	EB2	Light Rail	Downtown Pittsburgh	Trafford	Norfolk Southern
	EB3	Light Rail	Downtown Pittsburgh	McKeesport / Versailles	Norfolk Southern and CSX RR
	EB4	Busway	East Busway at Swissvale	Oakland and Plum	NS and Union RR
	EB5	Busway	East Busway at Swissvale	Trafford	Norfolk Southern
	EB6	Busway	East Busway at Swissvale	McKeesport / Versailles	Norfolk Southern and CSX
	EB7	Busway	East Busway at East Liberty	Plum	PA 380/ Frankstown Road
	EB8	Light Rail	Convention Center	Murrysville	I-376/US22/US30
	EB9	Busway	East Busway at Swissvale	Murrysville	I-376/US22
Spine Line Corridor	SL1	Light Rail	Steel Plaza	Wilkinsburg	Centre/Colwell, Forbes/5 th and Penn
	SL2	Light Rail	Convention Center	East Liberty	Penn/Liberty, Baum/Centre and Penn
	SL3	Light Rail	Steel Plaza	Hazelwood	Centre and CSX Panther Hollow
	SL4	Light Rail	Steel Plaza	Homestead (Waterfront)	Centre/Colwell and CSX Panther Hollow
Monongahela Valley Corridor	MV1	Commuter Rail	Station Square	Clairton	Norfolk Southern
	MV2	Commuter Rail	Station Square	McKeesport / Versailles	CSX
	MV3	Commuter Rail	Penn Station	McKeesport / Versailles	Norfolk Southern and CSX Panther Hollow
	MV4	Commuter Rail	Millvale	McKeesport / Versailles	CSX Panther Hollow
	MV5	Light Rail	Convention Center	Rankin and Etna	CSX Panther Hollow
	MV6	Light Rail	Station Square	Clairton	Norfolk Southern
	MV7	Busway	Station Square	Clairton	Norfolk Southern
NS Corr.	NS1	Commuter Rail	Pittsburgh Amtrak Station	Greensburg	Norfolk Southern

Each Long List alternative was evaluated against the transportation and community needs of the study in a qualitative format to effectively identify those that would be most likely to lead to improved transit opportunities in the study area. The final short list alternatives are presented in **Exhibit 1-6** where they were renamed with a two-part abbreviation designating their corridor and mode as follows:

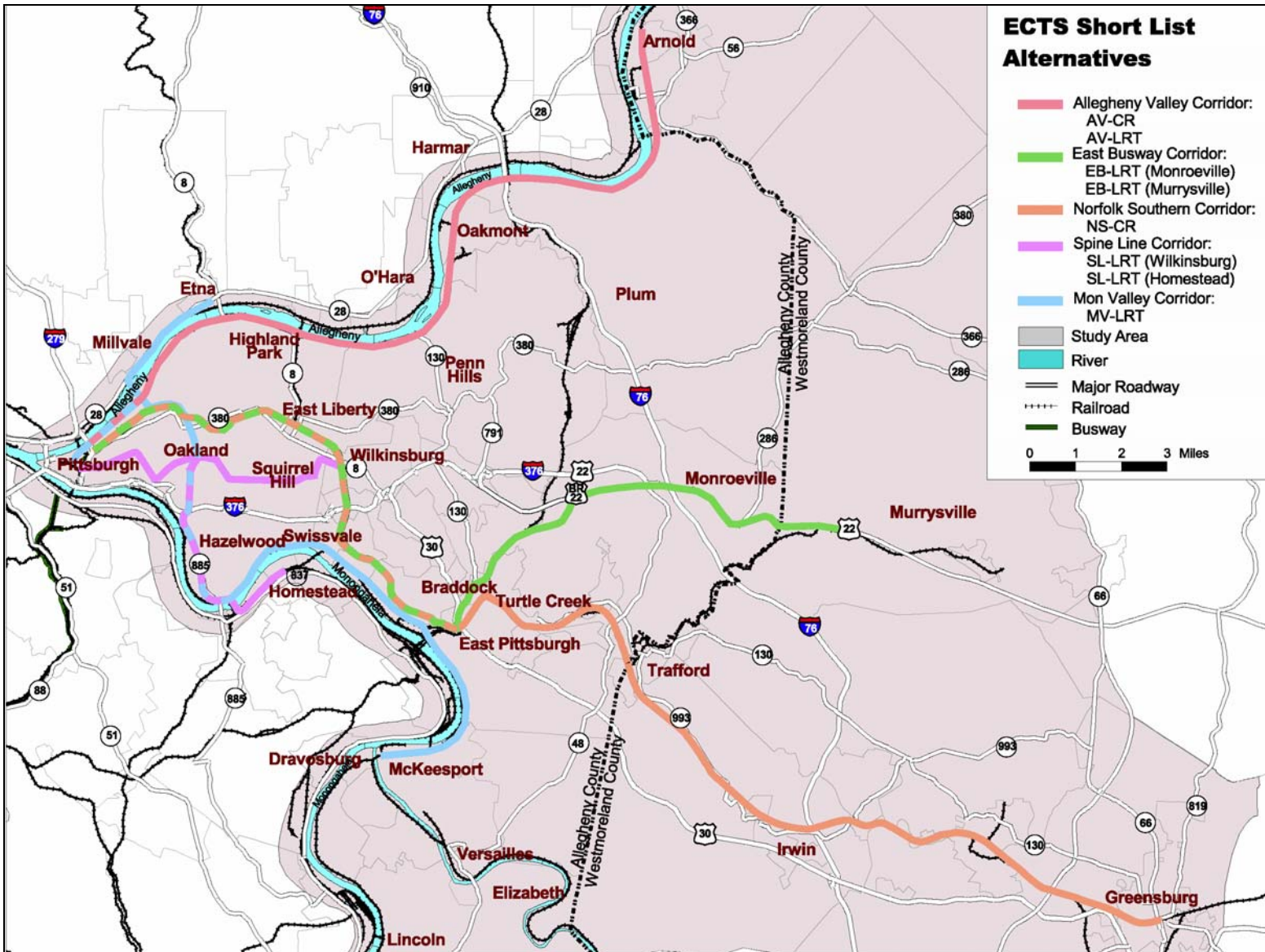
Exhibit 1-6: Short List of Alternatives and Naming Convention

Long List Name	Description	New Short List Name
AV1	Allegheny Valley Commuter Rail	AV-CR
AV4	Allegheny Valley Light Rail	AV-LRT
EB1 and EB8	East Busway - Light Rail to Monroeville/Murrysville	EB-LRT (Monroeville/Murrysville)
EB4 and EB9	East Busway - Busway to Monroeville/Murrysville	EB-BW (Monroeville/Murrysville)
SL1	Spine Light Rail to Wilkinsburg	SL-LRT (Wilkinsburg)
SL4	Spine Light Rail to Homestead	SL-LRT (Homestead)
MV5	Monongahela Valley Light Rail	MV-LRT
NS1	Norfolk Southern Commuter Rail	NS-CR
TSM	Transportation Systems Management	TSM

Exhibit 1-7 illustrates the general location of the short list alternatives in the study corridor. The Short List alternatives meet the study area needs as follows:

- **AV-CR** – This alternative provides a new transit choice that increases the quality of amenities while utilizing an existing transportation resource, the AVR, which has expressed interest in accommodating passenger service; has the potential to reduce congestion on Route 28 and Allegheny River Boulevard; and provides an opportunity to coordinate station planning with community plans in the corridor and recent initiatives in New Kensington. The public outreach process also indicated a strong preference to define and evaluate this alternative further.
- **AV-LRT** – This alternative provides a new transit choice that increases the quality of amenities while utilizing an existing transportation resource; has the potential to reduce congestion on Route 28 and Allegheny River Boulevard; provides a faster ride from the Allegheny Valley to Downtown unaffected by roadway congestion; creates an easier transfer to the “T” for travel to the North Shore and South Hills; decreases the number of vehicles on the corridor’s busy roads; and provides an opportunity to coordinate station planning with community plans in the corridor and recent initiatives in New Kensington.
- **EB-LRT (Monroeville/Murrysville)** – This alternative utilizes existing transportation resources; has the potential to reduce congestion along the Parkway East (I-376) and Route 22 with a convenient and high quality service from Monroeville/Murrysville to Downtown; provides an opportunity to coordinate station planning with community plans in the corridor and recent initiatives in East Liberty; provides a faster ride from the East Busway corridor to Oakland and Downtown unaffected by roadway congestion; creates an easier transfer to the “T” for travel to the North Shore and South Hills; and decreases the number of vehicles on the corridor’s busy roads. In addition, the public outreach effort indicated a strong interest in examining the conversion of the East Busway to light rail.

Exhibit 1-7: Short List Alternatives



- EB-BW (Monroeville/Murrysville)** – This alternative utilizes existing transportation resources; has the potential to reduce congestion along the Parkway East and Route 22 with a convenient and high quality service; provides an opportunity to coordinate station planning with community plans in the corridor including recent initiatives in East Liberty; and has potential to reduce auto congestion in Downtown with a minor increase in bus volumes. In addition, these alternatives were suggested by the public as options to extend into the rapidly developing areas of Murrysville.
- **SL-LRT (Wilkinsburg)** – This alternative provides a new transit choice with frequent service in the study corridor; enhances the quality of service and amenities at station stops; provides an opportunity to coordinate station planning with community plans in the corridor including recent initiatives in Oakland; has potential to reduce auto and bus congestion between Oakland and Downtown; provides a faster ride between Wilkinsburg, Oakland, and Downtown unaffected by roadway congestion; creates an easier transfer to the “T” for travel to the South Hills and a one-seat ride to the North Shore; and decreases the number of vehicles on the corridor’s busy roads. In addition, public outreach indicated strong preferences to further define and evaluate this alternative since it linked Oakland and downtown Pittsburgh.
 - **SL-LRT (Homestead)** – This alternative provides an opportunity to enhance economic development and quality of life in Homestead and Hazelwood; utilizes existing transportation resources; provides a faster ride to Oakland and Downtown unaffected by roadway congestion; creates an easier transfer to the “T” for travel to the South Hills and a one-seat ride to the North Shore; decreases the number of vehicles on the corridor’s busy roads; adds a new, high-quality service between Hazelwood and Oakland; enhances the quality of service and amenities at station stops; and provides the ability to coordinate with recent community planning efforts in Hazelwood. In addition, public outreach indicated strong preferences to further define and evaluate this alternative since it linked Oakland and downtown Pittsburgh and supported initiatives in Hazelwood.
 - **MV-LRT** – This alternative provides a new transit choice with frequent service in the study corridor; offers a north-south connection from Etna through Oakland to McKeesport; enhances the quality of service and amenities at station stops; provides an opportunity to coordinate station planning with community plans in the corridor including recent initiatives in Hazelwood and Rankin; provides a faster ride to Downtown and Oakland unaffected by roadway congestion; creates an easier transfer to the “T” for travel to the South Hills and the North Shore; and decreases the number of vehicles on the corridor’s busy roads. This alternative was also supported strongly through the public outreach process as an opportunity to connect major activity centers with older urban areas in need of economic development.
 - **NS-CR** – This alternative provides an improved transit choice and service periods, especially for commuters; has the potential to reduce congestion on Routes 22, 30 and I-376 between Greensburg and downtown Pittsburgh; utilizes an existing transportation resource; provides an opportunity to enhance economic development and quality of life in older urban areas (e.g. Jeannette); offers improved connections to other transit services in downtown Pittsburgh; and provides the ability to coordinate with recent planning efforts in Greensburg.
 - **TSM** – The Transportation Systems Management Alternative consists of lower cost improvements to the existing transit system, and will be defined more fully in the Short List.

Each of the short listed alternatives meets the needs of the study since they would encourage the use of public transit, efficient land use policies and reduce auto dependency and their emissions.

1.7 SHORT LIST ALTERNATIVES

Short List alternatives were analyzed in detail to identify potential alignments, capital costs, operating and maintenance costs and potential ridership levels.

The build alternatives studied are as follows:

ALLEGHENY VALLEY CORRIDOR

AV-CR: Commuter rail service between downtown Pittsburgh and Arnold, Westmoreland County utilizing the existing AVR right-of-way. Service would be provided via an at-grade alignment with diesel locomotives pulling coach and cab cars. A bus shuttle would transport riders from 16th Street to downtown Pittsburgh. Ridership is estimated at 6,700 daily boardings in 2025 with an incremental annual operating and maintenance cost of approximately \$8.8 million and capital cost of approximately \$258 million for a fully built out, high quality commuter rail service. The study also identified two lower cost options that incorporated reductions in service levels and capital investments resulting in a Starter System and Minimal Investment System with estimated capital costs of approximately \$131 million and \$64 million respectively.

Advantages include use of existing AVR railroad right-of-way, minimal residential impacts, high quality-limited stop commuter service and the potential to reduce peak period congestion in the corridor. Disadvantages include the presence of many grade crossings in the Strip District and Lawrenceville areas, large elevation differences between track level and residential areas, indirect access to downtown Pittsburgh and limited availability of land for park & ride lots.

AV-LRT: Light rail line between downtown Pittsburgh and Arnold, Westmoreland County, utilizing existing AVR right-of-way and providing a high quality direct connection to downtown Pittsburgh since it would connect with the North Shore Connector's underground extension of the "T" at the Convention Center. Ridership is estimated at 18,200 daily riders in 2025 with an annual incremental operating and maintenance cost of approximately \$16.3 million and capital cost of approximately \$804 million.

Advantages include the use of AVR railroad right-of-way, the potential for redevelopment in the Allegheny Valley (a current goal of communities in the corridor), transit travel time savings between Arnold and downtown Pittsburgh, the potential to reduce congestion on existing roadways, and frequent and high quality transit service all day in the corridor. Disadvantages include large elevation differences between track level and residential areas, numerous grade crossings in the Strip District and Lawrenceville and limited availability of land for park & ride lots.

EAST BUSWAY CORRIDOR

EB-LRT (Monroeville & Murrysville) - Consists of a light rail line from downtown Pittsburgh to Monroeville with a spur to Oakland. The service would begin at the existing Steel Plaza Station and follow the North Shore Connector's underground extension of the "T" to the Convention Center Station where it would emerge into the Strip District and then join the East Busway near 26th Street converting the busway to light rail out to Swissvale. An extension would be constructed from Swissvale to Monroeville Mall via NS and Union Railroad right-of-way. Ridership is estimated at 42,900 daily riders in 2025 with an annual incremental operating and maintenance cost of approximately \$25.0 million and capital cost of approximately \$1.3 billion.

The extension to Murrysville via elevated infrastructure along Route 22 would increase ridership to 46,700 daily riders with annual incremental operating and maintenance costs of approximately \$33.3 million and a capital cost of approximately \$2.0 billion for the entire line from downtown Pittsburgh to Murrysville.

Advantages include direct connections to downtown Pittsburgh, Oakland and Monroeville Mall, convenient transfers at Steel Plaza for access to the North Shore, reduced travel times from the eastern portion of study area to downtown Pittsburgh and the ability to replace existing bus routes entering the city with a single high capacity rail service. Disadvantages include service disruptions during conversion of the East Busway, redundant investment in a well-functioning transit facility (i.e. East Busway) between downtown Pittsburgh and Swissvale, increased bus traffic in neighborhoods where buses would feed light rail stations, creation of a two-seat ride for commuters. Also, the high construction cost of the alignment beyond Keystone Commons is a disadvantage.

EB-BW (Monroeville): Consists of an extension of the East Busway from Swissvale to Monroeville Mall via primarily NS and Union Railroad rights-of-way. Service would be provided with standard 40-foot and articulated diesel buses similar to current operations. Ridership is estimated at 41,500 daily riders in 2025 with an annual operating and maintenance cost of approximately \$8.4 million system-wide and capital cost of approximately \$368 million.

Advantages of this alternative include the use of an existing right-of-way and transit facility, reduced travel times between Monroeville and downtown Pittsburgh, minimal construction impacts to the existing East Busway and continued operational flexibility of the busway for local, express and trunkline services. Disadvantages include increased levels of bus traffic on the East Busway and downtown Pittsburgh and high capital costs of construction between Keystone Commons and Monroeville Mall due to elevated structure requirements.

It is important to note that the EB-BW (Murrysville) alternative was not analyzed as part of the Short List evaluation. The study partners decided to test one extension option only based on the premise that sufficient information could be gathered from this analysis to determine the potential for a major transit opportunity (busway or light rail) out to Murrysville. The objective was to identify the potential demand (ridership) for such an investment knowing that its implementation would be several decades away given the current and projected population and employment densities that would be needed to support a major transit project.

SPINE LINE CORRIDOR

SL-LRT (Wilksburg): Consists of an underground light rail line from the North Shore through downtown Pittsburgh to Wilksburg following the general alignment of Centre Avenue, Forbes Avenue, and Braddock Avenue to the East Busway Wilksburg Station. Ridership is estimated at 39,400 daily riders in 2025 with an annual incremental operating and maintenance cost of approximately \$12.3 million and a capital cost of approximately \$2.5 billion.

Three options were developed to reduce the level of capital investment including phased implementation and at-grade infrastructure. Option 1 would phase the project from downtown Pittsburgh to Oakland then to Wilksburg with the first phase costing \$1.5 billion and the second \$1.0 billion. Option 2 would utilize at-grade infrastructure through Oakland, saving approximately \$300 million, for a total cost of \$1.2 billion from downtown Pittsburgh to Oakland. Option 3 assumed an entire at-grade alignment between downtown Pittsburgh and Oakland at an approximate capital cost of \$600 million.

Advantages of this alternative include transfer capability to the East Busway at Wilkinsburg and a direct connection to the North Shore, exclusive right-of-way unimpeded by street traffic and stoplights in Oakland, frequent and high quality transit service and the potential to reduce bus congestion on the streets of Oakland and downtown Pittsburgh. Disadvantages include high construction costs and impacts due to the underground alignment and a difficult connection to the existing "T" at Steel Plaza.

SL-LRT (Homestead): This alternative is similar to SL-LRT (Wilkinsburg) from downtown Pittsburgh to Oakland, however, it turns to the south near Craig Street onto CSX right-of-way continuing at-grade through Panther Hollow, Greenfield and Hazelwood and Homestead. Service would be provided with electric light rail vehicles. Ridership is estimated at 35,700 daily riders in 2025 with an annual incremental operating and maintenance cost of approximately \$23.0 million and a capital cost of approximately \$1.9 billion. The three options explored for SL-LRT (Wilkinsburg) also apply to this alternative given the similarity of investment from downtown Pittsburgh to Oakland. Option 1 would phase the project from downtown Pittsburgh to Oakland then to Homestead with the first phase costing \$1.4 billion and the second \$0.5 billion. Option 2 would utilize at-grade infrastructure through Oakland, saving approximately \$300 million, for a total cost of \$1.1 billion from downtown Pittsburgh to Oakland. Option 3 assumed an entire at-grade alignment between downtown Pittsburgh and Oakland at an approximate capital cost of \$600 million.

Advantages of this alternative include a direct connection to the North Shore, exclusive right-of-way unimpeded by street traffic and traffic signals in Oakland, frequent and high quality transit service, it complements the redevelopment of Hazelwood and its potential to reduce bus congestion on the streets of Oakland and downtown Pittsburgh. Disadvantages include high construction costs, impacts due to the need for an underground alignment, and difficult connection to the existing "T" at Steel Plaza.

MONONGAHELA VALLEY CORRIDOR

MV-LRT: This alternative consists of a light rail line from Steel Plaza in downtown Pittsburgh to McKeesport and Etna via the North Shore Connector's underground extension to the Convention Center, the Strip District and existing CSX right-of-way. Ridership is estimated at 34,700 daily riders in 2025 with an annual incremental operating and maintenance cost of approximately \$20.6 million and a capital cost of approximately \$1.1 billion. An option to extend from downtown Pittsburgh to Etna as a first phase and McKeesport as a second phase were explored resulting in approximate capital costs of \$369 million and \$805 million respectively.

Advantages of this alternative include the use of existing railroad right-of-way, provision of a north-south transit connection from Oakland to both the Allegheny Valley and McKeesport, service to the Carrie Furnace redevelopment area in Swissvale and Rankin, improved transit between Pittsburgh, Etna, Oakland and McKeesport and frequent and high quality transit service. Disadvantages include lack of east-west access through Oakland and freight train interference on construction and operation between Rankin and McKeesport.

NORFOLK SOUTHERN CORRIDOR

NS-CR: This alternative consists of a commuter rail line from the Amtrak Station in downtown Pittsburgh to Greensburg in Westmoreland County along existing NS right-of-way. Ridership is estimated at 8,800 daily riders in 2025 with annual incremental operating and maintenance costs of approximately \$16.5 million and a capital cost of approximately \$233 million. The study also identified

two lower cost options that incorporated reductions in service levels and capital investments, a Starter System and a Minimal Investment System with estimated capital costs of approximately \$142 million and \$76 million respectively.

Advantages for this alternative include the use of existing right-of-way, no at-grade crossings, potential for reduction of congestion on Parkway East, U.S. 30 and U.S. 22, provision of a convenient and high quality transit service between Greensburg and Pittsburgh resulting in significant travel time reductions between Greensburg and Pittsburgh. Disadvantages include train dispatch by NS with freight priority over passenger operations, labor intensive operation due to train staffing requirements, negotiations with NS for use of its right-of-way and the need for a new vehicle maintenance and storage facility.

The TSM alternative was also developed in an effort to identify the best opportunities for low cost improvements to the existing transit system:

TRANSPORTATION SYSTEM MANAGEMENT (TSM)

TSM: The TSM alternative was developed to test a number of ideas gathered through the public outreach process including new north/south services, improved service frequencies on selected existing routes, new routes to major employment centers, additional park & ride lots and new incline opportunities. TSM highlights include:

- **City of Pittsburgh / Oakland** – New service from Lawrenceville to Polish Hill; Incline between the Strip District and the Hill District; and, priority movements for bus services between Oakland and Downtown.
- **Monongahela Valley** - Service increases from Monongahela Valley communities to downtown Pittsburgh.
- **Allegheny Valley** - Service increases between New Kensington and downtown Pittsburgh and the Regional Industrial Development Corporation (RIDC) business park in O'Hara Township.
- **Eastern Suburbs** - Service increases and a new route from New Kensington to Monroeville.
- **Westmoreland County** - Service increase on all WCTA routes between Greensburg and Pittsburgh; new bus service from Greensburg to the SONY Plant at Mount Pleasant; and additional park & ride facilities in downtown Greensburg, Route 22/66 Interchanges in Delmont, Murrysville, Route 30 (Hempfield), Irwin, North Huntingdon, and Route 30 East (Carpenter Lane).

The TSM opportunities were tested for overall market potential but were not further defined or evaluated as part of the Short List analysis but instead will be carried forward to the next phases of project development (subsequent to this study) as the build alternatives are prioritized through the long-range planning process.

Exhibit 1-8 provides a summary of the key attributes for each of the short-listed build alternatives.

Exhibit 1-8: Attributes of Short List Build Alternatives*

	Alternative	Total Length (miles)	Number of Stations	Service Peak/Off-Peak (minutes)	Travel Time (minutes)	Daily Boardings (in year 2025)	Annual Incremental O&M Cost (2002 millions)	Capital Cost (2002 millions)
1	AV-CR	18.4	9	30 / 90	34 - Strip Dist. to Arnold	6,700	\$8.8	\$258.7
1a	AV-CR Starter System	18.4	9	60 / 90	34 - Strip Dist. to Arnold	1,900	\$5.3	\$131.0
1b	AV-CR Minimal Investment	18.4	9	Two AM trains Two PM trains	40 - Strip Dist. to Arnold	800	\$2.6	\$64.0
2	AV-LRT	19.3 (18.9 new)	14 (12 new)	10 / 20	37 - Steel Plaza to Arnold	18,200	\$16.3	\$803.6
3	EB-LRT (Monroeville)	17.4 (16.9 new)	19 (17 new)	10 / 15	39 - Steel Plaza to Monroeville 13 - Steel Plaza to CMU 32 - CMU to Monroeville	42,900	\$25.0	\$1,273.3 <i>(\$1,040 to Keystone Commons)</i>
3a	EB-LRT Extension to Murrysville	6.2 additional	4 additional	10 / 15	54 - Steel Plaza to Murrysville 13 - Steel Plaza to CMU 32 - CMU to Monroeville	3,800 additional	\$8.3 additional	\$741.6 additional
4	EB-BW (Monroeville)	15.6 (6.6 new)	15 (5 new)	10 / 15	42 - Penn Sta. to Monroeville 8 - Penn Sta. to Centre Ave. 38 - Center Ave. to Monroeville	41,500	\$10.9	\$367.6 <i>(\$230 to Keystone Commons)</i>
5	SL-LRT (Wilkinsburg)	8.8 (7.3 new)	15 (10 new)	5 / 7.5	23 - Steel Plaza to Wilkinsburg 12 - Steel Plaza to Oakland	39,400	\$12.3	\$2,496.7 <i>(Phase I: \$1,500, Phase II: \$1,000)</i> <i>(At-grade in Oakland and no extension to Wilkinsburg: \$1,200)</i> <i>(At-grade Downtown to Oakland \$600)</i>
6	SL-LRT (Homestead)	10.3 (8.8 new)	15 (10 new)	5 / 7.5	24 - Steel Plaza to Homestead 12 - Steel Plaza to Oakland	35,700	\$23.0	\$1,892.5 <i>(Phase I: \$1,430, Phase II: \$463)</i> <i>(At-grade in Oakland and no extension to Homestead: \$1,100)</i> <i>(At-grade Downtown to Oakland \$600)</i>
7	MV-LRT	21.0 (20.7 new)	16 (14 new)	10 / 20	14 - Steel Plaza to Etna 36 - Steel Plaza to McKeesport 13 - Steel Plaza to Oakland	34,700	\$20.6	\$1,061.8
7a	MV-LRT Etna Branch Only	5.6 (5.2 new)	7 (5 new)	10 / 20	14 - Steel Plaza to Etna 13 - Steel Plaza to Oakland	14,900	\$4.0	\$368.9
7b	MV-LRT McKeesport Branch Only	17.7 (17.3 new)	14 (12 new)	10 / 20	36 - Steel Plaza to McKeesport 13 - Steel Plaza to Oakland	19,800	\$16.5	\$804.7
8	NS-CR	30.9	7 (6 new)	30 / 90	49 - Penn Sta. to Greensburg	8,800	\$16.5	\$232.8
8a	NS-CR Starter System	30.9	7 (6 new)	60 / 90	64 - Penn Sta. to Greensburg	4,400	\$12.7	\$142.0
8b	NS-CR Minimal Investment	30.9	7 (6 new)	Two AM trains Two PM trains	64 - Penn Sta. to Greensburg	2,500	\$4.8	\$76.0

* Excludes TSM, which will be evaluated in future phases of study (e.g. AA, DEIS)

1.8 CONCLUSIONS AND NEXT STEPS

The short-listed alternatives were evaluated based on several measures including ridership potential, capital costs and operating and maintenance costs. This task helped to reveal the merits of each alternative. The following conclusions were drawn to suggest the next steps and timelines for advancing selected alternatives into subsequent phases of planning, design, and construction. It is important to note that the suggestions herein for next steps are made in relation to the federal process, in order to be eligible to use federal funds. If federal funds are not to be used, a different process to advance alternatives might be pursued. Furthermore, even if federal funds are to be pursued, the decision on level of effort to be followed is a collaborative one, that is identified at the time the decision is at hand, and takes into account local and regional conditions.

ALLEGHENY VALLEY CORRIDOR

AV-CR: This alternative has the potential to attract a reasonable level of ridership including new transit trips systemwide with a low capital investment. In addition, this alternative has wide public support to move forward including confirmed cooperation from the Allegheny Valley Railroad. The following steps are suggested for this alternative:

- Move forward into a full Alternatives Analysis and Environmental Analysis.
- Investigate lower cost options including vehicle technologies.
- Identify options to improve the connection with downtown Pittsburgh.
- Continue coordination with the Allegheny Valley Railroad.

AV-LRT: This alternative has the ability to more riders than commuter rail, but at a higher capital cost. The following steps are suggested for this alternative:

- Consider light rail from the Convention Center to the proposed commuter rail station for AV-CR to improve the connection to downtown Pittsburgh.
- Do not advance this alternative to the next phases of project development.

EAST BUSWAY CORRIDOR

EB-BW (Monroeville): The extension of the existing East Busway to Monroeville builds upon an existing and well-utilized transit service and facility that currently operates between downtown Pittsburgh and Swissvale. The EB-BW (Monroeville) alternative performed relatively well in most of the evaluation categories including capital costs and incremental cost per incremental new systemwide boarding. The following steps are suggested for this alternative:

- Move this alternative forward into a full Alternatives Analysis and Environmental Analysis.
- Examine benefits of extending to East Pittsburgh as an initial phase, with completion to Monroeville at a later date.
- Consider use of the proposed Mon-Fayette Expressway to access Monroeville to reduce costs.

EB-LRT (Monroeville & Murrysville): Each of these alternatives requires significant capital investment for the conversion of the existing East Busway to a light rail facility. As a result, these alternatives did not perform well on tests of cost effectiveness and ridership potential. Although the

segment from Monroeville to Murrysville shows some promise for attracting new riders it is not sufficient to overcome the high cost or the impacts of disruptive infrastructure required to traverse Route 22. The following steps are suggested for these alternatives:

- Eliminate these alternatives from further study based on their performance, high cost to implement and redundancy with the existing and recently extended (Swissvale) East Busway.
- Coordinate with the communities and businesses along the Route 22 to improve and expand existing bus service.
- Implement use of cleaner-fuel buses in the East Busway Corridor.

SPINE LINE CORRIDOR

SL-LRT (Wilkesburg/Homestead): Both alternatives attract similar and reasonable levels of total ridership, new systemwide boardings and boardings per route mile but at very high capital costs. However, both would provide excellent service to Oakland and both have received considerable public support. Possible at-grade options could significantly reduce the overall capital costs for these projects but with some degradation of service. Phasing of construction could spread capital costs over a more reasonable time period. The following steps are suggested for these alternatives:

- Move the SL-LRT (Homestead) forward into a full Alternatives Analysis and Environmental Analysis (e.g. DEIS).
- Examine service from Oakland to Wilkesburg or from Oakland to McKeesport as in MV-LRT to fully understand the benefits and trade-offs of each option.
- Develop at-grade scenarios in coordination with the City of Pittsburgh Engineering and Construction, and Planning departments and stakeholders in Oakland.
- Coordinate and/or combine effort with results of the Airport Multi-Modal Corridor Study to test needs and opportunities from Oakland and downtown Pittsburgh to the Airport.
- Examine phased construction scenarios such as downtown Pittsburgh to Oakland, Oakland to Hazelwood, and Hazelwood to Homestead.
- Perform a core capacity analysis of impacts on the existing downtown Pittsburgh "T" operation including a careful engineering review of the connection options available at Steel Plaza for a new service line from the East.
- Perform operational analysis of the possible benefits of replacing bus service between downtown Pittsburgh and Oakland.
- Continue communications with CSX Railroad for use of the right-of-way from Etna to Glenwood Yard and beyond to Homestead.

MONONGAHELA VALLEY CORRIDOR

MV-LRT: This alternative illustrates the potential to attract a high level of ridership and new systemwide boardings with moderate incremental O&M and capital costs. However, a review of the two branches indicates that they have merit independent of one another and should be considered as separate components combined with other alternatives already recommended for further consideration in the Allegheny Valley and Spine Line corridors. One element of this alternative is that it would provide LRT service to the Strip District, as an extension of the Convention Center line of the North Shore Connector. The following steps are suggested for these alternatives:

- Examine, as part of an Alternatives Analysis, light rail service to Etna from downtown Pittsburgh independently or in tandem with the Allegheny Valley alternatives.
- Evaluate the service line to McKeesport as part of the SL-LRT (Homestead) alternative that is similar in service levels and accessibility.
- Review and analyze appropriate feeder bus network to supplement the investment.
- Investigate potential for light rail serving the Strip District.

NORFOLK SOUTHERN CORRIDOR

NS-CR: This alternative demonstrates the ability to attract a reasonable level of total ridership and new systemwide boardings at a moderate level of capital investment and incremental O&M costs. The implementation of this alternative assumes the use of the NS right-of-way from Greensburg to downtown Pittsburgh with minimal enhancements to existing infrastructure and appears to provide increased access and mobility to the corridor between Greensburg and downtown Pittsburgh. The following steps are suggested for these alternatives:

- Move forward into Alternatives Analysis and Environmental Analysis.
- Explore the benefits of combining with the effort for AV-CR as part of a two-pronged study that would optimize the use of resources.
- Establish communications with NS Railroad to identify the requirements for accommodating both freight and passenger service with the greatest flexibility.
- Investigate lower cost options.

TRANSPORTATION SYSTEM MANAGEMENT

TSM: The TSM alternative identified several key opportunities for improving the existing transit system in each of the study corridors including a Bus Rapid Transit (BRT) application between Downtown and Oakland, involving elements such as traffic signal priority for buses at key intersections. Other TSM initiatives are new routes and service increases throughout the study area, the potential for an incline between the Strip and Hill Districts and significant demand for more Park & Ride facilities in Westmoreland County especially at locations in Greensburg, I-76/Irwin and Delmont. The next steps for the TSM include further refinement and evaluation as part of any AA/DEIS phases for the build alternatives. In addition, given the level of interest and ridership potential, WCTA should pursue the planning and development of park & ride facilities at the locations cited above.

A summary of the study conclusions and next steps is presented in **Exhibit 1-9**.

1.9 GENERAL GUIDANCE FOR NEXT STEPS

The following discussion provides guidance on the next steps that could be taken to implement future phases of project development for any of the proposed ECTS alternatives:

- **Long Range Plan (LRP) Adoption** - Adoption in the financially constrained SPC LRP.
- **Alternatives Analysis (AA)** – The highest level of transportation planning for major investments that seek Federal New Starts Funding.

- **Draft Environmental Impact Statement (DEIS)** – Analysis of environmental impacts and mitigations for major transportation investments and the no-build alternative as required by NEPA.
- **Final Environmental Impact Statement (FEIS)** – Documentation of mitigations and responses addressing comments and concerns raised during the DEIS as required by NEPA.
- **Preliminary Engineering (PE)** – Engineering that advances a project to the 30% design level.
- **Final Design (FD)** - Engineering that takes a project to the 90-100% design level.
- **Construction** – The actual construction of the major investment including purchase of right-of-way, construction, manufacture and delivery of rolling stock, start-up and testing.

One of the most important aspects of implementing a major transportation investment is the identification of stable and reliable capital and operating funds to ensure the completion of construction and continued operation and maintenance of the new system for decades to come. The following provides a menu of funding options that could be available for any of the ECTS alternatives.

- **Capital Sources (Existing):** These sources include federal Section 5307 and 5309 funds, Federal Highway Flexible Funding, State Bond Funds, Act 3 Dedicated Sales Tax (State) and Act 26 Capital (State) funds.
- **Operating Sources (Existing):** These state sources include Act 26 Operating, Pennsylvania Mass Transit Assistance, State Bond Funds, Vehicle Overhaul and Infrastructure Renewal Program.
- **Potential New Sources:** These potentially new sources of revenue could include a local sales tax, local income tax, vehicle registration fees and gas tax.
- **Innovative Funding Sources:** These sources could include Benefits Assessment Districts, joint development, Certificates of Participation for bus purchases, delayed local match, use of the State Infrastructure Bank and the Transportation Infrastructure Finance and Innovation Act.

More detailed information on these and other funding sources is available in Section 7.4.2 of this report.

Exhibit 1-9: Summary of Conclusions and Potential Implementation Schedule

Alternative	Recommendation	Approach & Opportunities	Priority	Schedule Planning/ Construction
AV-CR Allegheny Valley Commuter Rail	Advance to AA/DEIS or EA	<ul style="list-style-type: none"> Investigate lower cost options Evaluate "T" extension to Strip District station Coordinate and partner with AVR from the outset 	High	2004/2007
AV-LRT Allegheny Valley Light Rail	No Advancement			
EB-BW (Monroeville) East Busway to Monroeville	Advance to AA/DEIS	<ul style="list-style-type: none"> Evaluate project phasing including extension to Braddock and East Pittsburgh Coordinate with the Turnpike Commission (i.e. Mon-Fayette Expressway) for transit accommodations 	High	2004/2010
EB-LRT (Monroeville) East Busway Light Rail to Monroeville	No Advancement			
EB-LRT (Murrysville) East Busway Light Rail to Murrysville	No Advancement			
SL-LRT (Wilkesburg) Spine Line Light Rail to Wilkesburg	Advance as Part of SL-LRT (Homestead)	<ul style="list-style-type: none"> Evaluate as part of SL-LRT to Homestead AA/DEIS Analysis of trade-offs for extensions from Oakland to Wilkesburg, Homestead or McKeesport 		
SL-LRT (Homestead) Spine Line Light Rail to Homestead	Advance to AA/DEIS	<ul style="list-style-type: none"> Investigate lower cost options Coordinate and partner with City Planning Develop phasing scenarios and core capacity analysis Coordinate with CSX for use / acquisition of railroad right-of-way Analysis of trade-offs for extension from Oakland to Wilkesburg, Homestead or McKeesport 	Medium	2006/2015
MV-LRT Mon-Valley Light Rail to Etna & McKeesport	Advance Downtown to Etna line to AA/DEIS and examine service to McKeesport	<ul style="list-style-type: none"> Evaluate LRT to Etna in separate study from LRT to McKeesport. Evaluate LRT to McKeesport as part of SL-LRT (Homestead) analysis Coordinate with CSX for use / acquisition of railroad rights-of-way 	Medium (LRT to Etna)	2005/2012
NS-CR Norfolk Southern Commuter Rail to Greensburg	Advance to AA/DEIS or EA	<ul style="list-style-type: none"> Investigate lower cost options Coordinate with NS for use of railroad right-of-way Coordinate with AV-CR next steps 	High	2004/2007
TSM	Advance simultaneously with above recommendations	<ul style="list-style-type: none"> Refinement parallel to the advancement of build alternatives Move forward with park & rides in Westmoreland County 	Medium To High	2004/2015

2 EXISTING CONDITIONS

2.1 DESCRIPTION OF STUDY AREA

The Eastern Corridor Transit Study area, as illustrated in **Exhibit 2-1**, extends from downtown Pittsburgh to the City of Greensburg in Westmoreland County, from the north shore of the Allegheny River northeast to New Kensington and to the south shore of the Monongahela River southeast to Clairton. The study area covers 385 square miles, encompassing 53 municipalities in their entirety and portions of 34 others north and south of the Allegheny and Monongahela Rivers and along the eastern border near Route 66. The study area includes portions of Allegheny and Westmoreland Counties.

2.2 DEMOGRAPHIC AND SOCIOECONOMIC CHARACTERISTICS

To better understand the study area's residential and employment characteristics, demographic trends were reviewed based on 1990, 1997 and 2000 Census records and the Southwestern Pennsylvania Commission (SPC) long-range forecasts. Demographics of the study area were analyzed by travel analysis zone (TAZ), a geographic division of an area, used in travel demand modeling that correlates to major trip producers or attractors, and is based on population, employment, and numerous other factors.

2.2.1 POPULATION

The total population of the study area in 2000 was 804,891 persons, of whom 214,627 resided within the City of Pittsburgh. Allegheny County's eastern suburbs also exhibited a fairly high population base; in particular, the municipalities of Penn Hills and Monroeville contained 46,809 and 29,349 persons, respectively. Within Westmoreland County, the largest concentrations of population existed in the municipalities of Hempfield, Murrysville, and North Huntingdon with 30,244, 18,872 and 29,123 persons, respectively.

As illustrated in **Exhibit 2-2**, a majority of the City of Pittsburgh had population densities of at least 4,000 to 11,999 persons per square mile in 2002 with greater densities in portions of Shadyside, Bellefield, Oakland, and Homewood. Only a few tracts in the city had less than 2,000 persons per square mile, including the Strip District and the communities of Hazelwood and Glen Hazel.

Population densities in the remainder of the study area were generally lower than the City of Pittsburgh, less than 2,000 persons per square mile in many communities. Areas of higher density outside the City of Pittsburgh include:

- Portions of McKeesport and Wilkinsburg (12,000 persons per square mile)
- Swissvale, Edgewood, Wilkinsburg, Arnold and New Kensington, (between 7,500 and 11,999 persons per square mile)
- Rankin, Homestead, Pitcairn, Turtle Creek, Oakmont, Verona, Greensburg, Jeannette, and Irwin (between 4,000 and 7,499 persons per square mile)

Exhibit 2-1: Study Area Map

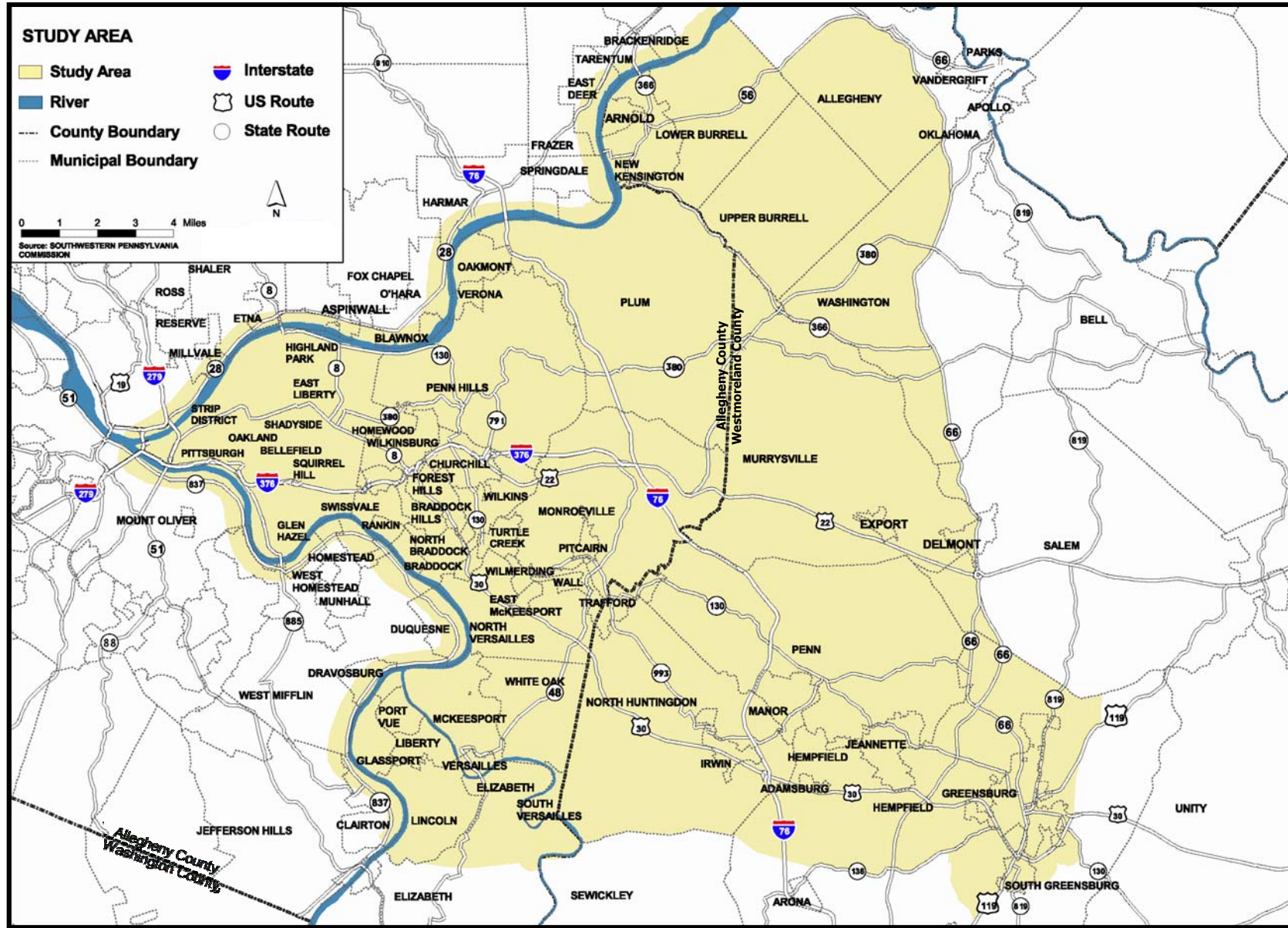
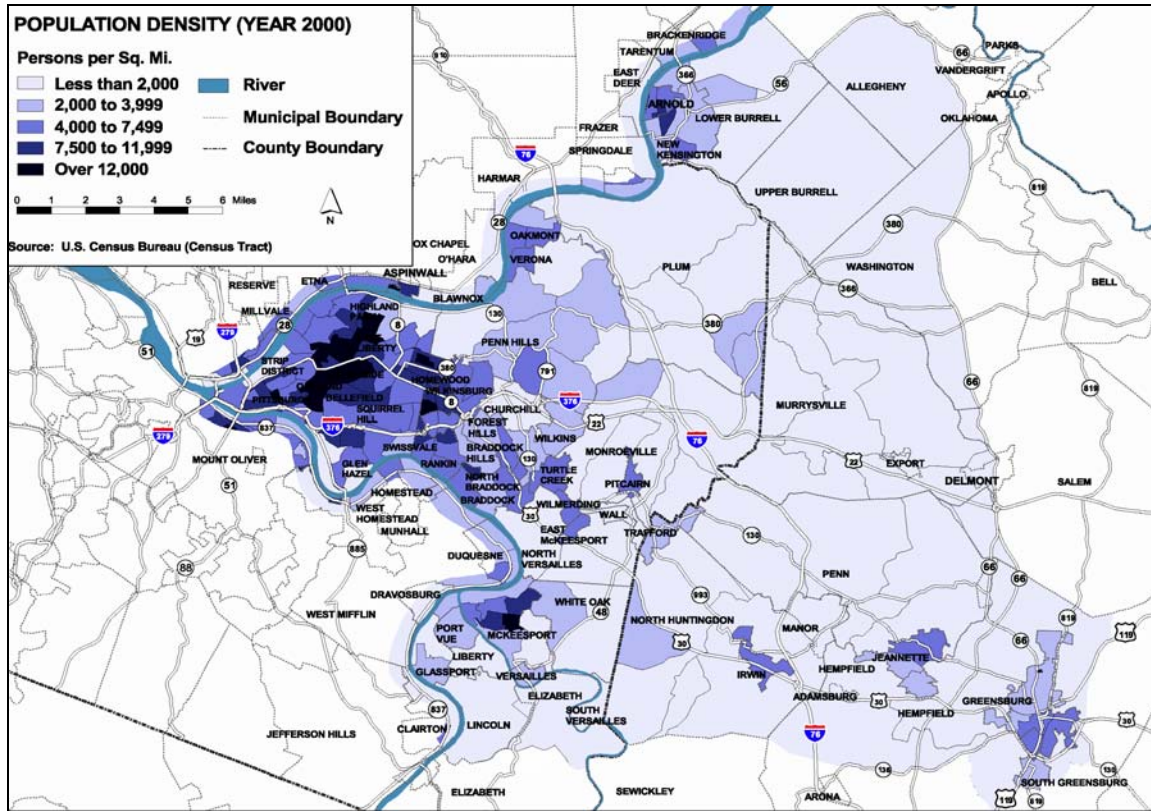


Exhibit 2-2: Population Density in 2000



Based on SPC Cycle VI forecasts, developed using 1997 census data, a reversal in the decreasing population trend is expected, with an overall population increase of 7.23% between 1997 and 2025 in the study area. Areas predicted to gain population are focused mostly in the east, while the western portion of the study area will likely experience population changes ranging from small increases to large decreases, as illustrated in **Exhibit 2-3**.

2.2.2 MINORITY POPULATION

In the year 2000 the total percentage of minorities, defined as non-white persons, within the study area was 19% (153,858 persons out of a total study area population of 804,891). The largest minority populations were located in the western portion of the study area, as shown in **Exhibit 2-4**. Within the City of Pittsburgh, the area between Route 380 (Bigelow Blvd) and 5th Avenue in Downtown, the Strip District, East Liberty, Friendship, Garfield, Stanton Heights, Point Breeze, and Glen Hazel all have at least 50% minority populations. Areas in the eastern suburbs with 50 to 100% minority populations include portions of Penn Hills, Wilksburg, Rankin, Braddock, North Braddock, and McKeesport. Within the eastern portion of the study area, sections of Jeannette, Greensburg, and Arnold have between 10 and 24% minorities; a portion of New Kensington contains between 25 and 49% minority population. The remaining communities in the eastern portion of the study area contain minority populations of less than 10%.

Exhibit 2-3: Population Change 1997-2025

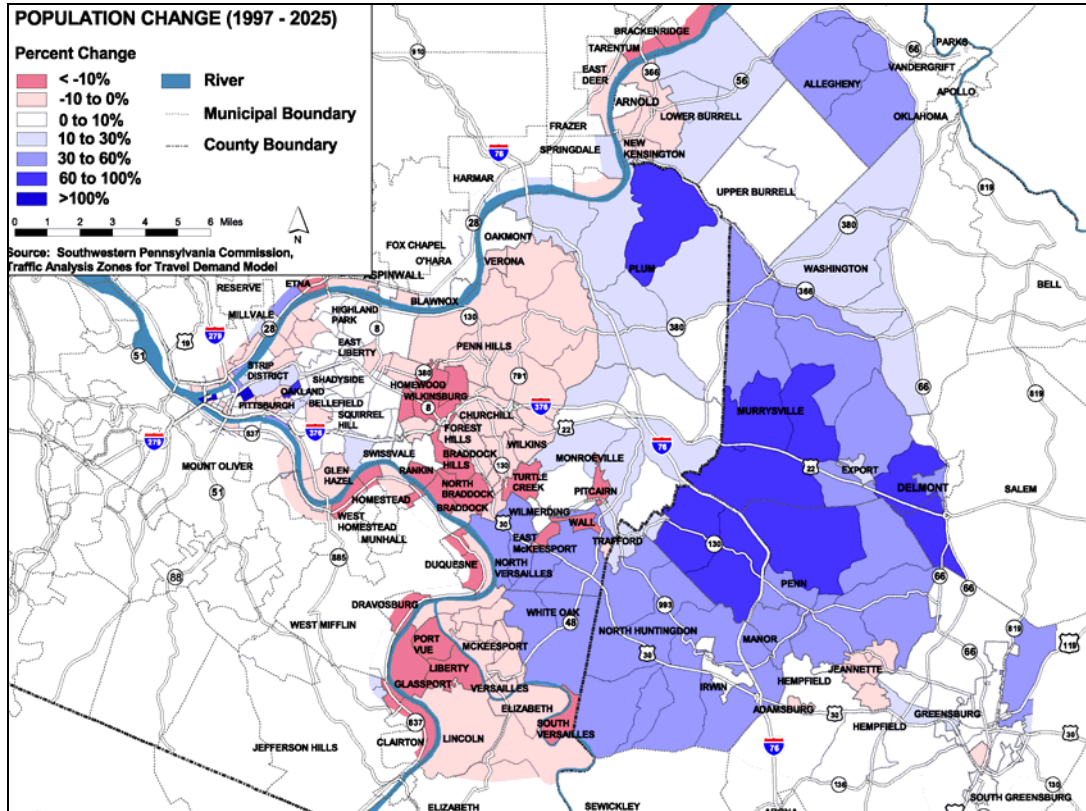
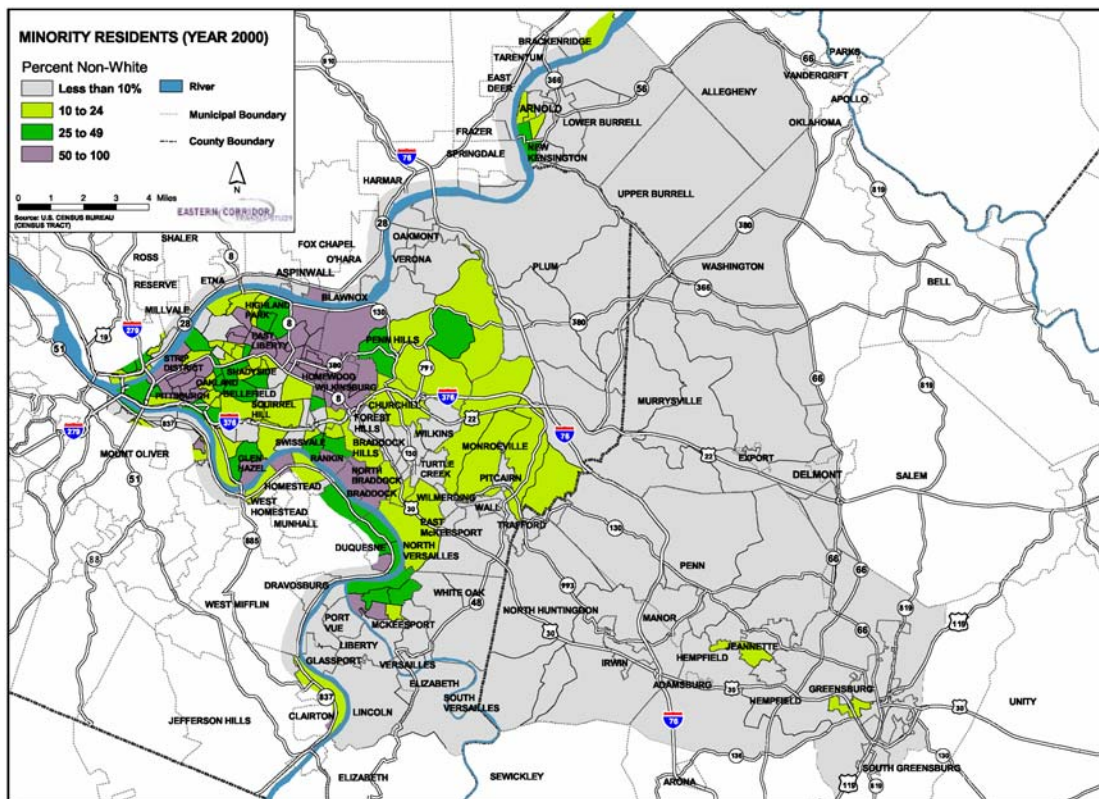


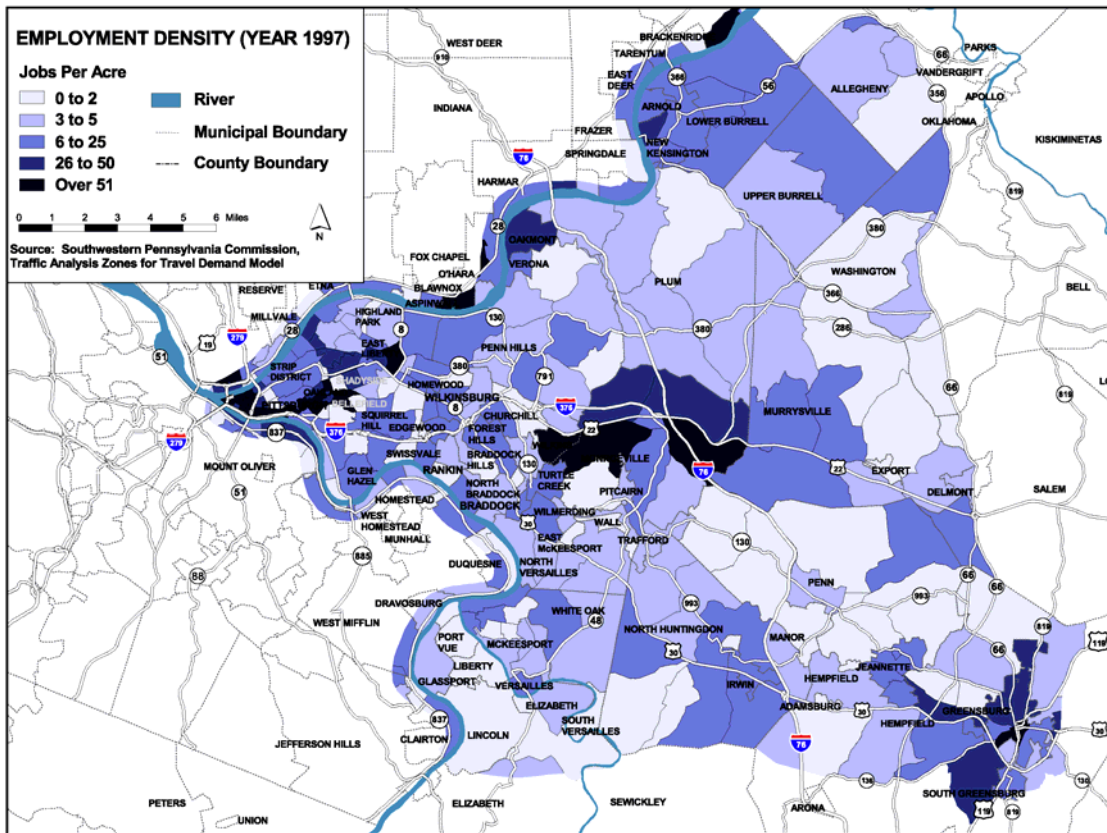
Exhibit 2-4: Minority Residents in 2000



2.2.3 EMPLOYMENT

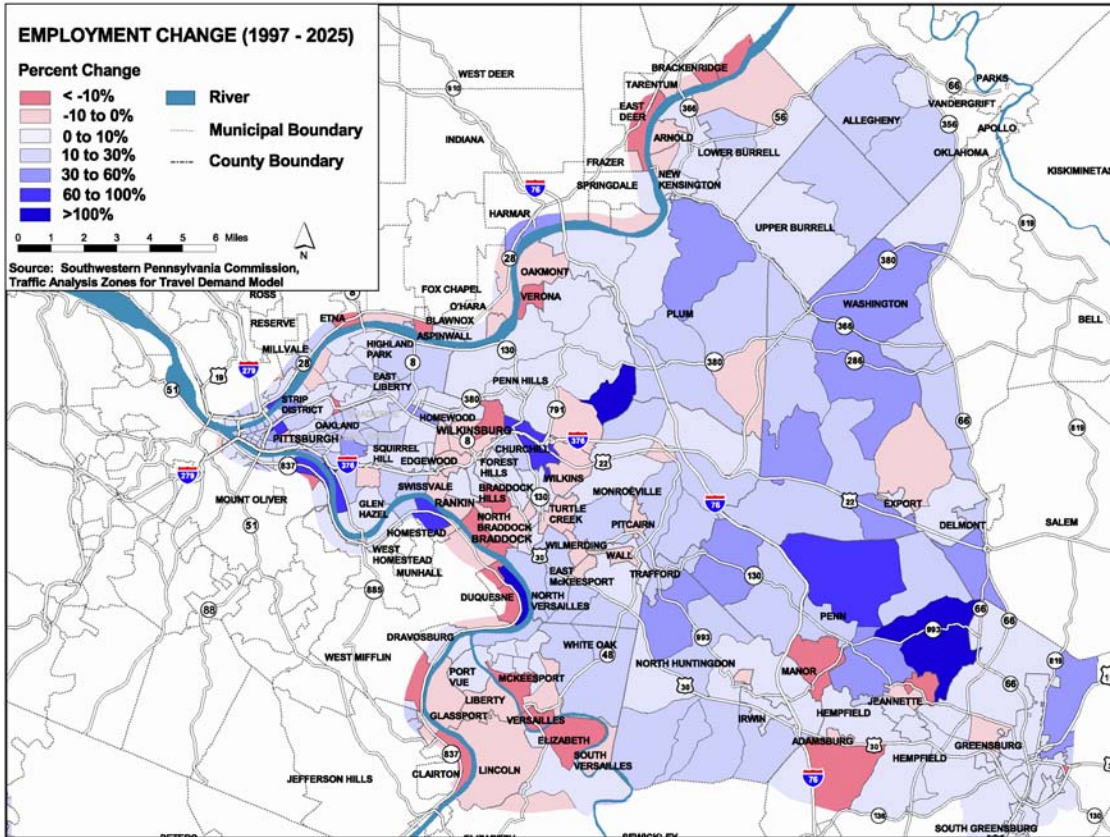
Employment density for 1997 is illustrated in **Exhibit 2-5**. The highest employment densities (over 51 jobs per acre) were in Allegheny County, specifically portions of the City of Pittsburgh, including the Golden Triangle and Oakland. Some City of Pittsburgh neighborhoods also have some of the lowest employment densities, at 0 to 2 jobs per acre. Within the eastern suburbs, the number of jobs per acre ranged from 0 to 25, although most areas contained between 0 and 2. The highest concentrations of jobs per acre in the eastern suburbs were in Edgewood, Wilkins, and Monroeville, between 6 and 25. Nearly all of Westmoreland County contains 0 to 2 jobs per acre. A portion of Greensburg, as well as a portion of New Kensington, had between 26 and 50 jobs per acre.

Exhibit 2-5: Employment Density 1997



The number of jobs within the study area is projected to grow by 10% from 635,507 in 1997 to 700,554 in 2025. More specifically, the City of Pittsburgh is projected to experience slight increases in employment with several traffic analysis zones in the 0-10% and 10-30% range of growth. However, the areas of Wilksburg, Edgewood, Swissvale, Glassport, and Lincoln are projected to experience some decreases in employment as illustrated in **Exhibit 2-6**. In Westmoreland County, the majority of traffic analysis zones indicate slight to moderate growth in employment, but Lower Burrell, Arnold, Murrysville, Jeannette, and Hempfield Township are expected to have decreases in employment density.

Exhibit 2-6: Change in Employment 1997-2025

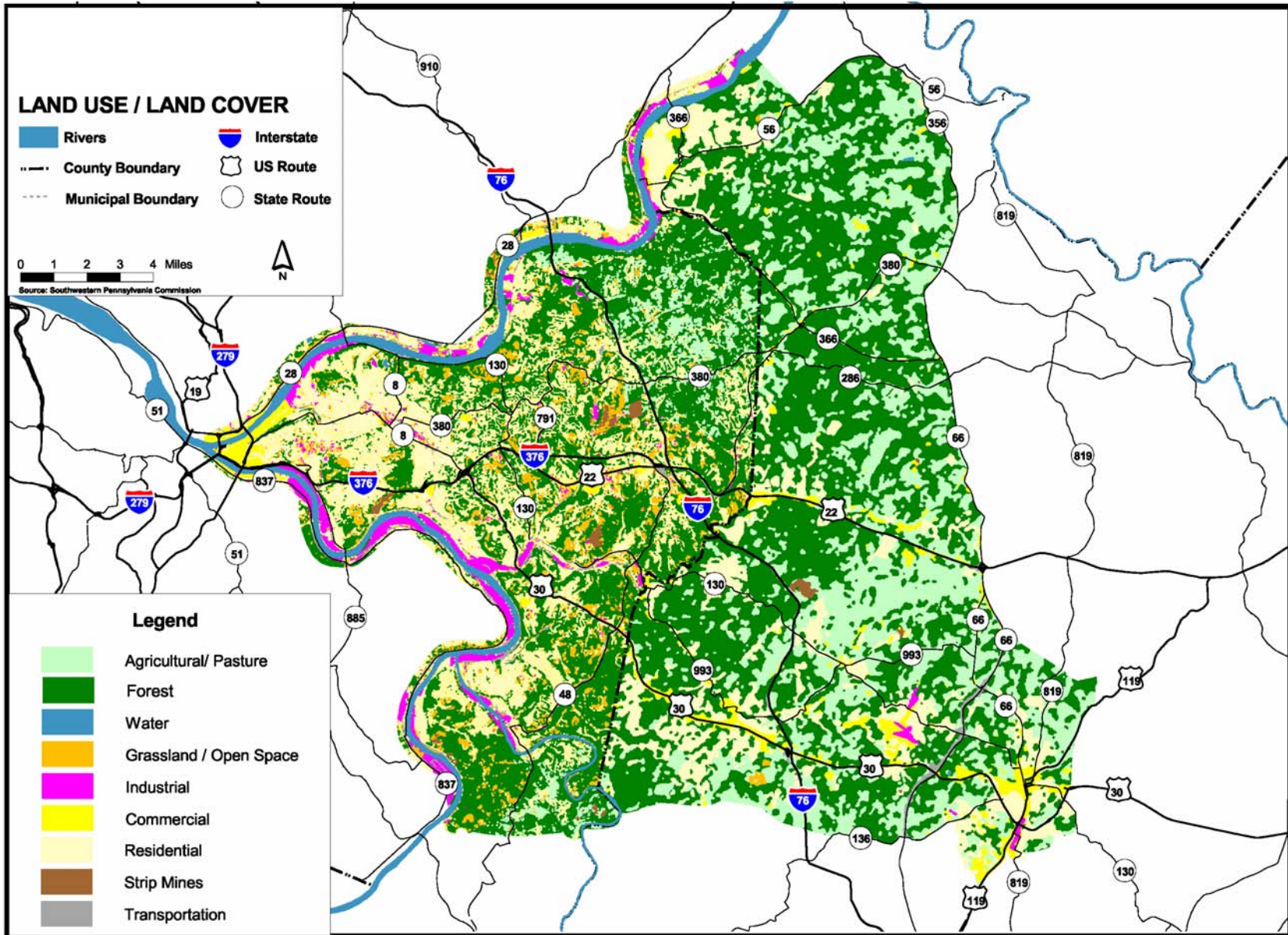


2.3 LAND USE

The City of Pittsburgh, particularly Downtown and Oakland, with its sizeable population and employment base, complemented by other trip generators such as shopping and recreational attractions, is the functional focus of the study area. This western portion of the study area contains the dense urban development associated with the City, while farther east in the study area, the spatial distribution pattern of development becomes less dense with smaller nodes of medium density development. Exceptions to this general pattern include the river valleys, which maintain medium to high-density development characteristics for significant stretches. **Exhibit 2-7** shows the land uses found within the study area.

The predominant land features of the study area are the rivers that have historically dominated the landscape of the area, serving as the initial transportation network and continuing to serve as the major conduits for the shipment of large quantities of bulk goods. Early development patterns focused on these riverfronts. As the region began to grow, railroads were built within the relatively flat river valleys and supported a greater intensity of community and industrial development near the waterfront. This pattern of medium to high-density development, focusing on the river valleys and the rail lines, is still a dominant land use feature in the study area. In the 1920's, the first highways were developed in Pittsburgh. After World War II, more highways were built and automobile ownership significantly increased. At this time, medium density developmental nodes at the urban fringe, like those associated with the communities of Monroeville and Murrysville have become more commonplace.

Exhibit 2-7: Land Use/ Land Cover



2.4 TRANSPORTATION NETWORK

2.4.1 HIGHWAY FACILITIES

The highway network in the study area primarily consists of radial roadway networks with downtown Pittsburgh as the hub.

- **I-376 (Parkway East)** - The principal east-west transportation link in the heart of the study area is Interstate 376/Route 22 (Parkway East) which in some locations carries over 120,000 vehicles a day. The Parkway East extends from downtown Pittsburgh to Interstate 76/Pennsylvania Turnpike in Monroeville.
- **S.R. 28** - The principal highway link in the northern section of the study area is Route 28, a four lane limited access arterial that runs from the North Side of Pittsburgh through the eastern limit of the study area paralleling the north shore of the Allegheny River. A number of deficient sections are programmed for improvement from Troy Hill to the Millvale area.
- **S.R. 885** - This roadway begins in downtown Pittsburgh as Boulevard of the Allies. Near Oakland it turns south through Hazlewood, crosses the Glenwood Bridge and continues south to the Allegheny County Airport and Clairton. It has several sharp curves and speed restrictions
- **S.R. 837** – This roadway parallels the southern shore of the Monongahela Valley from Pittsburgh to beyond the limits of the ECTS study area.
- **S.R. 51** - The southern link in the study area's radial highway network, Route 51, is outside of the study area limits but does serve as the primary southeast/northwest link in the transportation network. Route 51 is a four-lane arterial.
- **U.S. 30/U.S. 22** - In the eastern portion of the study area, the primary highways serving as east/west transportation links for Westmoreland County and the eastern suburbs of Allegheny County are Route 30 and Route 22. Both routes are four lane arterials along most of their length with intermittent turning lanes and numerous signalized intersections.

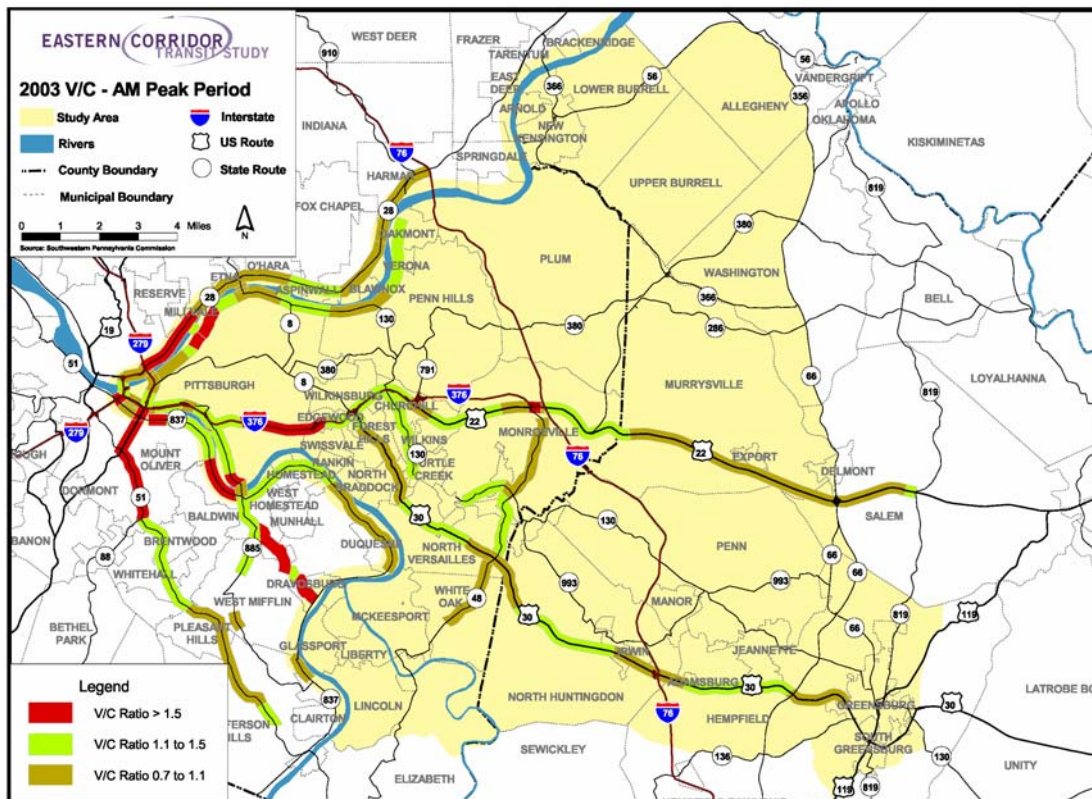
2.4.1.1 Congestion

Congestion occurs when traffic volumes approach or exceed the capacity of the roadway. The *Highway Capacity Manual (HCM)*, published by the Transportation Research Board, defines a capacity as the maximum sustainable flow rate at which vehicles or persons can be expected to traverse a point or uniform segment of a lane or roadway during a given time period. The HCM contains procedures for calculating capacity. SPC's regional travel demand model produces an estimated actual travel volume, which when divided by the capacity from HCM calculations produces a volume to capacity ratio (v/c) for that link.

SPC has defined congestion as being high when the modeled v/c exceeds 1.1, moderate when the v/c is between 0.7 and 1.1, and low when the v/c is less than 0.7. In addition, the study team defined congestion as being extreme when v/c exceeds 1.5.

All primary highway facilities discussed above operate at, or above capacity, as shown in **Exhibit 2-8** and **Exhibit 2-9**. These exhibits show that despite the numerous transportation improvements contained in the SPC 2025 Transportation and Development Plan for Southwestern Pennsylvania, no anticipated improvement to the congestion in the study area is expected.

Exhibit 2-8: 2003 Traffic Volume to Capacity Ratios in 2003



2.4.1.2 Accident Rates

Accident rates in the study corridor were compared to the statewide average for similar facilities maintained by PENNDOT for various classifications of rural and urban highways. Locations in the study corridor with accident rates exceeding the statewide rates are shown in **Exhibit 2-10**. A segment containing the highest accident rate (5.4 times the statewide average) includes a portion of I-376. The portion of State Route 51 intersecting Midwood Avenue also has a relatively high accident rate, 3.8 times the statewide average. (Route 51 was included for informational purposes only as it is not within the study area). Overall, Interstate 376, Route 28, Route 51, and Route 885 contain segments that have accident rates higher than three times the statewide average for similar facilities. With the exception of Route 22, all of the facilities studied have accident rates that exceed the statewide average for at least one-fourth of their length.

Exhibit 2-9: Traffic Volume to Capacity Ratios Projected for 2025

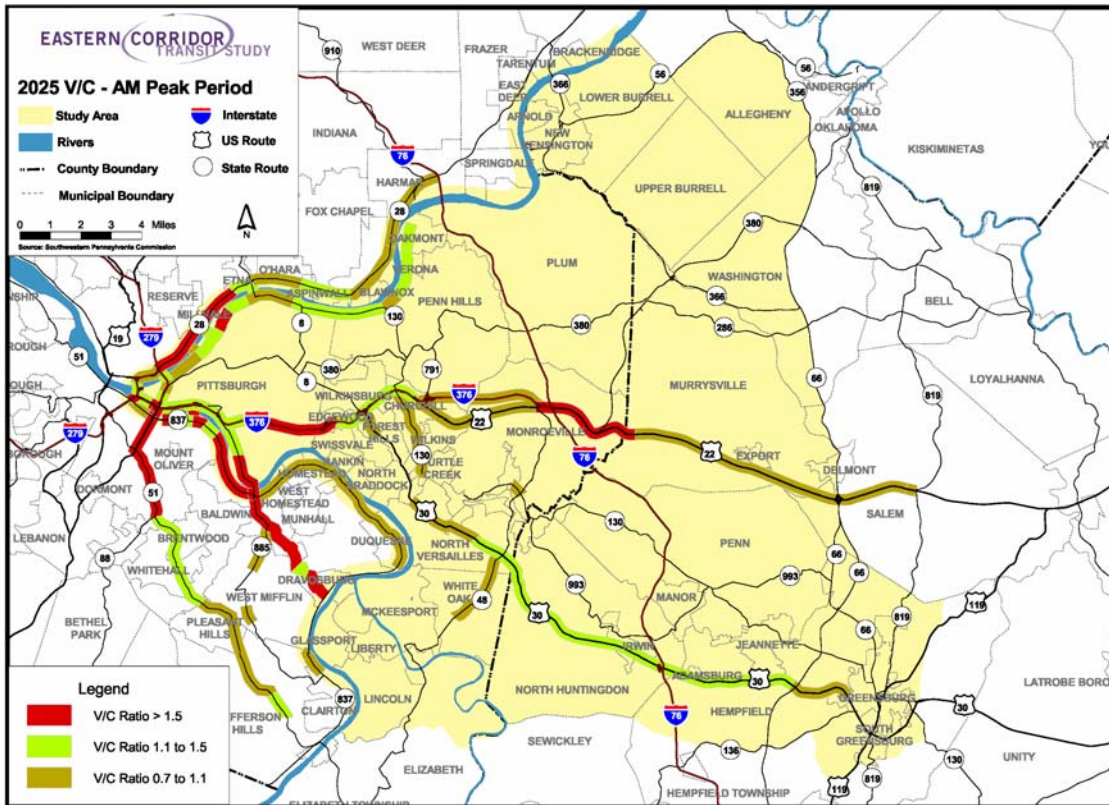
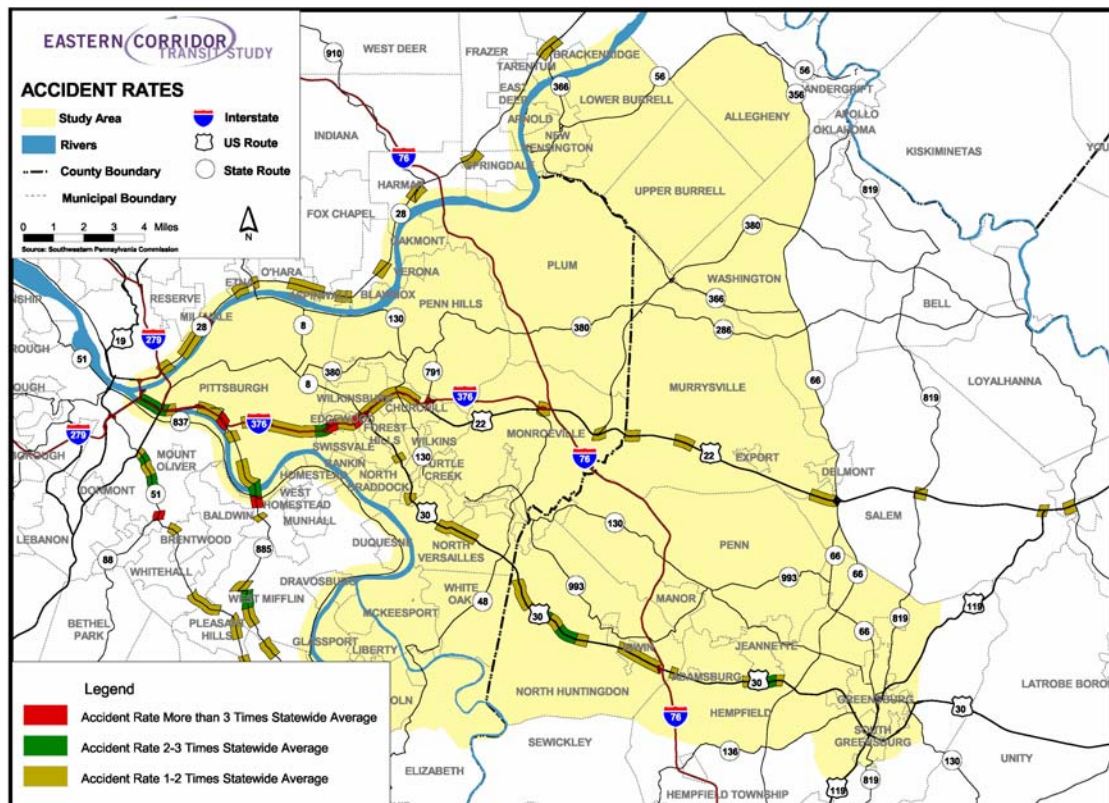


Exhibit 2-10: Accident Rates

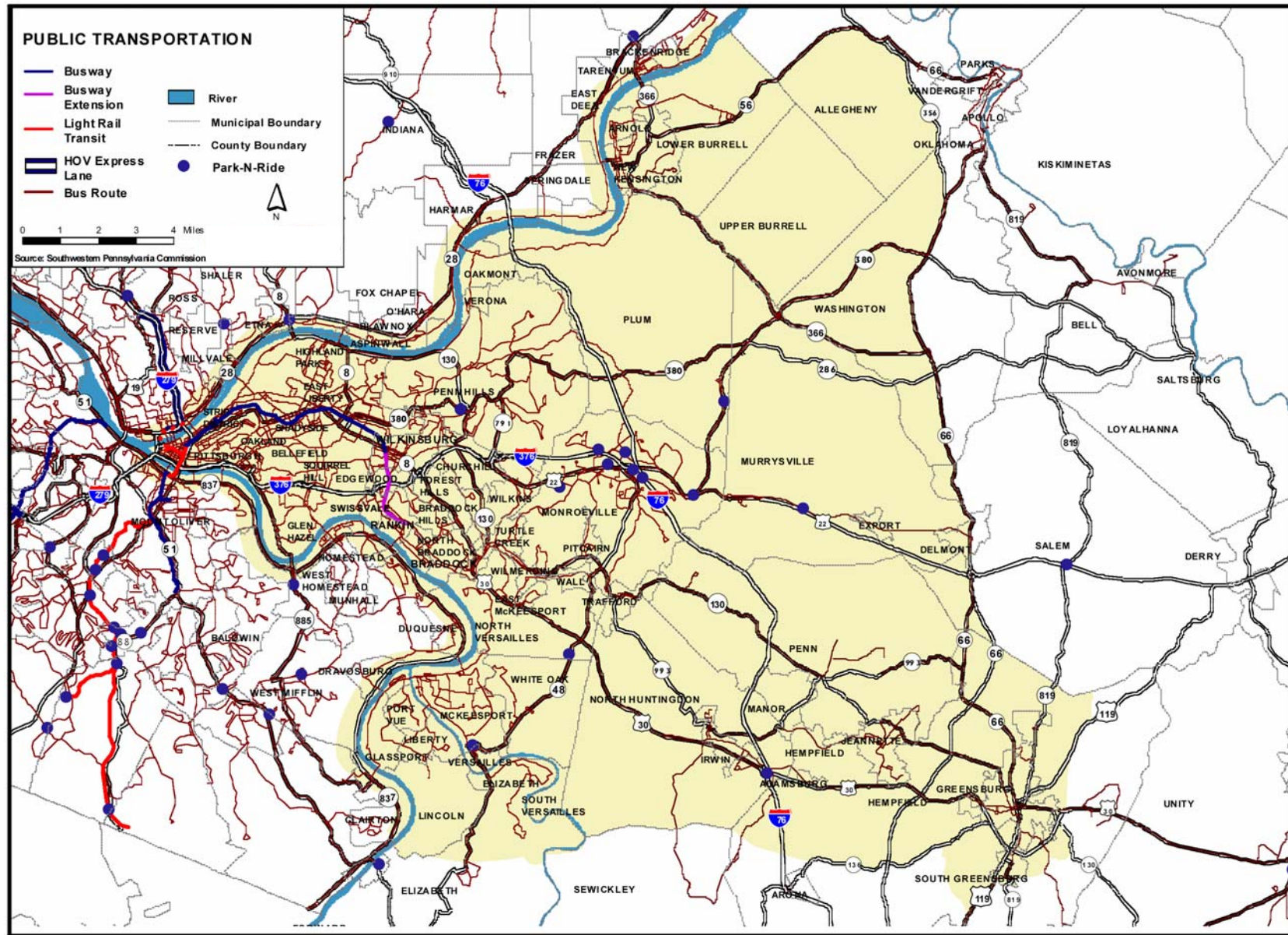


2.4.2 PUBLIC TRANSPORTATION NETWORK

The study area contains two primary public transit providers, the Port Authority of Allegheny County (PAAC) and the Westmoreland County Transit Authority (WCTA). Both agencies provide various transit services, including fixed-route bus and paratransit. Additionally, PAAC operates busways and light rail transit. **Exhibit 2-11** shows transit routes and park & ride locations in the study area.

- **Port Authority Fixed-Route Bus Service** – The routes within the study area that experience the highest ridership include the 100, 500, 51A, 51C, 54C, 61A, 61B, 61C, 71A, 71C, 71D, 81B, 86A, 86B, 91A, and EBA.
- **Westmoreland County Transit Authority Fixed-Route Bus Service** - A total of 21 routes operate during weekdays and six routes on Saturday. Most of WCTA's routes are contained within the study area, except for 9A, 10, 10S, 11, and 17.
- **The Martin Luther King, Jr. East Busway** - Extends 9.1 miles in length from downtown Pittsburgh at Penn Station to its termination in Swissvale and provides an exclusive right-of-way for bus services to downtown Pittsburgh.
- **The "T"/Light Rail Transit System** - Contains a total of six stations within the study area, including Penn Park, Steel Plaza, Wood Street, Gateway Center, First Avenue, and Station Square. The "T" is comprised of three distinct lines traveling to the South Hills, including: 42S South Hills Village through Beechview, Dormont, Mt. Lebanon, and Bethel Park; 42L Library through Beechview, Dormont, Mt. Lebanon, and Bethel Park to the Library; and, the 52 line traveling to Allentown. An extension of the "T" to the Convention Center and North Shore is in final design.
- **ACCESS** - Paratransit service within the PAAC service area provides door-to-door transportation. Vehicles pick up users at their requested locations and drop them off at destination(s) they specify. Reservations are required a day in advance.
- **Park & Ride Facilities** – Parking lots (one garage at First Avenue) are provided so that transit users can access transit stations and stops by automobile.

Exhibit 2-11: Density of Public Transit Routes in the Study Area



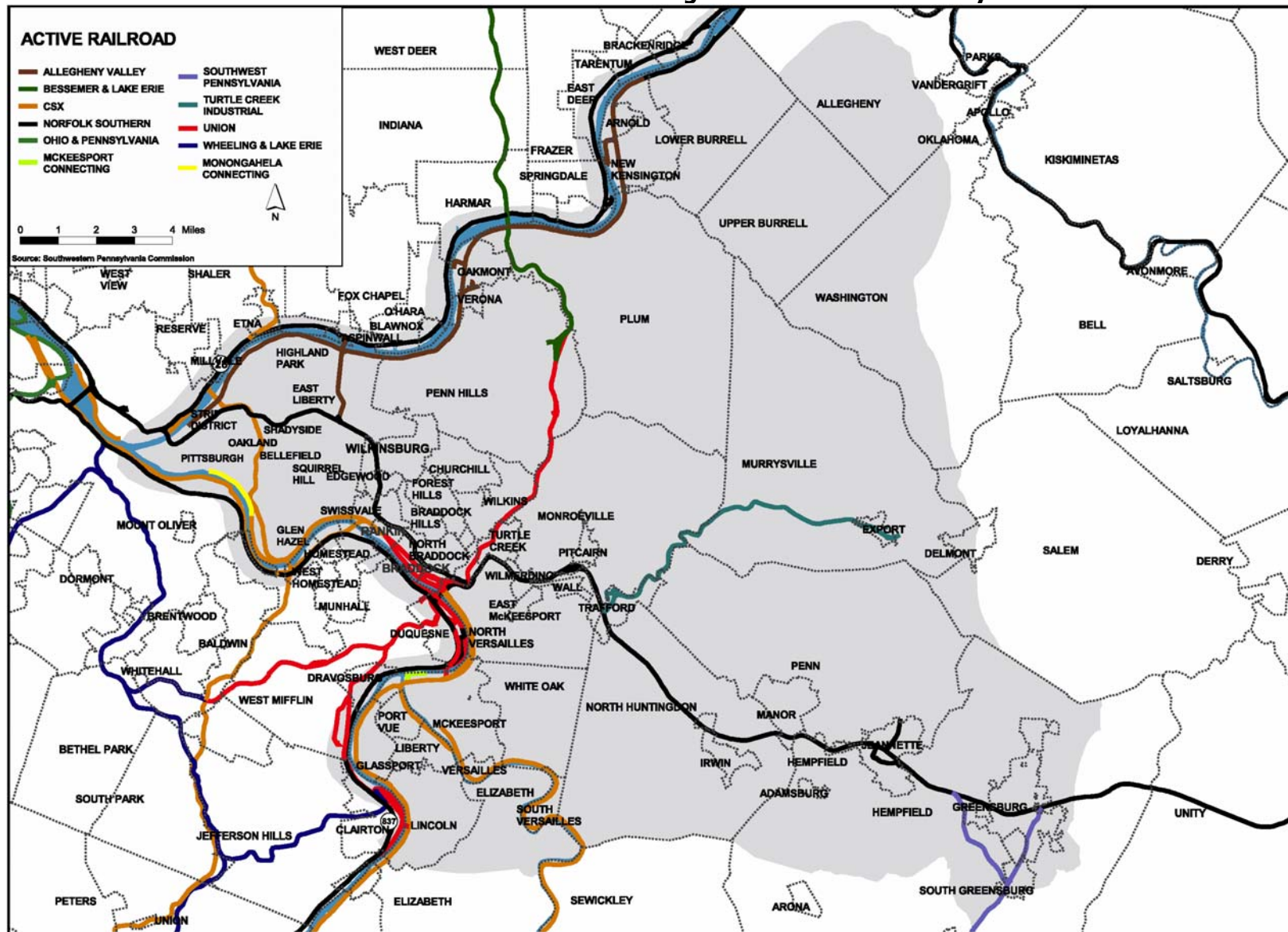
2.4.3 RAILROADS

In addition to the highway and transit facilities in the study area, there are ten freight railroads, described in **Exhibit 2-12** and illustrated in **Exhibit 2-13**. The majority of these railroads are fully operational; however, some lines have been abandoned or are inactive, including parts of the CSX, Union, and Wheeling and Lake Erie railroads.

Exhibit 2-12: Characteristics of Active Freight Railroads in the Study Area

Railroad	Location
Allegheny Valley (AVR)	Strip District to Lower Burrell along south shore of the Allegheny River. Includes Brilliant Branch which connects to Norfolk Southern line in Homewood.
Bessemer and Lake Erie	Proceeds from a southern terminus in Penn Hills (Union Railroad interchange) and travels north to Harmar. Along with the Union Railroad, the Bessemer and Lake Erie's primary function is to serve US Steel facilities in the Monongahela Valley.
CSX	Operates several lines in the study area along the Allegheny, Monongahela and Youghiogheny Rivers, as well as a line through Panther Hollow in Oakland.
Norfolk Southern (NS)	Operates on three lines through the study area: The Conemaugh Line which parallels the north shore of the Allegheny River through the study area; the Pittsburgh line which extends from downtown Pittsburgh to Greensburg, passing through Lawrenceville, Bloomfield, Shadyside, East Liberty, Homewood, Wilkinsburg, Edgewood, Irwin, and Jeannette; and the Monongahela Line which is located near the south side of the Monongahela River.
Southwest Pennsylvania	Two branches extend to Hempfield and to a junction in Greensburg with the Norfolk Southern line. The two branches connect at South Greensburg and extend south of the study area.
Turtle Creek Industrial	Line beginning with a connection to the Norfolk Southern in Trafford and continues to Export, via Murrysville.
Union	From an interchange with the Bessemer and Lake Erie, this line extends into the Monongahela River Valley. At North Versailles, the line extends west beyond the study area, or either travels north for approximately two miles where it connects with the CSX line in Rankin or heads south following the Monongahela River.
Wheeling & Lake Erie	The line begins in Clairton and extends west beyond the study area.
McKeesport Connecting	An industrial switching railroad in McKeesport.
Monongahela Connecting	Within the City of Pittsburgh, this line extends north/west from the CSX line on the northern Monongahela River shore near Schenley Park. It extends as far west as the Birmingham Bridge and has a stub end.

Exhibit 2-13: Locations of Active Freight Railroads in the Study Area



2.5 TRAVEL PATTERNS

Given the linkage between transportation and land use, a brief discussion of this relationship helps to facilitate an understanding of the travel patterns in the study area. The Pittsburgh region is distinguished by a strong central business district (CBD), which attracts a significant share of trips from the surrounding areas. Even as suburban development continues to expand, the Pittsburgh CBD maintains its status as the economic heart of the metropolitan area. Meanwhile, population has been declining within the city and suburban developments at the urban fringe continue to increase in population. As residents continue to move farther from urban cores, trip lengths and travel times have increased as a result of longer commutes.

In order to understand and illustrate travel patterns and transportation needs in the study area, a review of daily commutes within the ECTS study area was undertaken using the SPC travel demand model. The SPC model is comprised of 995 traffic analysis zones and accounts for a range of trip types including Home-Based Work, Home-Based Other and Non-Home Based trips. Home-Based Work (HBW) trips were used to examine primary travel patterns in the study area to simplify the analysis since most of these trips occur during the morning and evening rush hours/peak periods when traffic congestion is most severe and the demand for transit is highest. The total trip table for the region (995-rows x 995-columns) was aggregated into a set of 42 zones with 20 of the zones representing the study area. The 20 study area zones were further grouped into the following three categories: the City of Pittsburgh, Inner Suburban Zones, and Outer Suburban Zones, as discussed below.

- **City of Pittsburgh** – The public transportation network within the City of Pittsburgh is well developed with frequent service connecting many population and employment centers. Highway travel is congested in the City, and parking is scarce and expensive. As a result, transit mode share is comparatively high, with about 50% of work trips into downtown Pittsburgh made on transit.
- **Inner Suburbs** – Development density within the Inner Suburbs is not as intensive as it is in the City of Pittsburgh. Highways are less congested, parking is more abundant and it is generally provided at no cost. Consequently, the transit share of all trips in the inner suburbs is lower than it is Downtown.
- **Outer Suburbs** – The public transportation network is sparse and provides infrequent service. Population and employment densities are relatively low. Highways are generally not congested, with the exception of localized bottlenecks and areas of considerable congestion on routes 22 and 30. Overall, the transit mode share is low.

Exhibit 2-14 represents average weekday Home-Based Work trips that are produced by and attracted to zones within the study area in 2003. The last column of the trip table provides the total number of work trips made to each zone by residents of the study area. The Pittsburgh CBD (Zone 1) draws the greatest number of workers from the study area, for a total of 48,740 work trips. The Oakland district (Zone 3) and the Greensburg area (Zone 34) attract 37,560 and 37,978 workers, respectively. The important difference between these zones is that the Oakland work attractions are much more concentrated, occurring in only one Pittsburgh zone covering a 3.2 square mile area. The work trips to Greensburg, on the other hand, are attracted to an entire city and the surrounding suburbs occupying a 68.7 square mile area, an area 21 times larger than the Oakland district. Monroeville (Zone 25) draws the next largest number of workers for a total of 30,124 attractions.

Exhibit 2-14: 2003 Home-Based Work Trips (Attractions and Productions)

Area	Area	City of Pittsburgh						Inner Suburbs							Outer Suburbs							Total Attractions
	Community /District	CBD	Strip District	Hill District Oakland	Shadyside Squirrel Hill	Pittsburgh Hazelwood	Mt. Wash Brookline	Highland Park Wilkinsburg	Swissvale/Forest Hills /Braddock	Churchill / Wilkins	Monroeville	Penns Hills Oakmont /Verona	McKeesport/N. Versailles Verona	Allegheny Cnty / Plum	Plum/New Kensington/ Kiski Valley	Port Vue Elizabeth Forward	Irwin Manor N.Huntingdon	Penn Jeannette	Murrysville Export Delmont	Greensburg & vicinity	Westmoreland Cnty/North Central	
City of Pittsburgh	CBD	212	2,526	3,141	5,867	4,458	3,146	2,863	4,394	2,509	2,107	2,915	3,264	1,902	2,248	1,681	1,845	1,053	952	881	776	48,740
	Strip District	27	702	715	1,878	1,207	558	795	788	513	370	754	582	394	519	288	319	180	169	129	148	11,035
	Hill District / Oakland	38	1,417	3,063	4,782	4,950	2,288	2,927	2,953	1,849	1,338	2,568	2,232	1,440	1,396	1,024	1,149	633	594	424	495	37,560
	Shadyside / Squirrel Hill	12	629	827	5,126	2,970	821	2,423	1,522	1,137	670	1,907	1,007	921	1,097	349	553	304	322	167	271	23,035
	Hazelwood	6	197	438	1,571	2,357	730	1,503	1,292	776	469	997	750	524	459	271	410	221	221	94	147	13,433
Mt. Wash. / Brookline	2	39	120	214	404	509	208	347	158	139	168	302	120	85	185	135	63	55	37	29	3,319	
Inner Suburbs	Highland Park Wilkinsburg	2	58	113	594	759	171	1,666	822	803	378	1,292	509	527	460	155	292	164	189	63	150	9,167
	Swissvale/Forest Hills/Braddock	3	38	93	316	612	281	942	2,569	998	846	794	1,622	514	341	499	841	411	246	149	132	12,247
	Churchill/Wilkins	0	15	49	163	261	111	770	998	1,790	1,251	1,363	1,334	927	577	372	720	477	347	137	218	11,880
	Monroeville	1	21	56	173	275	130	651	1,094	2,001	5,898	1,677	3,126	4,038	1,372	965	2,600	2,375	2,050	717	904	30,124
	Penns Hills Oakmont/Verona	0	13	18	122	115	34	458	221	576	334	3,423	283	1,327	1,854	87	211	169	360	80	352	10,037
	McKeesport/N. Versailles/Verona	1	12	26	75	124	78	212	828	529	1,260	342	7,246	434	239	3,209	2,480	859	237	353	125	18,669
	Allegheny Cnty/Plum	1	3	10	41	47	23	154	156	380	1,003	934	425	3,516	1,109	172	525	542	837	194	585	10,657
Outer Suburbs	Plum/New Kensington/Kiski	0	3	5	30	22	7	69	45	103	138	684	89	1,037	12,989	39	114	244	676	166	1,724	18,184
	Port Vue/Elizabeth Forward	0	1	4	6	14	10	17	53	33	98	25	898	43	24	2,628	564	133	31	92	24	4,698
	Irwin / Manor N.Huntingdon	0	3	4	14	27	13	52	156	111	525	102	1,150	259	151	822	9,641	4,049	551	2,468	390	20,488
	Penn / Jeannette	0	1	2	5	12	9	29	45	60	309	80	217	355	307	121	1,566	4,202	1,515	1,607	661	11,103
	Murrysville Export Delmont	0	1	1	8	7	3	21	30	52	205	123	87	605	608	42	371	1,132	3,355	532	972	8,155
	Greensburg & vicinity	0	1	4	10	10	4	16	44	45	176	58	307	190	334	307	3,285	4,028	1,043	26,317	1,799	37,978
	Westmoreland Cnty/ N Central	0	1	1	4	3	1	11	11	14	48	62	26	244	1,245	21	179	447	710	679	2,612	6,319
Total Productions	305	5,681	8,690	20,999	18,634	8,927	15,787	18,368	14,437	17,562	20,268	25,456	19,317	27,414	13,237	27,800	21,686	14,460	35,286	12,514	346,828	

Work trip attractions, ranging from 18,000 to 23,000 trips, are concentrated in four other zones as follows: Shadyside/Squirrel Hill districts (Zone 4), McKeesport/North Versailles (Zone 27), New Kensington/Plum/Kiski Valley (Zone 28), and Irwin/Manor/North Huntington (Zone 30).

City of Pittsburgh

The largest number of work trips between zones within Pittsburgh is focused in the CBD and the Oakland area. According to the trip table in **Exhibit 2-14**, the East Liberty/Highland Park and Shadyside/Squirrel Hill zones have the highest number of workers, 5,867 and 4,458, respectively, commuting to the Pittsburgh CBD. Similarly, the Oakland area attracts 4,782 and 4,950 workers from the Shadyside/Squirrel Hill and Pittsburgh/Hazelwood areas, respectively. A significant number of workers attracted to jobs in the Oakland and East Liberty/Highland Park zones also live within these zones; 3,063 intrazonal work trips are made within the Hill District/Oakland area, while 5,126 intrazonal trips are completed within the Shadyside/Squirrel Hill area.

With respect to trips made inside the study area, 92% of work trips (57,947 of 63,236) produced in Pittsburgh are made to other areas within Pittsburgh, as show in **Exhibit 2-15**.

Almost all of the remaining work trips originating in Pittsburgh, (i.e., 5,039 trips), are destined for the Inner Suburbs and only 251 workers travel from Pittsburgh to the Outer Suburbs. The large number of work trips internal to Pittsburgh reveals a concentrated travel market for work trips. Approximately 49% of these trips are currently accommodated by transit.

Inner Suburbs

As shown in **Exhibit 2-14**, the Inner Suburbs are the destination of a considerable number of work trips from the Outer Suburbs, but are less so to residents of Pittsburgh. The Inner Suburbs produce a considerable number of work trips that are destined for Pittsburgh. According to the summary trip table in **Exhibit 2-15**, 56,797 (43% of 131,195 total) work trips originate in the Inner Suburbs and are destined for Pittsburgh; 22.94% of these trips (13,027) use transit.

Outer Suburbs

Residents of the Outer Suburbs are less dependent on Pittsburgh for employment than the residents of the Inner Suburbs. However, 32,502 work trips are made from the Outer to the Inner Suburbs, while 9,157 work trips are made in the reverse direction, indicating a relatively strong interaction between these areas. But the majority of work trips produced in the Outer Suburbs, 97,517 trips (64% of the 152,397 total work trips), are destined for employment centers within the boundaries of the Outer Suburbs (i.e., most workers in the Outer Suburbs are also its residents). From the Outer Suburbs to Pittsburgh, 22,378 trips were produced, while the reverse commute from Pittsburgh to the Outer Suburbs consists of 251 work trips.

Exhibit 2-15: 2003 Home-Based Work Trips & Transit Trips (Summary)

To From		Pittsburgh			Inner Suburbs			Outer Suburbs			Total Attractions		
		Total Trips	Transit Trips	% Transit	Total Trips	Transit Trips	% Transit	Total Trips	Transit Trips	% Transit	Total Trips	Transit Trips	% Transit
Pittsburgh	Trips	57,947	28,309	48.85%	56,797	13,027	22.94%	22,378	604	2.70%	137,122	41,940	30.59%
Inner Suburbs	Trips	5,038	607	12.05%	65,241	2,382	3.65%	32,502	334	1.03%	102,781	3,323	3.23%
Outer Suburbs	Trips	251	4	1.59%	9,157	109	1.19%	97,517	574	0.59%	106,925	687	0.64%
Total Productions	Trips	63,236	28,920	45.73%	131,195	15,518	11.83%	152,397	1,512	0.99%	346,828	45,950	13.25%

"Tripshed" maps are an effective means for graphically depicting the travel behavior of the study area's residents across a variety of trip purposes. In this approach, the number of trips that are attracted to a particular zone (or receiving area) from all surrounding zones (or sending areas) may be illustrated. The resulting graphic provides both the distribution and intensity of trips attracted to a particular zone; trip attractions are normalized by area (i.e., per square mile of producing zone) to portray the intensity of travel between zones.

In particular, the analyses conducted here utilize this graphical tool to portray the trip patterns of workers through "commutershed" maps. For consistency, the maps and analyses are presented according to the zonal categories (i.e., Pittsburgh, Inner Suburban and Outer Suburban Zones) used in the discussions above. These commutershed maps and their descriptions provide further support for the conclusions stated above.

City of Pittsburgh CBD

A depiction of travel patterns and transit use for work trips to the Pittsburgh CBD is presented in **Exhibit 2-16** and **Exhibit 2-17**. These maps depict the drawing power of the CBD for work trips from the study area and surrounding zones. The attractiveness of the Pittsburgh CBD extends up to 25 miles from the Point, declining at Greensburg and the north central Westmoreland County areas (Zones 32 and 35), as shown in **Exhibit 2-16**.

Zones 2,3,4,5, and 23, produce the greatest intensity of work trips in any given travel direction towards downtown Pittsburgh. Zones 10 and 7, which are directly south and north of the Pittsburgh CBD, respectively, also send a considerable number of workers to the Downtown area.

In general, transit use for work trips to the Pittsburgh CBD is relatively high. Transit use ranges from 40% to 85% of trips within a 10-mile radius and 10% to 40% of trips within the 10 to 15-mile radius of the CBD, as shown in **Exhibit 2-17**. Within a 10-mile radius of the CBD, transit use west and southwest of the study area also appears to be high. Intrazonal travel within the CBD is relatively low. This is not unexpected since the CBD offers fewer housing opportunities compared with surrounding zones.

Exhibit 2-16: Home-Based Work Trips Attracted to the Pittsburgh CBD

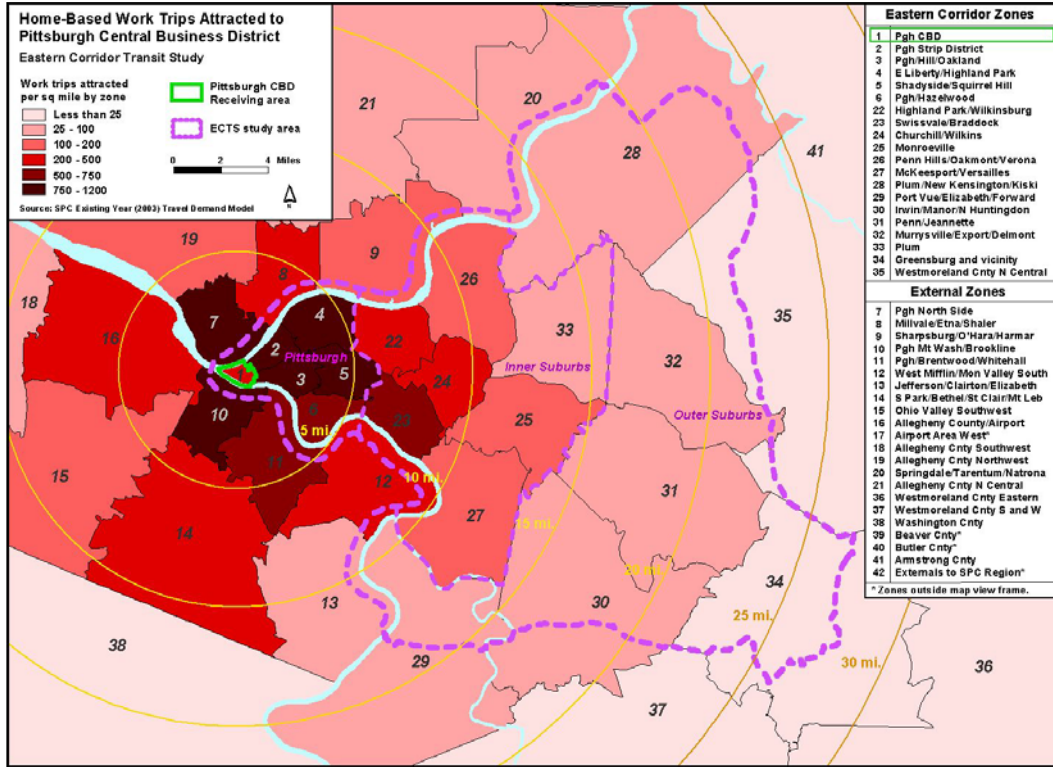
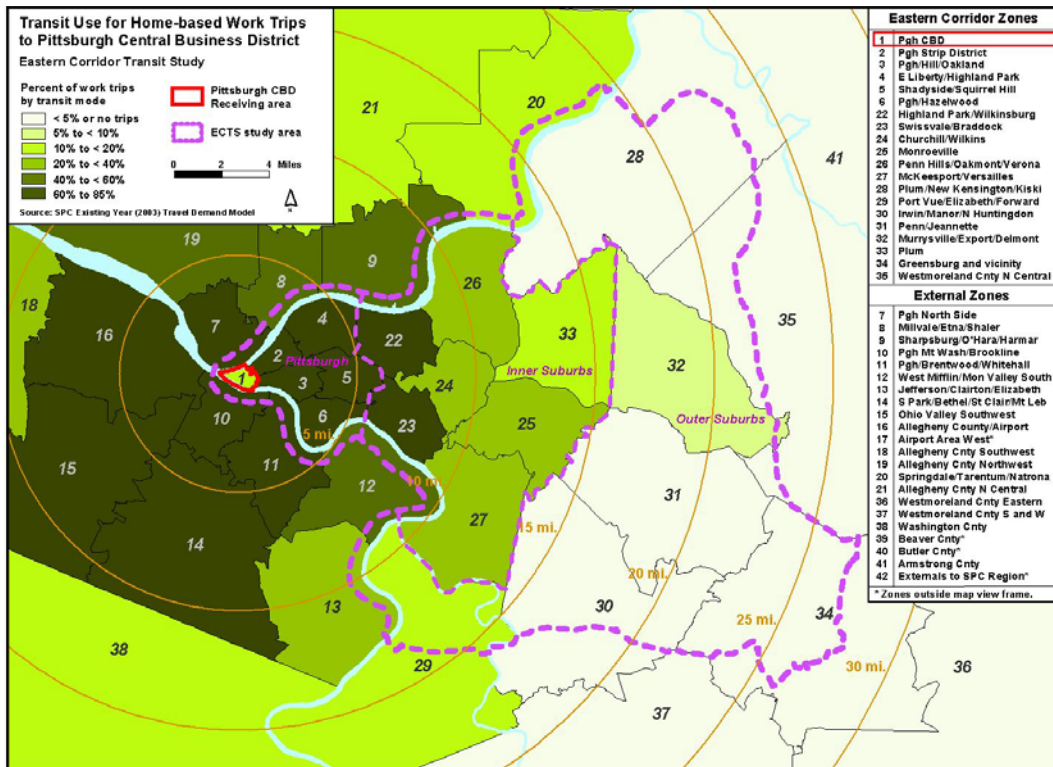


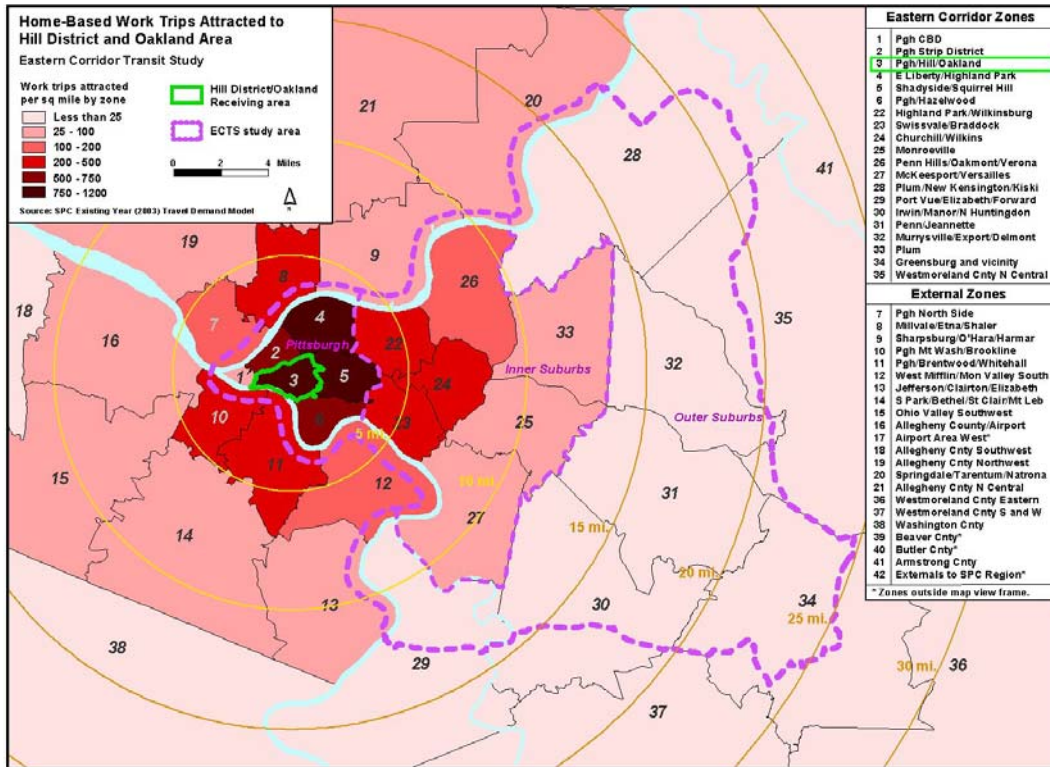
Exhibit 2-17: Home-Based Work Trips Attracted to the Pittsburgh CBD - Percentage Using Transit



Oakland

Commuter-shed and transit use maps of the Oakland area are presented in **Exhibit 2-18** and **Exhibit 2-19**. The Oakland area (Zone 3) attracts a significant number of workers from the entire study area, though at a somewhat lesser intensity than the Pittsburgh CBD (Zone 1). The summary trip table in **Exhibit 2-15** shows that approximately 48,740 work trips from within the study area are destined for the Pittsburgh CBD, and approximately 37,560 trips from the same commuter-shed are destined for the Hill District/Oakland area. In general, transit use for work trips to the Oakland area is comparatively less than that for the Pittsburgh CBD.

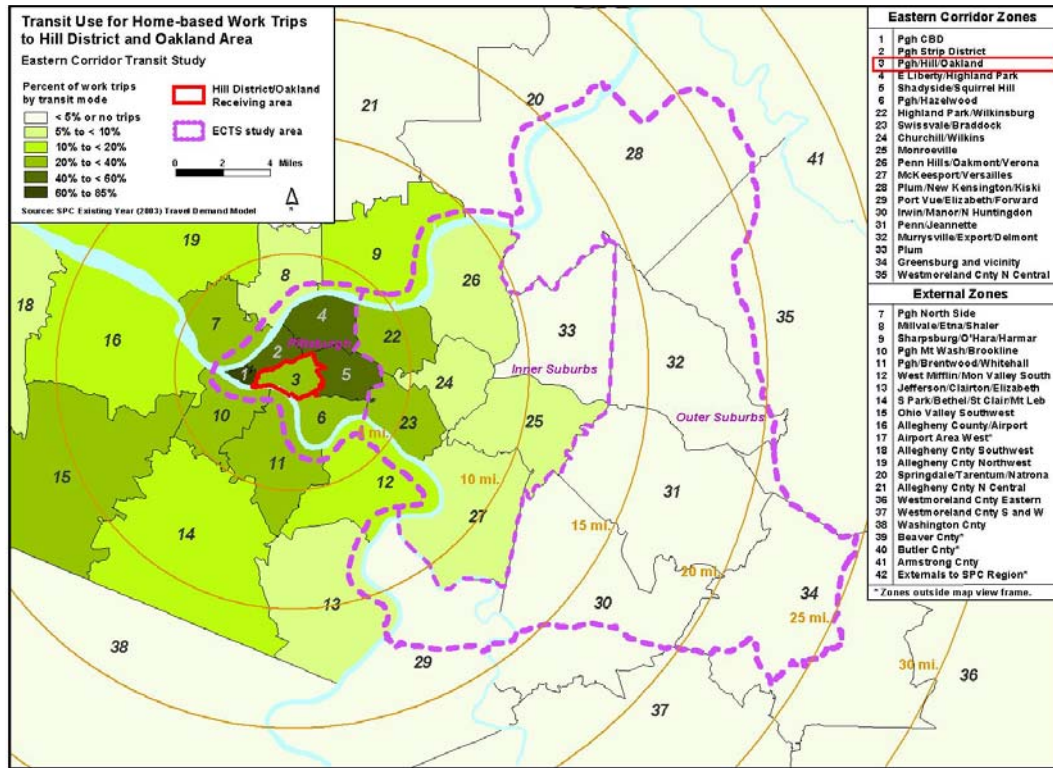
Exhibit 2-18: Home-Based Work Trips Attracted to the Oakland Area



Inner Suburbs

The zones of the Inner Suburbs produce a large number of trips that are destined for employment centers in Pittsburgh, while a comparable number of work trips originate there for work within the Inner Suburbs. The attractiveness of the Inner Suburbs is, however, significantly less than Pittsburgh. The Inner Suburban Zones tend to be a destination for work trips primarily from within the study area. Most workers in a typical zone of the Inner Suburbs travel from locations that are within a 5- to 10-mile radius of the zone center. In addition, relatively few trips are destined for the Inner Suburbs from areas across the Allegheny and Monongahela Rivers. The number of intrazonal trips tends to be relatively high for the Inner Suburbs. On average, less than 10% of the commute trips within the Inner Suburbs area are made by transit.

Exhibit 2-19: Home-Based Work Trips Attracted to the Oakland Area – Percentage Using Transit



- **Monroeville** - which supports a substantial amount of commercial, industrial, and office space, offers the strongest work trip attraction of any community in the Inner Suburbs portion of the study area. Monroeville draws a relatively high number of work trips from up to a 10-mile radius, attracting over 30,000 work trips.

According to commute patterns shown in **Exhibit 2-20**, Monroeville draws the highest number of work trips from Zone 24, and to a lesser extent Zones 23, 27 and 33. Transit use is very low for trips from these zones, accommodating less than 5% of work trips as shown in **Exhibit 2-21**. However, for trips destined for Monroeville from Zones 23 and 24, transit use is comparatively high. The relatively low level of transit use for all zones surrounding Monroeville suggests a significant opportunity for transit, especially in the heavily congested I-376 corridor which traverses Zones 3, 5, 24, and 25. The number of work trips is similarly high from Zone 27, which is primarily served by PA State Highway 48.

- **McKeesport and North Versailles** - (Zone 27) area attracts a total of 18,669 work trips. Additionally, the number of work trips is notably high from the Swissvale and Braddock area (Zone 23), although transit provides for less than 10% of these work trips.

In general, a 10% or lower level of transit use is typical for trips destined for the McKeesport and North Versailles area. Zones 2 and 3, which are relatively far away, send a high percentage of trips to Zone 27 by transit, as shown in **Exhibit 2-23**. However, the total number of trips originating in these zones is very low (i.e., less than 30 trips), generating relatively few transit trips. The greatest opportunity for transit is for Zones 12, 23, 25, 29 and 30, immediately surrounding the McKeesport and Versailles area, and also providing the greatest number of trips, as shown in **Exhibit 2-22**.

Exhibit 2-20: Home-Based Work Trips Attracted to the Monroeville Area

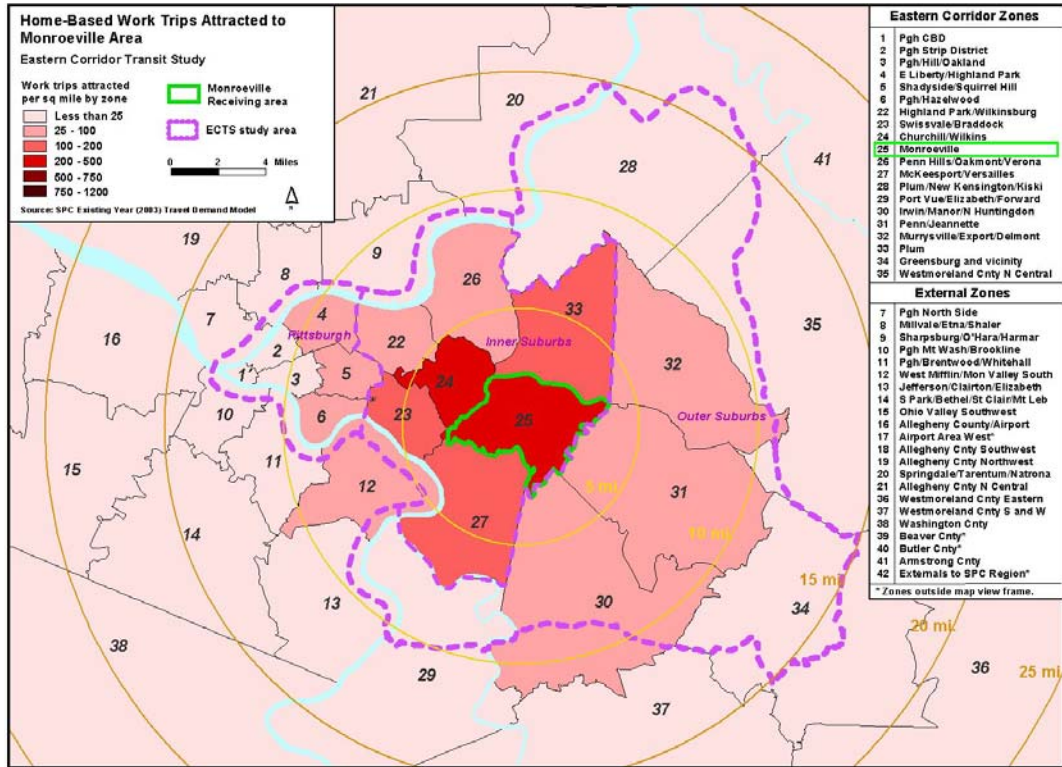


Exhibit 2-21: Home-Based Work Trips Attracted to the Monroeville Area – Percentage Using Transit

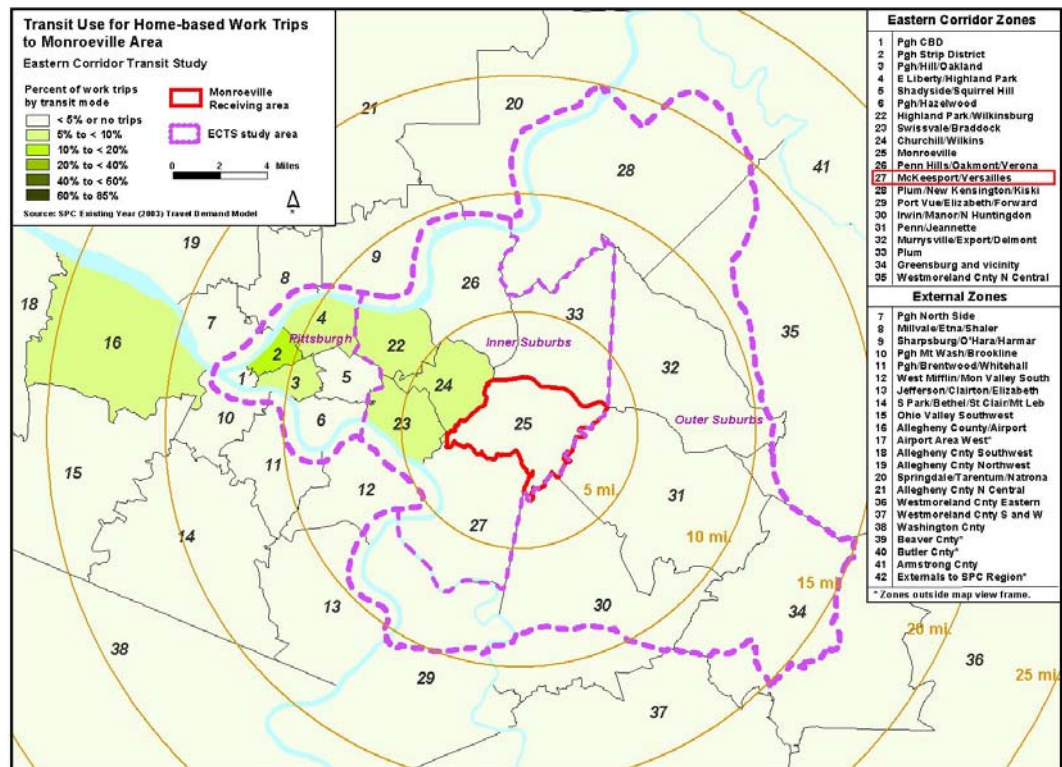


Exhibit 2-22: Home-Based Work Trips Attracted to McKeesport & N. Versailles

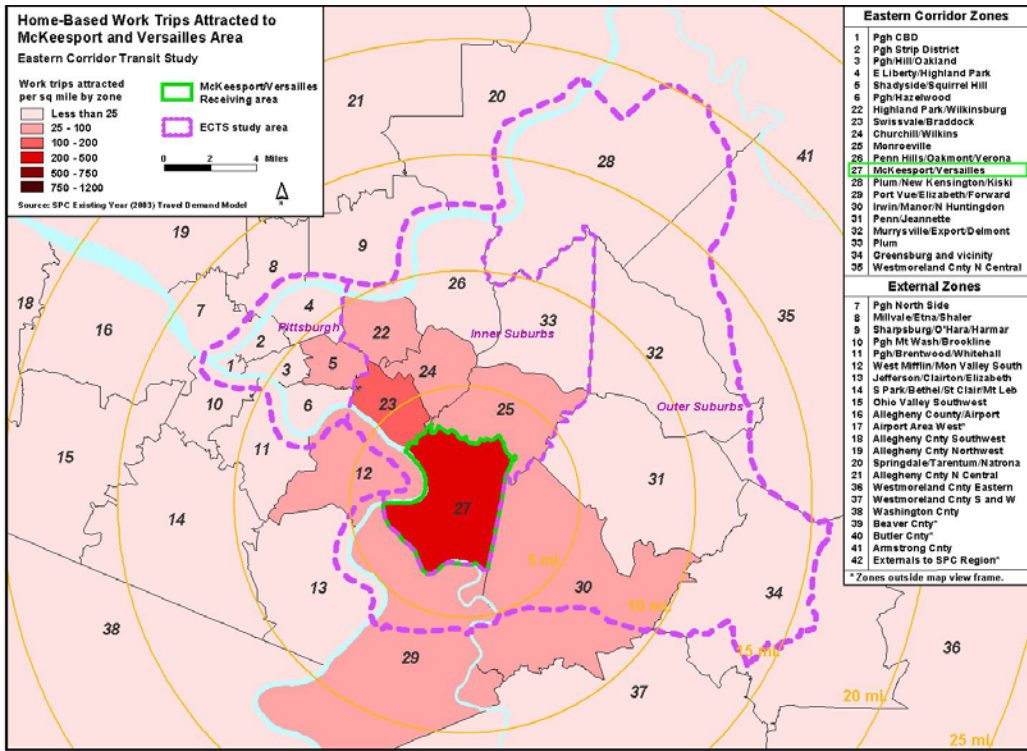
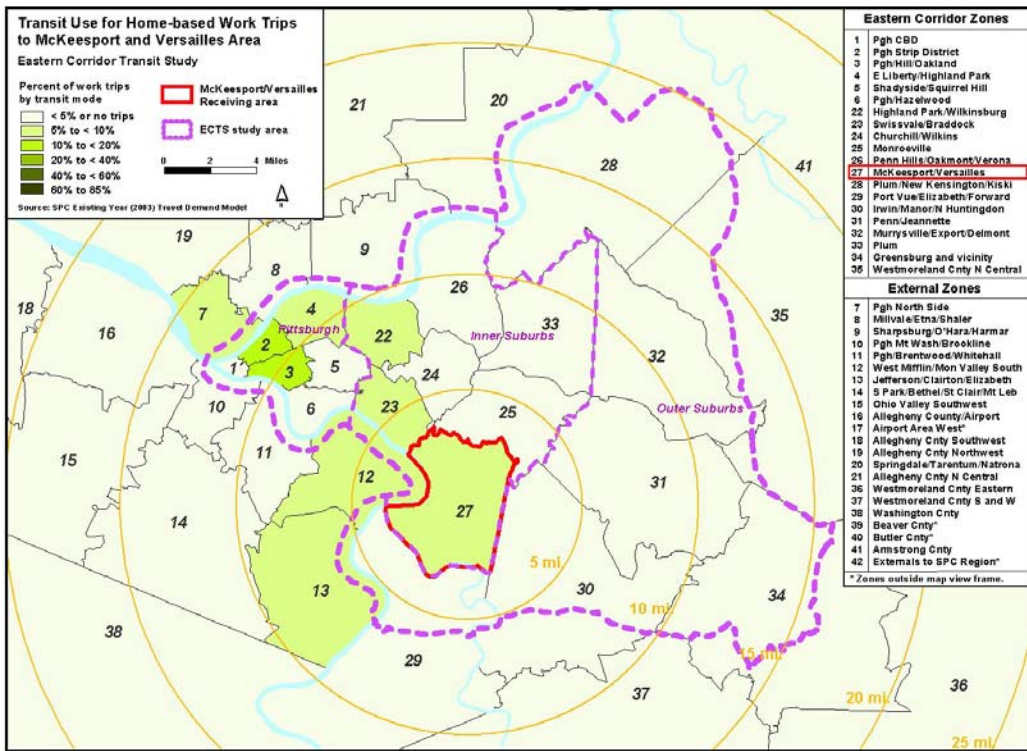


Exhibit 2-23: Home-Based Work Trips Attracted to McKeesport & N. Versailles – Percentage Using Transit



Outer Suburbs

Zones 28 through 32, 34, and 35, comprise the Outer Suburban Zones portion of the study area. With the limited exception of the more urbanized areas of Greensburg and New Kensington, the Outer Suburban Zones typify low density, suburban, or rural development patterns. The Outer Suburban Zones attract and produce a relatively high total number of work trips, comparable with Pittsburgh and the Inner Suburbs. The origins and destinations of trips in the Outer Suburbs are widely dispersed.

- **Penn/Jeannette** - area serves as an excellent example of the suburb-to-suburb commutes that typify work trip patterns in the Outer Suburbs. Work trip origins and destinations within the Penn/Jeannette area (Zone 31) account for at least 200 work trips per square mile, comparable to the level of intrazonal trips observed for zones of the Inner Suburbs, as illustrated in **Exhibit 2-24**. Bordering zones provide only 25 to 100 trips per square mile to the Penn/Jeannette area. It is also important to notice that an insignificant number of trips are destined for the Penn/Jeannette area from the Inner Suburbs and Pittsburgh; this pattern is characteristic of zones in the Outer Suburbs. The dispersed nature of land uses in these Outer Suburbs accounts for their low intensity of trip origins and destinations (please see **Exhibit 2-24**).

Exhibit 2-24: Home-Based Work Trips Attracted to the Penn/Jeannette Area

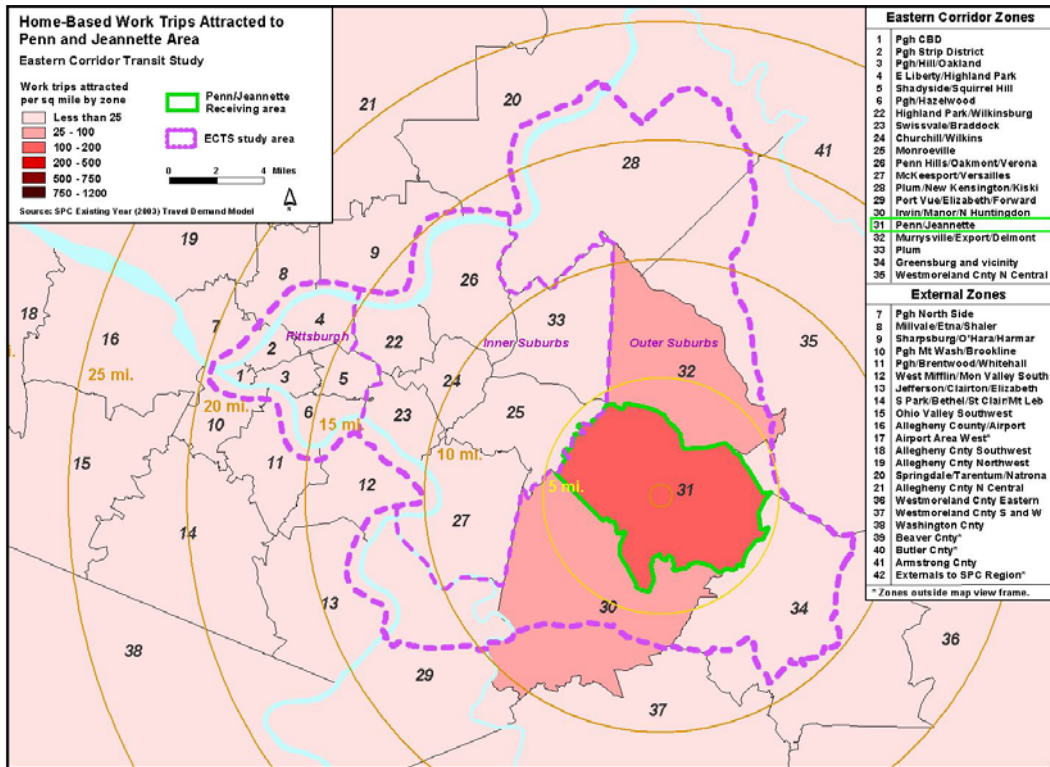
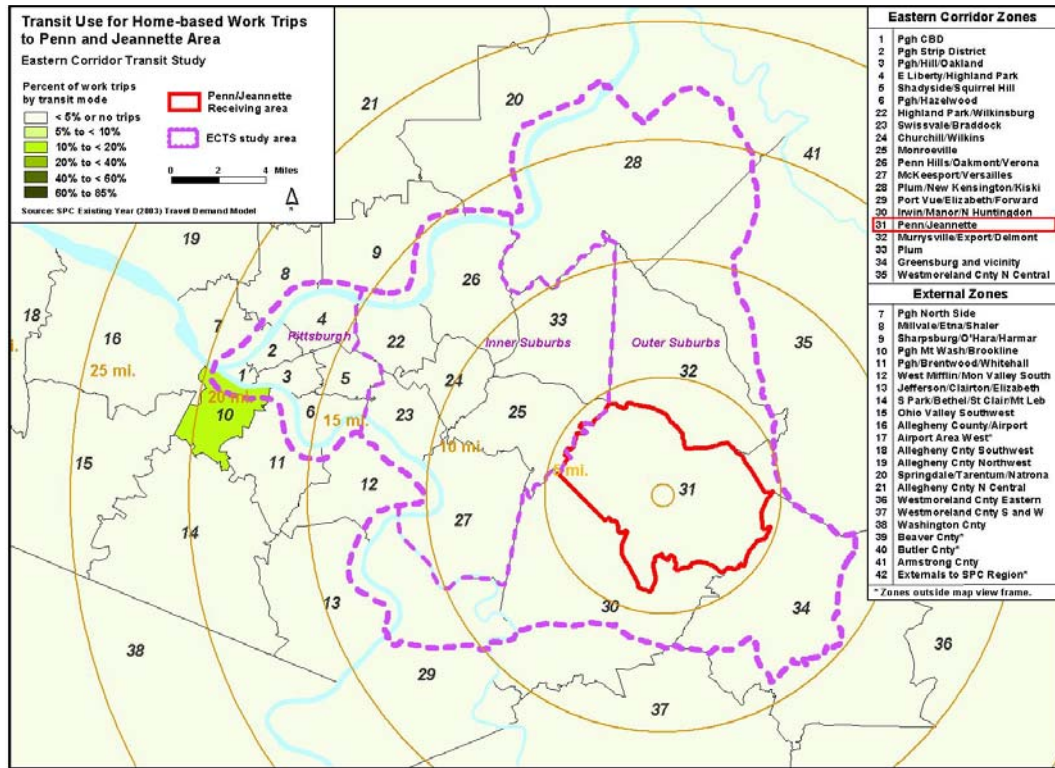


Exhibit 2-25: Home-Based Work Trips Attracted to the Penn/Jeannette Area – Percentage Using Transit



- **Greensburg** - and vicinity, denoted by Zone 34, is the destination for a significant number of trips from as far as 15 miles away and supports a high level of interzonal trips, as shown in **Exhibit 2-26**. Almost 107,000 work trips are destined for the Greensburg area; however, Greensburg attracts an insignificant number of trips from the City of Pittsburgh and the Inner Suburbs. Greensburg and its vicinity serve as a better example of an urban area, dominating the commuter patterns of the surrounding suburban areas, as shown in **Exhibit 2-26** and **Exhibit 2-27**.

Exhibit 2-26: Home-Based Work Trips Attracted to Greensburg and Vicinity

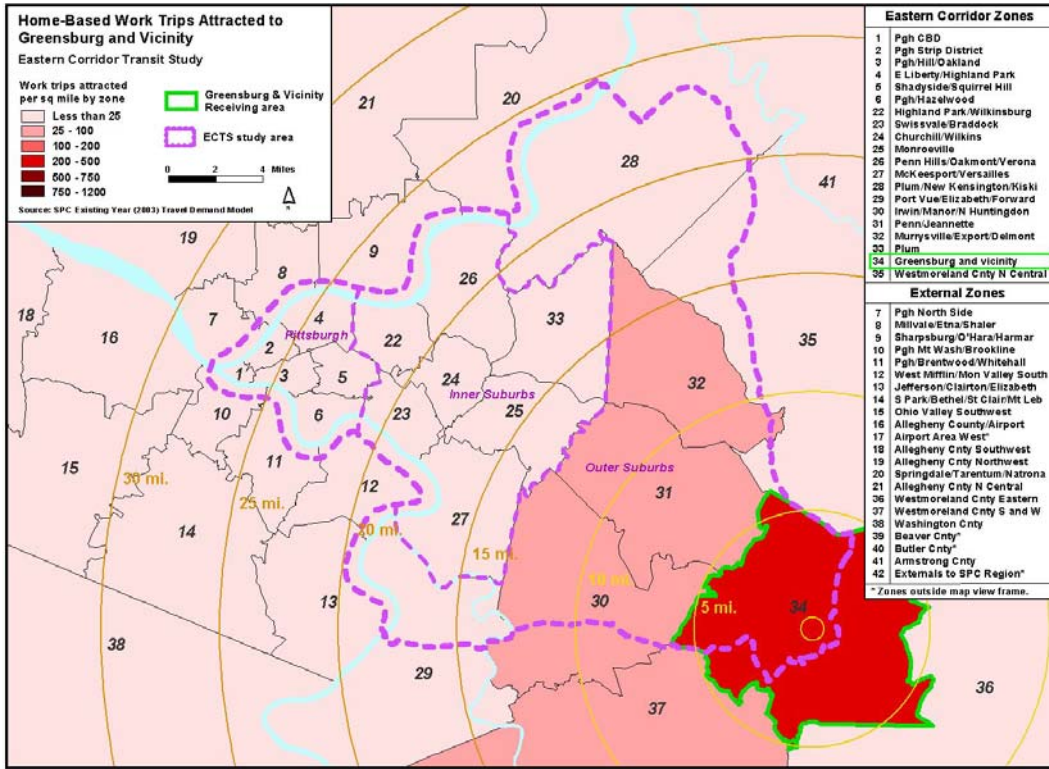
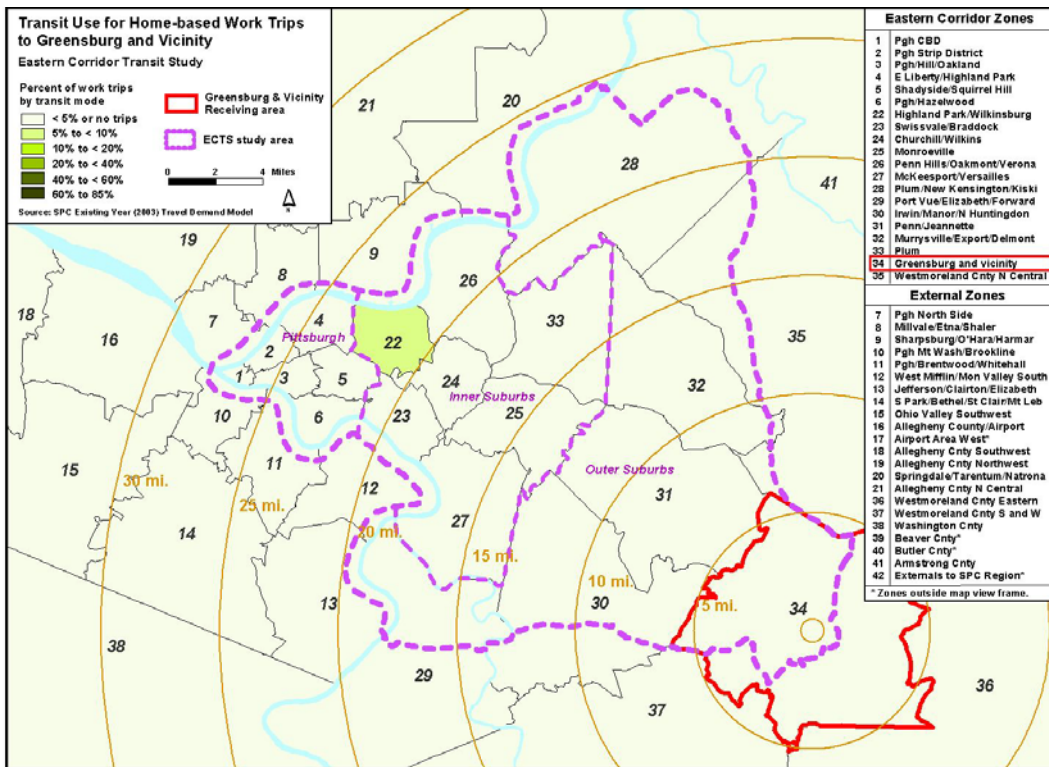


Exhibit 2-27: Home-Based Work Trips Attracted to Greensburg and Vicinity – Percentage Using Transit



2.6 PREVIOUS STUDIES AND PLANNED IMPROVEMENTS

Key studies that have been completed in the past as well as any new planning or development initiatives by local governments and organizations have been reviewed and summarized:

- **2025 Transportation and Development Plan for Southwestern Pennsylvania (LRP)** - A fiscally constrained, prioritized program of transportation improvements through the year 2025 developed by the SPC. It was officially adopted in July 2000, and the most recent amendment was in February 2003. It includes: North Shore Connector (\$363 million), East Busway Extension to Swissvale and the First Avenue Light Rail Transit Station (both completed), Mon/Fayette Expressway from SR51 to I-376 (\$1.9 billion) and the high-speed Maglev project from the Pittsburgh International Airport to Greensburg (\$2.8 billion).
- **2003-2006 Transportation Improvement Program (TIP)** – The 2003-2006 TIP is a fiscally constrained prioritization of roadway, transit, and other related projects for October 1, 2002 through September 30, 2006. The 2003-2006 TIP was adopted in late June and was effective as of October 1, 2002. Projects included in the TIP are: East Busway Extension to Rankin, 1st Avenue LRT station, North Shore Connector, I-376 resurfacing, bridge rehabilitations, lane additions or signal improvements on SR22, Route 30, and Tarentum Bridge, park & ride lots on Route 30.
- **Airport Multi-Modal Corridor Project (AMM MIS)** – A Major Investment Study of Parkway West (I-279) and Routes 22, 30, and 60, between the City of Pittsburgh and the Pittsburgh International Airport, sponsored by PAAC, SPC, the Pennsylvania Department of Transportation (PENNDOT), the City of Pittsburgh, Allegheny County, and the Allegheny County Airport Authority. The study's goal was to find the best transportation option(s) to reduce travel time between the City and the Airport, and to improve transportation connections to employment and development opportunities in the Airport Corridor and throughout the region. It was completed in February 2003 with recommendations to widen Parkway West by one lane in each direction, extend BRT beyond the existing West Busway, make investments in interchanges, tunnels, and safety in the corridor and implement a light rail line between the airport and Pittsburgh, inclusive of the North Shore and South Hills via the North Shore Connector Project. Two preferred alignments for the light rail line were considered.
- **Strategic Regional Transit Visioning Study (20/20 Vision)** – Initiated in 2001 with the goal of developing a regional framework for public transportation investments, and identifying strategies and policies for transit to help communities achieve their development/growth aspirations. It identified corridors for development of transit systems, determined need for short-term improvements, examined potential applications of technology, and considered implementation strategies.
- **Pennsylvania High-Speed Maglev Project** - Environmental Impact Statement (EIS) for a 54-mile high-speed magnetic levitation transportation system from the Greensburg area to the Pittsburgh International Airport. The system would have stations located in Greensburg, Monroeville and downtown Pittsburgh within the Eastern Corridor Transit Study area and two additional stations at the Airport. The project is one of the two remaining competitors, along with Baltimore-Washington, D.C., for implementation of a High-speed Maglev transit system in the United States.
- **Mon/Fayette Expressway DEIS** – DEIS of a toll road facility 65 miles from Pittsburgh (through the Monongahela River Valley and western Fayette County) and Interstate 68 in West Virginia, just

east of Morgantown. Primary goals include improved access to redevelopment sites in the economically depressed Monongahela River towns and faster and safer travel options for through-traffic, particularly commercial vehicles that currently use existing north-south arteries such as PA Routes 51, 88, 837, and 885, as well as U.S. Route 40 (the National Road).

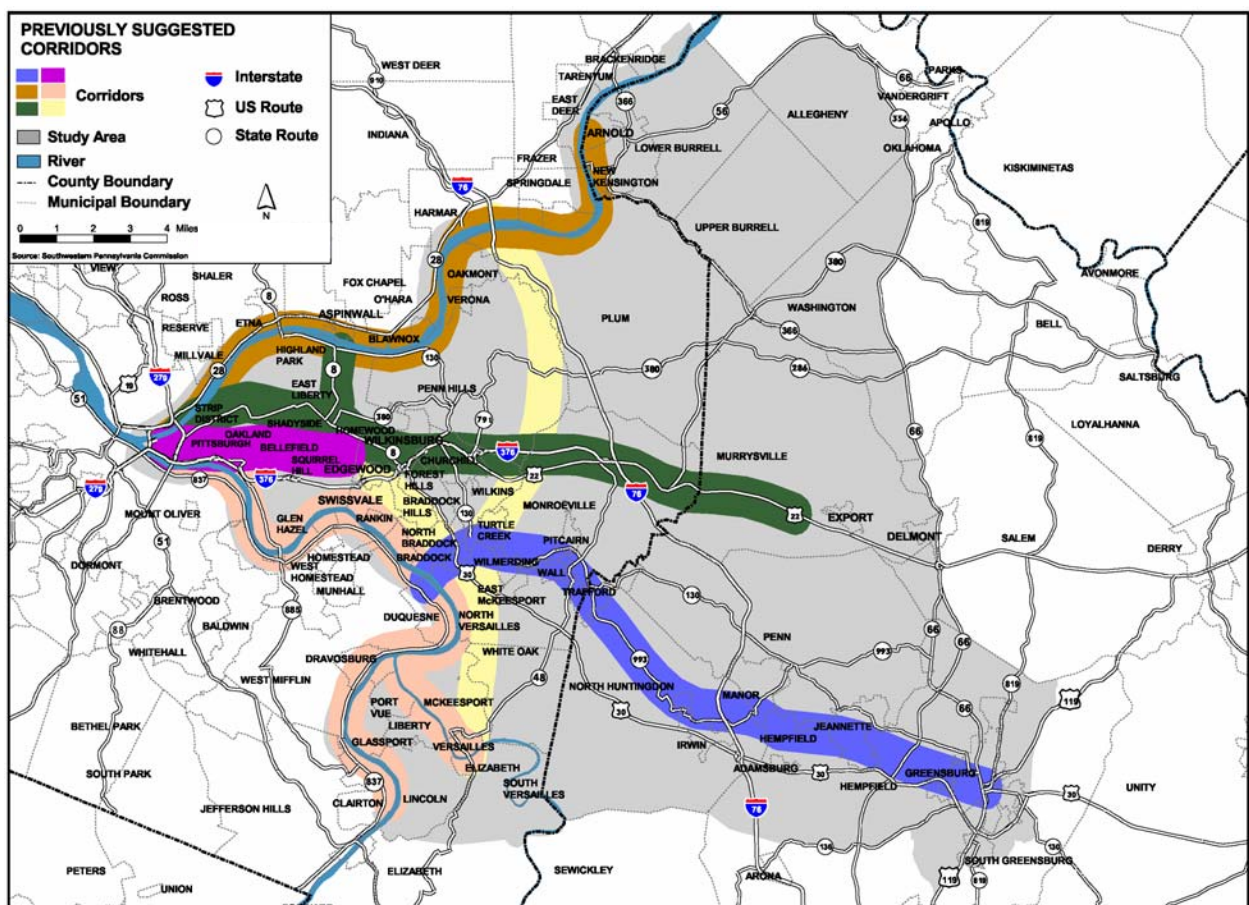
- **Spine Line Corridor Study** - Completed in 1993 to study alternatives for improved transit service in an eight-mile corridor between Downtown to eastern Pittsburgh including Squirrel Hill, Oakland, Hill/Midtown, Downtown and several North Side neighborhoods. A full, major investment study (MIS) started in 1995 but was cancelled in 1996 at the direction of the Port Authority Board of Directors. The three major alternatives were:
 - Extending the existing bus service between Downtown, Oakland and Squirrel Hill via the Martin Luther King, Jr. East Busway.
 - Increasing the frequency of existing bus service.
 - At-grade and subway light rail to East End communities and the North Side
- **Initial Phase Alternatives Analysis** - This three-year study completed in 1982, it analyzed various alternatives within nine specified corridors. Several corridor improvements are contained within the Eastern Corridor Transit Study area and include a busway and rapid transit in the Spine Line Corridor, and a busway along a partial stretch of the Allegheny Valley Railroad extending into Etna.
- **East Busway Extension** - The Environmental Assessment Study for the Phase I Martin Luther King, Jr. East Busway Extension Project, completed in 1995. Three alternatives were studied as part of this report: the No-Build condition, Transportation System Management improvements and extension of the East Busway to the Swissvale/Rankin line.
- **OTAK Study** - Commissioned by the Turtle Creek Council of Governments and consisted of two related studies: the East Light Rail Transit Community Design Report and the Review of East Busway Light Rail Conversion/Extension Cost Estimates. The East Light Rail Transit Community Design Report includes specifications regarding planning, and transit-oriented design ideas. The Review of East Busway Light Rail Conversion/Extension Cost Estimates considered conversion of the East Busway to light rail transit.

Several corridors within the study area were previously suggested as opportunities for major transit investments as part of other planning efforts and/or public outreach initiatives. In some instances studies have been completed and in others, there is considerable public interest. The following corridors served as an initial list for consideration in this study (see **Exhibit 2-28**):

- **Allegheny Valley Corridor** – Approximately 23 miles long, from downtown Pittsburgh to New Kensington via the communities of Lawrenceville and Oakmont.
- **East Busway Corridor** – Approximately 23 miles long, from downtown Pittsburgh to Penn Hills, paralleling the East Busway through Swissvale, along railroad rights-of-way via the communities of Braddock, Turtle Creek, Pitcairn, and McKeesport.
- **Parkway East (I-376) and Route 22 Corridor** – Approximately 27 miles long, from downtown Pittsburgh to Murrysville in Westmoreland County paralleling the East Busway, Parkway East and Route 22 via the communities of Wilksburg, Churchill, and Monroeville.

- **Spine Line Corridor** – Approximately 8 miles long, from downtown Pittsburgh to Squirrel Hill either in an at-grade or subway alignment via Oakland and various arterials (e.g. Fifth Avenue, Forbes Avenue, Centre Avenue, and Colwell Avenue).
- **Norfolk Southern Corridor** – Approximately 31 miles long, from downtown Pittsburgh to Greensburg, paralleling the East Busway continuing to Braddock and through the communities of Trafford, North Huntingdon, and Jeannette, generally following the NS right-of-way.
- **Monongahela Valley Corridor** – Approximately 25 miles long, from downtown Pittsburgh to the communities of McKeesport, Clairton, and Versailles paralleling the Monongahela and Youghiogheny rivers, and the CSX and NS railroads.

Exhibit 2-28: Previously Suggested Study Corridors Map



3 PUBLIC OUTREACH AND AGENCY COORDINATION

An extensive public involvement process was undertaken for the Eastern Corridor Transit Study to effectively engage residents, public officials and others within the large and diverse study area that extended from downtown Pittsburgh to New Kensington, Murrysville, Greensburg and McKeesport. The challenge facing the public involvement team was to reach out to and engage in public dialogue a diverse set of stakeholders, community leaders, major businesses, institutions and the general public in an organized and efficient manner. The project team employed a number of different strategies throughout the duration of the study via three rounds of direct public outreach that included Corridor Working Groups, Public Open Houses and Station Design Workshops (shown in **Exhibit 3-1**), combined with Targeted Outreach, Public Officials Briefings, and Agency Coordination. In total, approximately 150 meetings were conducted during the course of the study. The following discussion elaborates on these key components of public outreach.

Exhibit 3-1: Public Outreach Meetings

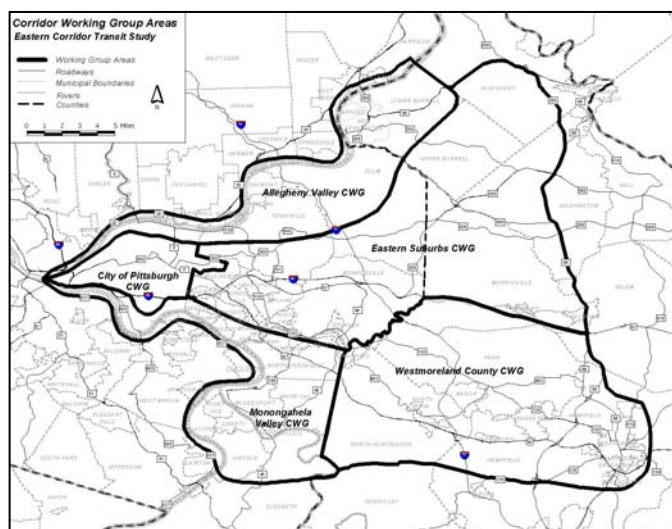
Type of Meeting	Number of Meetings
Corridor Working Groups	10
Open Houses	13
Targeted Outreach	86
Public Officials Briefing	14
Station Design Meetings and Workshops	8
Agency Coordination Meeting (ACM)	3
Steering and Technical Committees	16
Total Meetings	150

3.1 CORRIDOR WORKING GROUPS

In deference to the large study area, its diverse set of potential transit and development needs and the many stakeholders representing it, the study team designed and convened five geographically based Corridor Working Groups as illustrated in **Exhibit 3-2** to represent the City of Pittsburgh, Allegheny Valley, Eastern Allegheny County Suburbs, Monongahela Valley and Westmoreland County.

Exhibit 3-2: Corridor Working Group Areas

The working group structure was developed as an alternative to an overall corridor advisory committee and intended to augment the open houses and foster both group and one-on-one discussions in an effort to manage the large study area. They were also designed to maximize convenience for residents in different corridors of the study area. Each working group was comprised of key stakeholders, constituencies, and individual citizens gleaned from SPC’s Public Participation Panels (PPPs), internal contact databases, and previous planning study participants (e.g. East Busway, 20/20 Visioning, and Spine Line Study).



These groups were convened to nurture facilitated group discussion and to frame the issues to be explored at the public open houses. The working groups met twice, before each of the first two rounds of public open houses. During the third round of public input, the working group members were invited to attend the station design workshops as described below.

The first set of working group meetings, held in April of 2002, was especially important to introduce the study and its purpose with the ultimate goal to gather transportation and development needs throughout the entire study area. As a result, over 250 needs were identified, from working group input and other public outreach activities, serving as the foundation for the remaining tasks of the study. Each Corridor Working Group session was composed of a 30-minute study team presentation that was followed by 90 minutes of group discussion and feedback where the members were allowed to express their ideas on needs and desires for improved public transportation facilities and services. The final 90 minutes of each session was specifically assigned to the participants to voice their opinions, concerns and questions of the study process and the needs of the study area. The second set of Corridor Working Group meetings were structured identically to the first with the project team describing the preliminary transit alternatives followed by a facilitated discussion of ideas and concerns by the participants in an effort to refine the alternatives as they were prepared for more detailed analysis.

3.2 PUBLIC OPEN HOUSES

The purpose of the public open houses was to provide an opportunity for the general public to learn about the study, gather additional information on transportation and community needs and provide comments on transit opportunities for future study and potential implementation. The open houses included both a public officials briefing (one hour) and a general public engagement session (three hours). Large informational boards were set up at specific stations with study team staff available to discuss all projected related issues and to answer any questions (see photograph in **Exhibit 3-3**). Open Houses were conducted in three rounds throughout the study area at convenient locations agreed upon by both the study team and Project Technical Committee. The locations were chosen to provide easy access to different communities within the study area during each round as follows.

Exhibit 3-3: Downtown Open House



- **Round 1 - May 2002** – Regional Enterprise Tower (downtown Pittsburgh), Kingsley Center (East Liberty), Palace Inn (Monroeville), and Westmoreland County Community College (Youngwood)
- **Round 2 - October 2002** – YWCA (downtown Pittsburgh), East Liberty Presbyterian Church, Westmoreland Mall, Wilkinsburg High School
- **Round 3 - June 2003** – University of Pittsburgh (Oakland), YWCA (downtown Pittsburgh), Westmoreland Mall, Riverview Jr. High School (Oakmont), Community College of Allegheny County (Boyce Campus)

Within the framework of the open house format, the study team staffed a number of stations covering various aspects of the project at key points in the overall process (i.e. Needs Development, Short List Transit Alternatives, and Detailed Alternative Attributes). At each station, study team members, including consultant, PAAC, and SPC staff, were available to explain the study process, answer questions, and record public comment. The final station during each of the open houses consisted of an area to comfortably fill out comment forms about the open house, the study, and the results presented.

3.2.1 TRANSPORTATION & COMMUNITY PLANNING

Each round of the open houses focused on a specific theme that provided examples of coordinated approaches to transportation and community planning from the Pittsburgh region and other cities, both nationwide and worldwide. The three general themes included:

- **Transit Stations and Modes** – As part of the first round of open houses the study team developed three display boards of stations and modes in Pittsburgh and elsewhere to provide examples of how transit stations have been developed and coordinated within existing communities. Examples ranged from commuter rail and light rail in San Jose to bus rapid transit in Australia, heavy rail in Spain, and bus stop structures in Germany. **Exhibit 3-4** shows some of the pictures presented. The intention was to generate thought and ideas from the general public on how the approach to these types of facilities and their design could be applied in Southwestern Pennsylvania.
- **Transit and Community Development** – During the second round of open houses, the study team took the concept of stations and modes and related them to the application of Transit Oriented Development (TOD) through real and conceptual examples that included the TOD Vision for Clairton and Cranberry Township, East Liberty Vision Plan, and the Steel Plaza “T” Station. Some local examples are shown in **Exhibit 3-5**. The intention was to illustrate how transit station design, creative land use planning, community partnerships, and public/private participation can effectively integrate public transportation facilities into neighborhoods.
- **Station Design Workshops** – Throughout the study, the project team emphasized the importance of understanding the relationship between transit planning and community development. The effort to exhibit these ideas culminated with the station design workshops that were intended to focus on typical development types in the study corridor and discuss how transit facilities can fit into the fabric of the community. During the third and final round of public involvement, a series of station design workshops were held across the corridor, in place of the Corridor Working Group meetings. The workshops provided an opportunity to illustrate the range of transit facility investments that could be made in the study area. Examples are shown in **Exhibit 3-6** and **Exhibit 3-7**. These meetings were held in the following four locations to represent the diversity of communities in the study area.
 - East Liberty – representing an urban center;
 - Braddock, Rankin, and the Carrie Furnace site – representing City neighborhoods and a brownfield site;
 - Monroeville, representing a post World War II suburb; and
 - Greensburg, representing a town or city.

Participation in the station design workshops was open to all working group members. In addition, key local citizens and stakeholders were invited to attend and participate, to ensure that the station design concepts were in concert with previous and on-going planning efforts. The study team presented boards that showed existing conditions, with an emphasis on challenges and opportunities, and proposed transit-oriented design solutions. The design ideas ranged from bus shelters to transit centers, and included urban design recommendations to link transit facilities to overall community development. Workshop attendees participated enthusiastically and were interested by the opportunities for transit investments to enhance their communities.

Exhibit 3-4: Station Concepts



Exhibit 3-5: Transit Oriented Development

Transit and Community Development



TCOD Vision - Cherry Township, PA
Illustrated by UDA



Municipal Building, West Runaway Township
Carnegie, PA



East Liberty Vision Plan - Pittsburgh, PA
Illustrated by Rothschild Architects



Steel Plaza T Station - Pittsburgh, PA

Transit-Oriented Development (TOD) encompasses a wide array of development activities designed to encourage the use of public transit by improving and enhancing the environment in which transit operates. Transit-Oriented Development represents the commitment made by community planners to build a walkable, environmentally friendly, and attractive place to live, work, or play.

Creating Transit-Oriented Developments is not always easy. The recipe for success generally includes a combination of good transit station design, effective community partnerships, strong market conditions, creative land use planning, and the right mix of incentives to inspire developer, community, and local government participation.



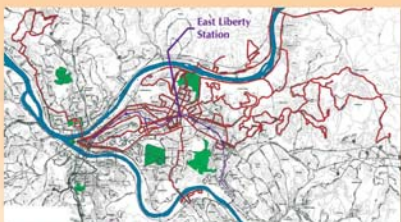
Potential TOD - Broadway Avenue, Pittsburgh, PA
Illustrated by UDA

EASTERN CORRIDOR TRANSIT STUDY

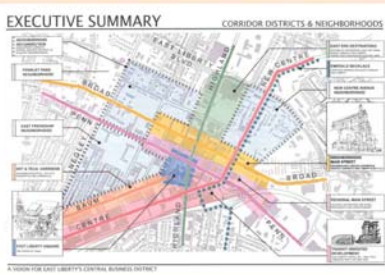
Exhibit 3-6: East Liberty Case Study

Transit Facility Planning

Case Study 1 - Urban Centers - East Liberty



Transit Routes through East Liberty

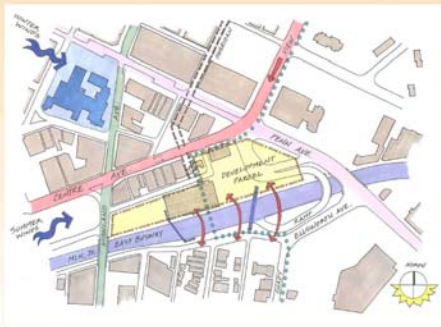


EXECUTIVE SUMMARY
CORRIDOR DISTRICTS & NEIGHBORHOODS

A Vision for the Center of East Liberty - Prepared by Rothschild Architects

Urban Center - East Liberty

- Densely built area within a city
- Location for major commercial, civic and institutional activities
- Serves as an employment center
- Other Urban Centers: Downtown Pittsburgh, Oakland, Strip District



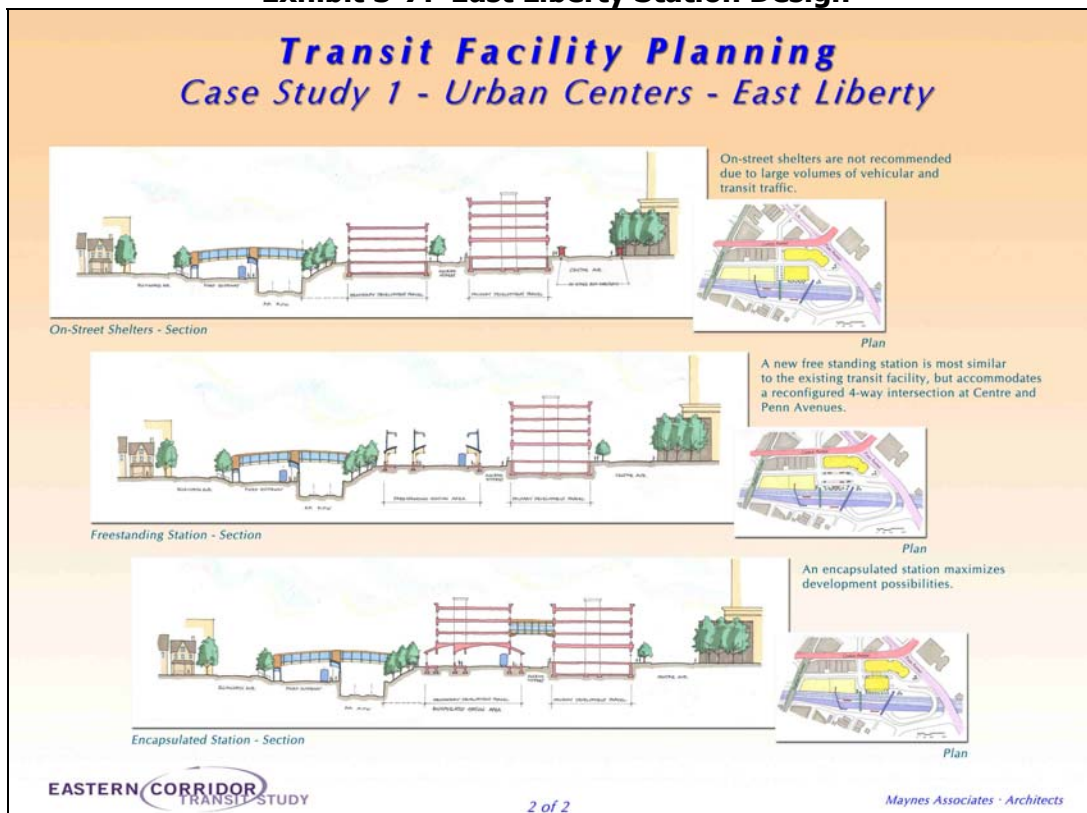
Site Development Diagram

EASTERN CORRIDOR TRANSIT STUDY

1 of 2

Maynes Associates - Architects

Exhibit 3-7: East Liberty Station Design



3.3 TARGETED OUTREACH

The public involvement team worked in collaboration with PAAC, SPC, and the WCTA to identify a subset database of organizations and stakeholders for targeted outreach, paying special attention to rounding out participation throughout the corridor. This outreach effort was based on experience that traditional public meeting and notification channels do not always result in the involvement and education of those parties who would be most affected by the project proposals.

Members of the project team conducted and participated in approximately 85 targeted outreach meetings as shown in **Exhibit 3-8**. The meetings were held throughout the entire study area.

3.4 PUBLIC OFFICIALS BRIEFINGS

The first hour of each open house was designated for briefing of public officials, which included federal, state, county, and municipal officials representing communities in the entire bi-county study area. A region-wide public officials briefing was conducted in June of 2002 at the David Lawrence Convention Center, where the ECTS was presented along with other regional transportation projects including the Airport Multimodal Major Investment Study, North Shore Connector LRT Extension, Strategic Regional Transit Visioning Study, and the Pennsylvania High-Speed Maglev Project. Two additional briefings were conducted for Westmoreland County public officials in September and November of 2003 that focused on commuter rail transit opportunities.

Exhibit 3-8: Targeted Outreach Meetings

Chambers of Commerce	Meetings: 5
Allegheny Valley, Monroeville, New Kensington Area, Shadyside, Wilkinsburg	
Planning and Advocacy Organizations	Meetings: 8
Association of Community Organizations for Reform Now (ACORN), Allegheny County Transit Council (three meetings), Oakland Transportation Management Association, Pittsburgh Downtown Partnership Transportation Committee, Pittsburgh Transportation Equity Project (two meetings)	
Local and Regional Agencies	Meetings: 14
Allegheny County Area Agency on Aging, Allegheny County Economic Development, Monroeville Planning Department, Pittsburgh Department of City Planning: Comprehensive Staff, Port Authority Board of Directors, Economic Development Committee, SPC Allegheny County Public Participation Panel, SPC Bike/Ped Committee, SPC Board of Directors, Sustainable Pittsburgh Urban Cycling Group, SPC Westmoreland County Public Participation Panel, Westmoreland County Transit Authority Board of Directors (two meetings), SPC Nemacolin Retreat	
Community Organizations	Meetings: 18
Bloomfield-Garfield Corporation, East Liberty Development, Inc., Hazelwood Initiative Planning Committee, Hill District Consensus Group (two meetings), Millvale Development Corporation, Monongahela Valley Initiative, Neighbors in the Strip, Oakland Community Based Organizations Collaborative Meeting, Oakland Community Council, Oakland Planning and Development Corporation, Pittsburgh Urban League, Polish Hill Civic Association, Regent Square Civic Association, Oakland Community Council Transportation Committee, Shadyside Action Coalition, Squirrel Hill Urban Coalition, Uptown Community Action Group	
Institutions	Meetings: 10
Beth Shalom Congregation, Carlow College, Carnegie Mellon University (two meetings), Chatham College, The Carnegie, Oakland Task Force (two meetings), UPMC Braddock, UPMC McKeesport	
Special Populations	Meetings: 5
Citizens for Accessible Transit, Ground Zero, Hispanic/Latino Center, Sri Shirdi Sai Baba Temple, Vintage Senior Center	
Environmental Organizations	Meetings: 6
Friends of the Riverfront: Collaborative Environmental Organizations Meeting, Riverlife Task Force (three meetings), Sierra Club, Sustainable Pittsburgh	
Other Stakeholders	Meetings: 19
Allegheny County League of Women Voters, Allegheny Valley Railroad (three meetings), Richard Florida (Carnegie Mellon University), Mackin Engineers (Consultants to Turnpike Commission), Khari Mosley, Citizen Alert, Pennsylvania Trolley Museum, Citizens Plan Representatives (two meetings), Pittsburgh City Councilman William Peduto (two meetings), Pittsburgh History and Landmarks Foundation Transportation Committee, Pittsburgh Partnership for Neighborhood Development, Regional Industrial Development Corporation, Rothschild Architects/East Liberty Development Standards, Soffer Organization, CSX Railroad	

3.5 PROJECT NEWSLETTER & WEBSITE

Two newsletters were completed during the course of the study prior to the first two rounds of open house meetings. The first newsletter highlighted the purpose of the study and the needs of the study corridor, while the second focused on the Short List of Alternatives and next steps in their development. Development of a third newsletter is currently under consideration to illustrate the final alternatives and their key attributes.

PAAC designed and maintained an interactive website for the Eastern Corridor Transit Study with links to other project sponsors including SPC and WCTA. SPC and WCTA websites were also linked back to the study website to allow convenient access for their website visitors. The study website provided detailed information on the study including a study area map, times and locations for public meetings, frequently asked questions, maps of the alternatives, and the entire group of illustrations for the transportation and community planning effort, and was updated throughout the study process.

3.6 ADDITIONAL PUBLIC CONTACT

Prior to public open houses, flyers advertising the open houses were sent to a total of 6,800 persons and organizations. In addition, 81 packets of flyers were sent to libraries, community centers, senior centers, municipal buildings, and other key public locations. Individual newsletters were sent to the same database of 6,800 recipients and packets of newsletters were sent to the same key public locations as the flyer packets. The flyers and newsletters were both posted on the Port Authority website. In addition, bus placards were placed in Port Authority and Westmoreland County Transit Authority buses to notify the public of the open houses. The public was also notified of upcoming open houses through a project e-mail "blast list" of 500 recipients.

Working in cooperation with Port Authority, press releases and public service announcements of the public open houses were sent to media contacts. In addition, the open houses were advertised in the following newspapers: Pittsburgh Post-Gazette East Zone; Pittsburgh Tribune-Review Westmoreland Edition; New Pittsburgh Courier; and McKeesport Daily News. During the second round of public open houses, the meetings were also advertised in the Gateway Publications' East newspapers.

Additionally, Adelphia Cable taped and broadcast a session of "Focus on Issues" about the Study. Members of the Project Team were interviewed by Marilyn Skolnick, the show's host and had an opportunity for detailed discussion of the Study needs and Preliminary Alternatives. Adelphia Cable broadcast the program twice a week, daytime and evening, for one month. The broadcast area targets communities in Pittsburgh's eastern suburbs.

4 PURPOSE AND NEEDS

4.1 PURPOSE OF STUDY

The purpose of the Eastern Corridor Transit Study was to identify the transportation needs within the study area and develop appropriate transit solutions that efficiently and effectively satisfy those needs. The study effort built on existing public transportation infrastructure and systems while improving mobility, fostering economic development, considering environmental impacts, and utilizing existing transportation resources. Potential transit alternatives were explored, including improvements to existing bus service, busway / light rail extensions and/or improvements, and commuter rail service on existing railroad rights-of-way. The study encompassed the following technical tasks:

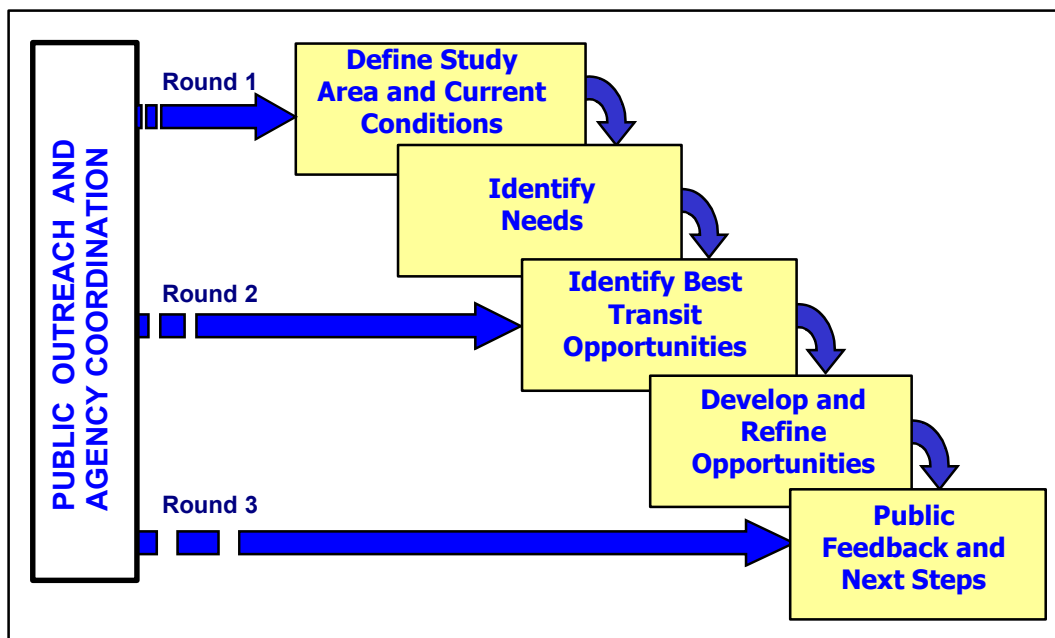
- **Needs Assessment** – Identification of existing transportation and economic conditions
- **Purpose and Need Statement** – Reasons for the study and need for transit improvements
- **Definition of Alternatives** – Development of public transportation alternatives to satisfy needs
- **Evaluation of Alternatives** – Qualitative and quantitative evaluation process to develop a Short List of Alternatives for more detailed analysis
- **Technical Analysis** – Operating, capital, ridership analysis and environmental review
- **Public and Agency Coordination** – General and targeted public outreach and agency coordination
- **Next Steps** – Guidance on the next phases of project development including Alternatives Analysis and Draft Environmental Impact Statement

In addition, this study was coordinated with several ongoing planning studies in the region including the 20/20 Visioning Study, Airport Multi-Modal Corridor Study, North Shore Connector, and the Pennsylvania High-Speed Maglev Project. The final objective of the ECTS was to identify the best opportunities for new public transportation investments in the study area that are competitive, both regionally and nationally, on a technical and economic scale.

4.2 STUDY PROCESS

The ECTS represents the preliminary step towards a more detailed analysis of public transportation investments for travel corridors extending east from downtown Pittsburgh. The purpose of ECTS is not to recommend any one specific transportation investment or corridor, but rather to provide information and conclusions to enable local decision makers to determine the best transit opportunities in each corridor for accommodating new and improved public transportation. This study began by defining a specific area and assessing current transportation conditions and needs. Through extensive public outreach and analysis, the study sought input from the general public and regional stakeholders to document transportation needs in each corridor and subsequently develop and evaluate public transportation opportunities to meet those needs. Three rounds of public involvement and agency coordination provided the overall guidance to the study process as illustrated in **Exhibit 4-1**.

Exhibit 4-1: ECTS Process



Next steps would include moving one or more of the best transit opportunities to the next phase of project development (e.g. AA, DEIS) after adoption into the SPC LRP.

4.3 STATEMENT OF NEEDS

The transportation and community needs of the study area were developed through the public outreach process, technical analyses, and agency coordination efforts. A major component to the development of the needs statement was the comments gathered at the first round of five corridor working group meetings and four open houses, as well as numerous targeted outreach sessions early in the study. Several general themes were expressed during meetings. As a result, these efforts laid the groundwork for the development of the study needs. The transportation and community needs for the Eastern Corridor Transit Study are:

Need 1: Improve Transit Choices in the Study Corridor

- There is a need for more rapid transit choices and service in the study area.
- There is a need for community circulator services for better access within neighborhoods and improved connections to through routes.
- Consider transit options that extend beyond the study corridor (e.g. Pittsburgh International Airport, Cranberry).
- There is a need for more park & ride lots for convenient access to both fixed guideway transit and fixed-route bus.
- Improve access to Oakland, the second largest activity center in southwestern Pennsylvania, from other points in the corridor as well as the Airport.
- There is a need for better service and connections to developing areas such as the Waterfront (Homestead), Monroeville, RIDC, and Penn Township.

Need 2: Improve the Quality of Service and Amenities at Station Stops and Transfer Points

- There is a need for longer service periods and more frequent service to allow more flexibility for accessing jobs and recreational activities during non-business hours.
- Upgrade transit stops with sufficient seating areas, protection from the elements, and visually aesthetic designs.
- There is a need for more direct or efficient links between the suburbs, urban areas, and activity centers.
- Provide better information about transit service routes, transfer points, and intermodal connections, including those between service providers.

Need 3: Preserve, Protect, and Utilize Existing Transportation Resources

- Need a mechanism to preserve rail rights-of-way within the study corridor and region.
- Better transit service and access in the Allegheny Valley through the use of an underutilized transportation facility (e.g. Allegheny Valley Railroad) to accommodate transit service to areas in Lawrenceville, Oakmont, and New Kensington.
- Need for dedicated bus lanes and/or transit prioritization to speed up service between areas in Westmoreland and Allegheny Counties.

Need 4: Enhance Environmental Quality

- Need to relieve air and noise pollution by considering environmentally friendly transit vehicles and modes. Consider light rail vehicles on the East Busway, or at a minimum, cleaner and quieter fuel technologies that could include electric buses.
- Utilize existing transportation resources such as transit and railroad rights-of-way to avoid new disturbances to the environment from a construction and operational perspective.
- Station stops and shelters should be adequately landscaped with attractive designs to enhance the visual and aesthetic qualities of both existing and planned transit facilities.
- Increase investments in pedestrian and bicycle facilities along existing and planned fixed guideway transit investments.

Need 5: Reduce Congestion with Effective Transit Solutions

- All of the major roadways in the study area, such as I-376, Routes 28, 22, 30, 48, 286 and 837, are now and are projected to be congested, with a majority of the roadways operating in the highly and severely congested range.
- A viable alternative to single occupancy vehicle usage is needed as a way to offset the effects of increased congestion in the corridor.
- An attractive transit solution will allow for transportation choices, which can serve to diminish reliance on the automobile.

Need 6: Coordinate Transit and Community Planning to Enhance Economic Development and Quality of Life

- Improved collaboration with neighborhood planning efforts should be commonly pursued by transit agencies, regional planning organizations, and local townships/municipalities in an effort to coordinate and integrate future transit investment locations/designs with community plans.
- Find ways to increase economic development opportunities along existing and planned transit guideways by improving partnerships between businesses and transit through joint development initiatives and service planning coordination that matches employee needs.
- Update transit facilities so that they are community assets.

Need 7: Develop a Transit Network that Conveniently and Continuously Links People and Activity Centers

- There is a need for an integrated fixed guideway transit system that connects through downtown Pittsburgh, serving differing parts of the region.
- Better service from the Hill District to other parts of the study area and region that eliminates the need for a transfer.
- Reduce automobile and bus congestion in downtown Pittsburgh to relieve gridlock during peak commuter periods and during special events.

4.3.1 GOALS AND OBJECTIVES

The statement of goals and objectives is an essential component of the Alternatives Analysis project planning process. Given the considerable geographic extent of the Eastern Corridor Transit study area, the study goals had to be sufficiently comprehensive to encompass the needs of a wide array of its neighborhoods, residents, activity centers, and jurisdictions. To this end, the goals were derived from the needs, and reflect the plans and desires of the communities within the study area, as well as the region as a whole. The goals represent a fusion of the identified transportation and community needs from the extensive public outreach and agency coordination process and needs assessment analyses, the SPC LRP vision, and the factors set forth in TEA-21, as discussed below.

Goal 1: Provide More Transit Choices and Improved Quality of Service: This goal addresses one of the primary concerns of the study area as indicated by the public for implementing additional transit choices, such as new bus routes, busways, light rail transit, bus rapid transit or enhancing existing facilities and services will serve to meet this goal. The objectives to attain this goal are:

- To improve and/or expand public transit service/alternatives to complement existing and ongoing investments
- To improve the attractiveness of public transit by making it faster, more reliable, and more convenient to use
- To improve access to rapidly developing areas (e.g. Oakland, Waterfront, Monroeville, Penn Township)
- To enhance transit access to the transit dependent

Goal 2: Promote Economic Development and Improve Quality of Life: Developing alternate transportation improvements provides the means to address not only mobility and accessibility issues, but also the opportunity to enhance economic development and the general quality of life in the study area. In order to maintain a quality of life that retains residents and attracts economic growth, the transportation system must offer efficient access to important destinations and must be implemented in concert with local community planning initiatives. The objectives to attain this goal are:

- To strengthen older urban communities as centers of economic opportunity
- To broaden the range and availability of public transportation alternatives for a variety of trip purposes
- To foster Transit-Oriented Development (TOD)
- To upgrade existing transit facilities so they become community assets
- To maximize economic development opportunities along existing and planned transit routes

Goal 3: Reduce Roadway Congestion through Transit Solutions: In the Eastern Corridor, travel demand is dominated by the automobile with all of the major roadways in the study area projected to experience high levels of congestion into the horizon year of 2025. By offering increased public transportation solutions, the study area can achieve a reduction in automobile vehicle miles traveled, thereby reducing traffic congestion, air pollution, and energy consumption. The objectives to attain this goal are:

- To provide an effective and attractive alternative that provides a convincing option to the use of the automobile for both work and recreational trips
- To reduce vehicle miles of travel in the study area and the region
- To reduce travel times between key activity centers in the study area

Goal 4: Minimize Impacts to the Environment and Preserve Existing Resources: Environmental quality is a multi-faceted consideration in transportation planning, encompassing air quality, energy conservation, and the preservation of farmland, open space, and existing transportation rights-of-way, all of which have an impact on quality of life in the region. It is desirable from a local and regional perspective to invest in transportation projects that reduce impacts to environmental resources, promote more compact (less land-intensive) forms of development, and utilize existing transportation resources. The objectives to attain this goal are:

- To address residential, commercial, and industrial "sprawl" development
- To utilize environmentally friendly transit vehicles and modes
- To increase the development and use of pedestrian and bicyclist facilities
- To identify transit improvements that utilize and preserve existing and underutilized transportation resources

Goal 5: Develop a Convenient, Cost Effective, and Integrated Transit Network: The development of a transit network that is cost effective, efficient, and integrated is a primary goal of the Eastern Corridor Transit Study and is supported by recommendations from the general public through the public outreach process. The development of an integrated transit network that links people, communities and activity centers, will serve to increase both convenience and productivity of the transit system. The objectives to attain this goal are:

- To invest resources efficiently
- To connect to other areas of the region beyond the Eastern Corridor Transit Study area
- To connect and enhance existing transit investments such as the existing busways to allow for convenient one-seat rides to various parts of the region
- To maximize the benefits to the region of the existing Light Rail Transit system, including the Downtown subway
- To improve the productivity and cost effectiveness of the transit system
- To reduce traffic congestion in downtown Pittsburgh

5 LONG LIST OF ALTERNATIVES

Twenty-nine transit build alternatives were developed based on the needs of the study and the initial list of investment corridors. The Long List of alternatives was presented to public to ascertain their input via the corridor working groups, open house meetings and targeted outreach, and then evaluated against the needs of the study in a qualitative format as discussed in this section.

The combined public outreach input and qualitative evaluation efficiently identified one or more alternatives that provided the greatest merit for an improved public transit opportunity within each of the proposed investment corridors. At the end of the Long List alternatives evaluation, the build alternative (or alternatives) for each corridor that best met the project needs and goals (from Section 4) were advanced to the Short List of alternatives.

This section defines and examines the following:

- No-Build Alternative
- Transportation System Management (TSM) Alternative
- Build Alternatives

The detailed examination of the build alternatives identifies advantages and disadvantages of each alternative. Then, at the conclusion of this section, each short-listed alternative is correlated with the study needs.

5.1 NO-BUILD ALTERNATIVE

The No-Build Alternative assumes no investments will be made to the existing transportation system and infrastructure over the next 20 years other than those programmed into the region's fiscally constrained LRP that is developed and regularly updated by SPC. The No-Build Alternative is identical to the one used in the recently completed Airport Multimodal MIS in an effort to coordinate the projects from a regional perspective. Key LRP projects within the study area and included in the No-Build Alternative are as follows:

- **North Shore Connector** – An extension of the existing “T” light rail line in downtown Pittsburgh from Gateway Center, under the Allegheny River to the North Shore area where it then utilizes a mixture of at-grade and elevated structure with stations near PNC Park and at Allegheny Avenue. The project also includes a line from Steel Plaza to a station serving the Convention Center.
- **Mon Fayette Expressway** – The Pennsylvania Turnpike Commission, as part of its expansion, is developing the Mon/Fayette Expressway, which will stretch about 65 miles south from Pittsburgh through the Monongahela River Valley and western Fayette County to Interstate 68 in West Virginia, just east of Morgantown. The phase from Route 51 to Interstate 376 would extend the Mon/Fayette system north from Jefferson Hills in southeastern Allegheny County to two interchanges with the Parkway East – one at Monroeville and one in the City of Pittsburgh. Two of the primary goals of the project are to improve access to redevelopment sites in the economically depressed Monongahela River towns where the steel industry once flourished, and to provide faster and safer travel options for through-traffic, particularly commercial vehicles, that currently use existing north-south arteries.

- **U.S. 22 Reconstruction and Widening** – The reconstruction and widening of two sections of US22 between Murrysville and Export, and between Export and Delmont.
- **S.R. 28 Reconstruction** – The reconstruction of SR28 between Troy Hill Road and the 31st Street Bridge as the first phase with an additional reconstruction project planned from the 31st Street Bridge to Millvale.
- **S.R. 286 Widening** – Widening of Route 286 to four lanes between Route 22 and Route 380.

The Pennsylvania High-Speed Maglev project was not included in the No-Build Alternative since it was not a component of the Airport Multimodal MIS No-Build Alternative and also because its final outcome remains unclear with regard to other competing cities and funding. However, this issue will be revisited during the next steps for any alternatives that move forward in the project development process to qualitatively assess the effects of Maglev. The No-Build Alternative will serve as the basis of comparison for the TSM and Build Alternatives that will subsequently move forward to the Short List of Alternatives and evaluation.

5.2 TRANSPORTATION SYSTEM MANAGEMENT (TSM) ALTERNATIVE

The TSM Alternative was not defined or evaluated as part of the long list as it will automatically move forward to the Short List of Alternatives. The TSM is typically defined as one or more low-cost investments that utilize and maximize the existing system and financial resources. The TSM alternative is fully defined in Section 6.4.1.

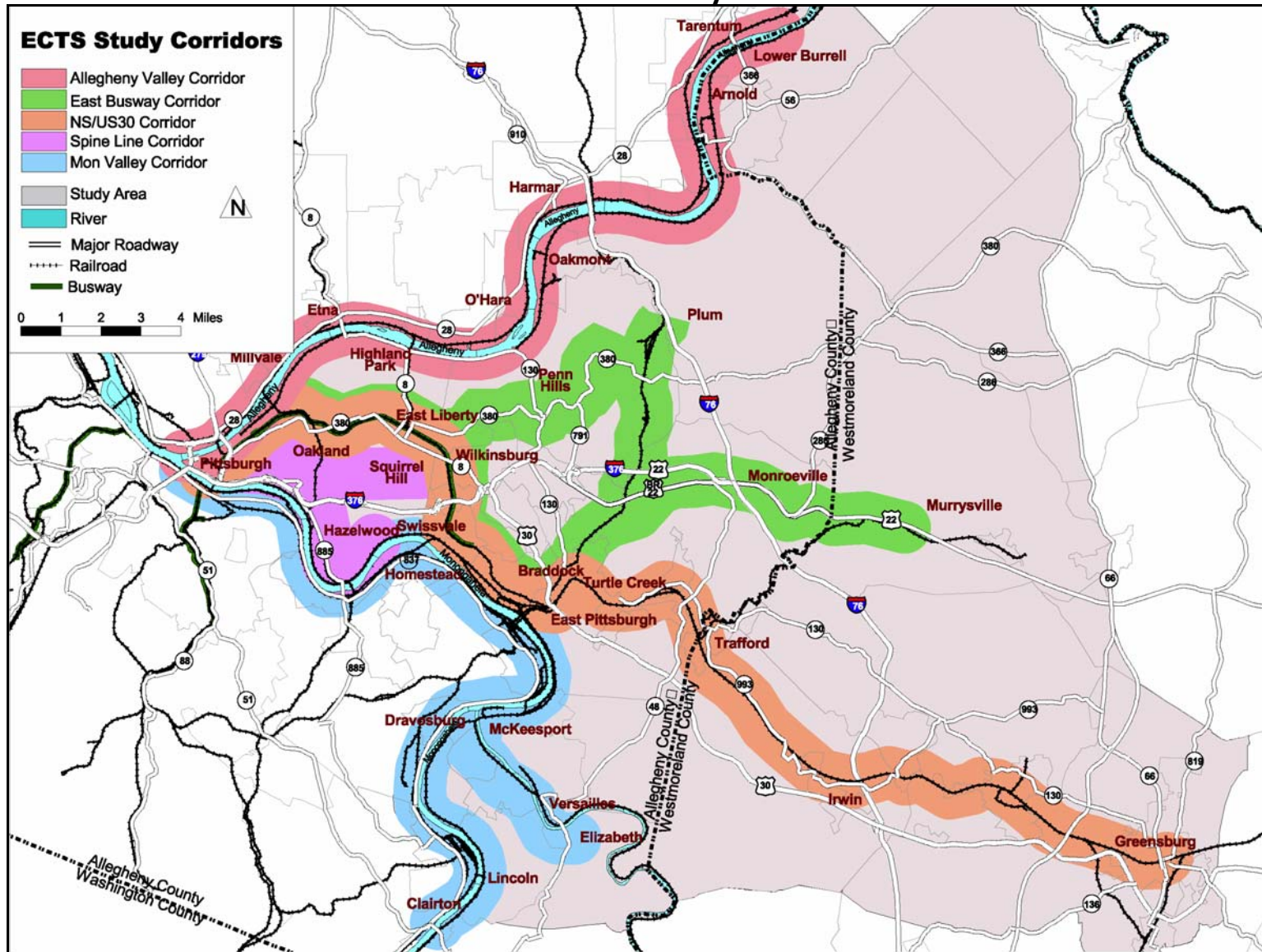
5.3 BUILD ALTERNATIVES

Build alternatives for this study are generally defined as major transportation investments, including bus and rail fixed guideway systems and facilities. Within the ECTS study area, twenty-nine build alternatives were identified for further consideration in the five study corridors shown in **Exhibit 5-1**. Of those alternatives, eight were in the Allegheny Valley Corridor, nine within the East Busway Corridor, seven in the Monongahela Valley Corridor, four in the Spine Line Corridor, and one in the Norfolk Southern Corridor. Each of the 29 alternatives was identified for further evaluation based on its ability to satisfy the following criteria:

- Improvement of transit choices and quality of service in the study area
- Enhance the environment and preserve existing transportation resources
- Reduce congestion
- Enhance economic development
- Conveniently and continuously link people and activity centers

The following sections present the build alternatives by corridor and describe the communities they would serve, potential service characteristics, mode, and primary right-of-way needs.

Exhibit 5-1: ECTS Study Corridors



5.3.1 ALLEGHENY VALLEY CORRIDOR

This corridor extends from downtown Pittsburgh to Tarentum and Lower Burrell and is approximately 23 miles long. It consists of the area immediately to the north and south of the Allegheny River, its most prominent natural feature. The Allegheny Valley is comprised mostly of towns that developed around industry and along railroad lines, for example: Aspinwall, Blawnox, Springdale, and Tarentum on the north side and Verona, Oakmont, Arnold, and Lower Burrell on the south side. Existing transportation infrastructure in the corridor includes the Allegheny River, the NS Railroad Conemaugh Line on the north side, the Allegheny Valley Railroad (AVR) on the south side, State Route 28 running parallel to the north side of the river for most of the corridor and Allegheny River Boulevard/Butler Street along the south shore.

The eight Allegheny Valley Corridor Alternatives, numbered AV1 through AV8, are listed in **Exhibit 5-2**. They include three commuter rail, three light rail, and two busway alternatives.

Exhibit 5-2: Allegheny Valley Corridor Long List Alternatives

Alt.	Mode	From	To	Primary Right-of-Way	Length (Miles)
AV1	Commuter Rail	Downtown Pittsburgh	Lower Burrell	AVR	22
AV2	Commuter Rail	Downtown Pittsburgh	Tarentum	AVR and NS Conemaugh	21
AV3	Commuter Rail	North Shore	Tarentum	NS Conemaugh	21
AV4	Light Rail	Convention Center	Lower Burrell	AVR	21
AV5	Light Rail	Convention Center	Tarentum	NS Conemaugh	22
AV6	Light Rail	Convention Center	Tarentum	AVR and NS Conemaugh	21
AV7	Busway	East Busway at East Liberty	Tarentum	NS Conemaugh	17
AV8	Busway	East Busway at East Liberty	Lower Burrell	AVR	20

5.3.1.1 Alternative Descriptions

- AV1: Commuter Rail from downtown Pittsburgh to Lower Burrell** - This alternative, shown in **Exhibit 5-3**, begins in downtown Pittsburgh and follows the AVR right-of-way along the southern shore of the Allegheny River. The proposed alignment travels through the Strip District, Lawrenceville, Morningside, and Highland Park within the City of Pittsburgh, then through Penn Hills, Verona, Oakmont, and Plum in Allegheny County, followed by New Kensington, Arnold and Lower Burrell in Westmoreland County. As a commuter rail operation, service would be primarily in the direction of peak travel: into the City of Pittsburgh in the morning and out of the city in the evening. Service headways would likely be 30 to 60 minutes in the peak and 1 to 2 hours in the off-peak.
- AV2: Commuter Rail from downtown Pittsburgh to Tarentum** - As shown in **Exhibit 5-4**, alternative AV2 begins in downtown Pittsburgh and travels through the Strip District, Lawrenceville, Morningside, and Highland Park on the AVR right-of-way and then connects to the Brilliant Branch near Highland Park, where it crosses the Allegheny River and turns onto the NS Conemaugh right-of-way. Between Aspinwall and Tarentum the alignment travels through Blawnox, Harmar,

Cheswick, Springdale, and East Deer, paralleling PA Route 28. Service levels for this alternative would be similar to AV1.

- AV3: Commuter Rail from North Shore to Tarentum** – This alternative mirrors AV1, but is located entirely on the north side of the Allegheny River (see **Exhibit 5-3**). It begins in the North Shore area and follows the NS Conemaugh right-of-way along the Allegheny River, traveling through Millvale, Etna, Sharpsburg, Aspinwall, O’Hara, Blawnox, Harmar, Cheswick, Springdale, East Deer, and Tarentum. The alignment parallels S.R. 28. Service would be similar to AV1 and AV2.
- AV4: Light Rail from Convention Center to Lower Burrell** – As illustrated in **Exhibit 5-3**, this alternative follows an alignment similar to AV1. It begins in downtown Pittsburgh and follows the AVR right-of-way along the southern shore of the Allegheny River. It travels through the Strip District, Lawrenceville, Morningside, and Highland Park within the City of Pittsburgh and Penn Hills, Verona, Oakmont, Plum, New Kensington, Arnold, and Lower Burrell. Light rail service would be frequent and operate for most of the day, providing opportunities for commuting to the CBD as well as mid-day trips and reverse commuting.
- AV5: Light Rail from Convention Center to Tarentum** - AV5 begins in downtown Pittsburgh at the Convention Center and uses new right-of-way through the Strip District to the existing AVR right-of-way. It follows the AVR to the CSX Railroad bridge at 33rd Street, where it crosses to the northern side of the Allegheny River and follows the NS Conemaugh right-of-way to Tarentum (see **Exhibit 5-4**). The alignment passes through Millvale, Etna, Aspinwall, Sharpsburg, Blawnox, Harmar, Cheswick, Springdale, East Deer, and Tarentum on the northern shore of the Allegheny River. Service levels would be similar to AV4.

Exhibit 5-3: Allegheny Valley Corridor Alternatives AV1/AV3/AV4

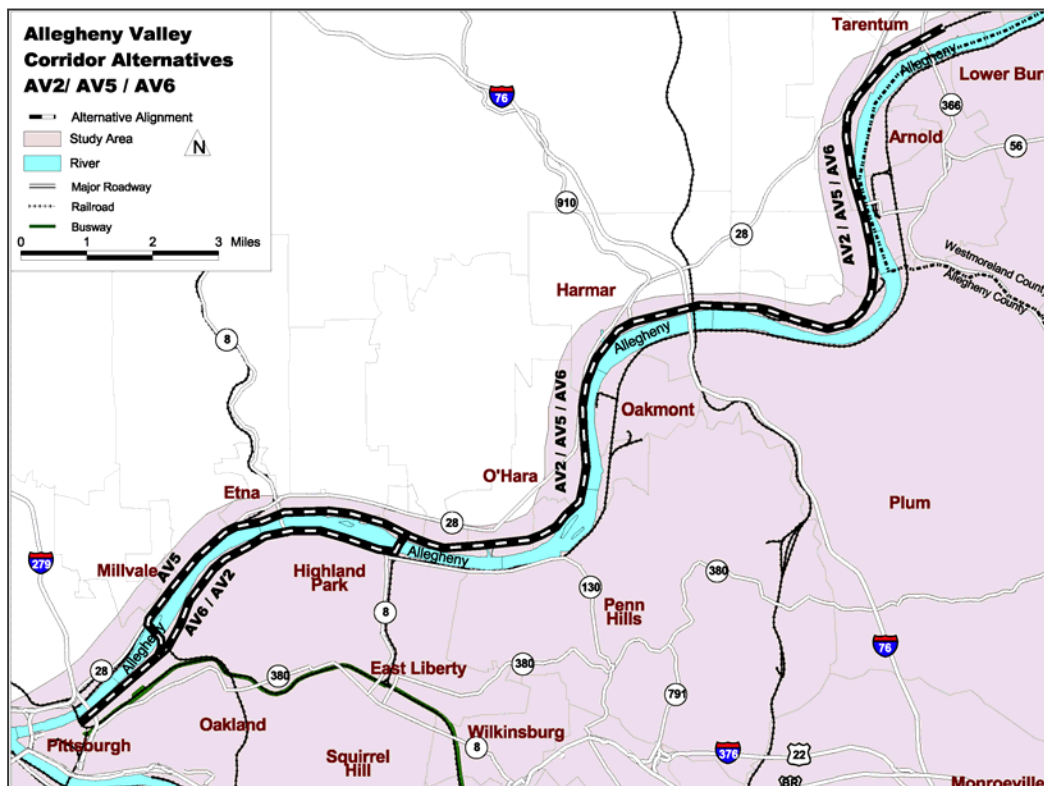
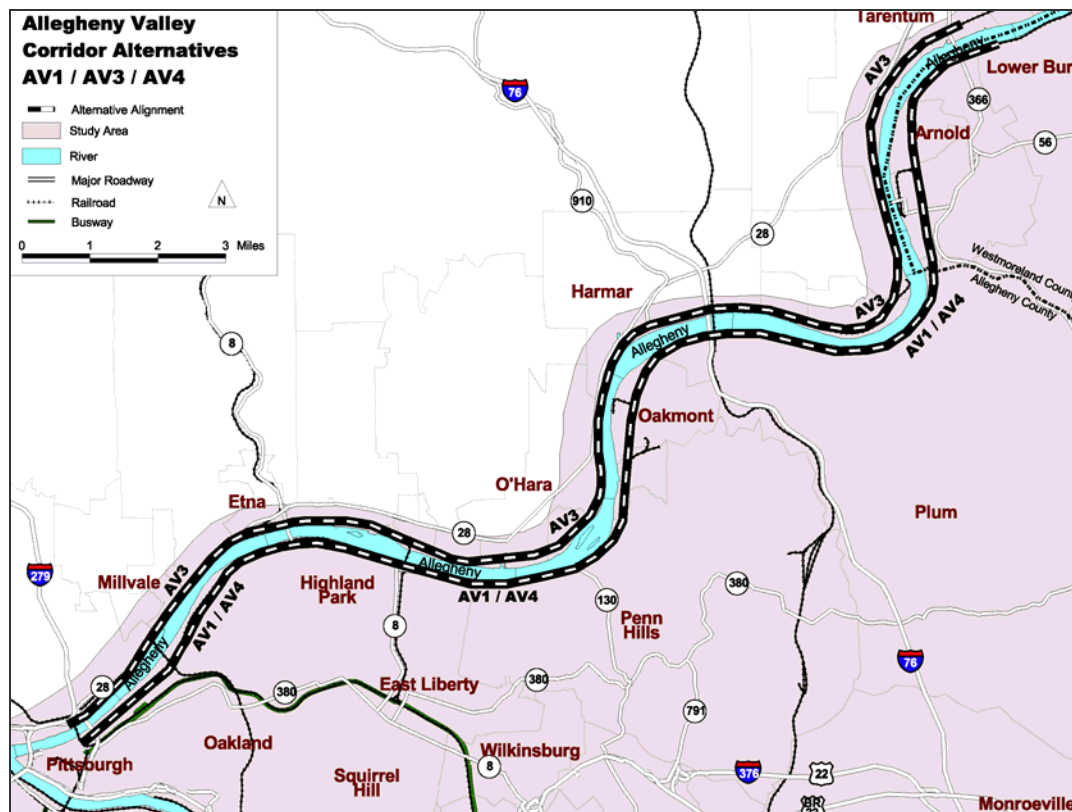
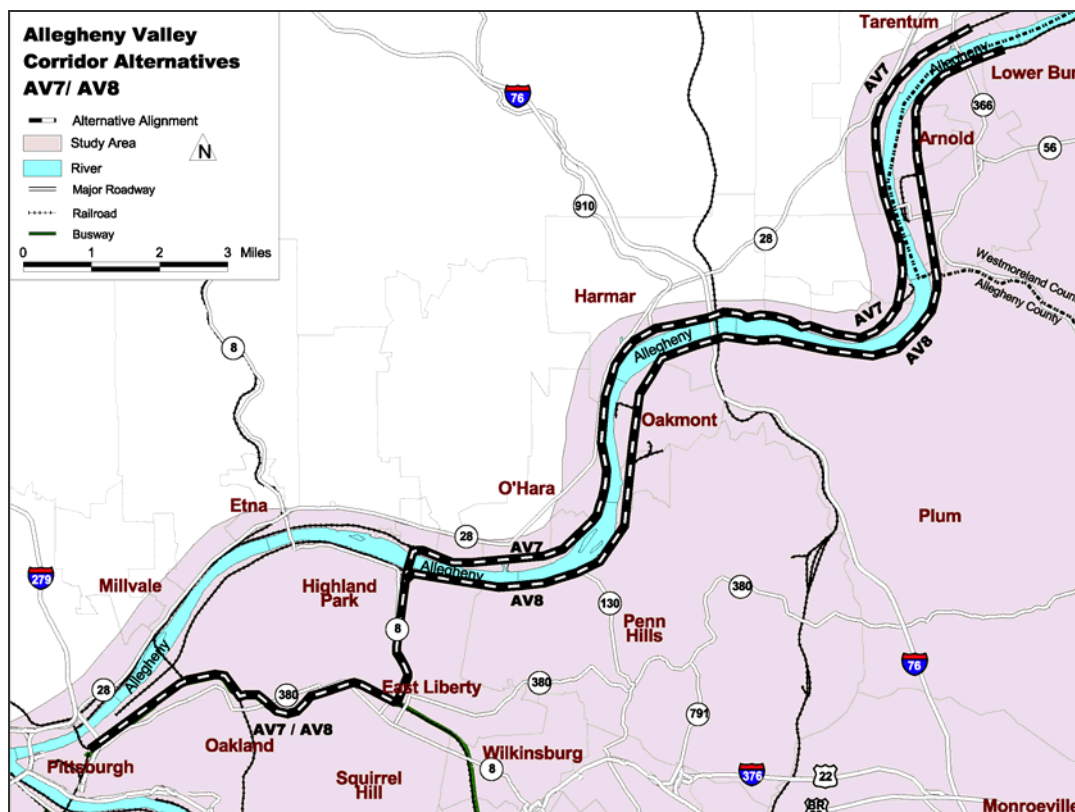


Exhibit 5-4: Allegheny Valley Corridor Alternatives AV2/AV5/AV6



- AV6: Light Rail from Convention Center to Tarentum** - As shown in **Exhibit 5-4**, this alternative begins in downtown Pittsburgh at the Convention Center and travels along new right-of-way and the existing AVR right-of-way through the Strip District, Lawrenceville, Morningside and Highland Park where it crosses the Allegheny River on the Brilliant Branch Bridge to Aspinwall where it turns onto the NS Conemaugh right-of-way. Between Aspinwall and Tarentum the alignment travels through Blawnox, Harmar, Cheswick, Springdale, and East Deer, approximately paralleling SR 28. Service levels would be identical to AV5.
- AV7: Busway from East Liberty to Tarentum** - Alternative A7, shown in **Exhibit 5-5**, would be a new branch of the East Busway to Tarentum. The branch starts near the East Liberty Station of the existing busway and follows the Brilliant Branch right-of-way to the northern shore of the Allegheny River in Aspinwall. From Aspinwall it follows the NS Conemaugh right-of-way to Tarentum, providing an exclusive busway from downtown Pittsburgh to Tarentum. It would extend the East Busway's area of service to Aspinwall, O'Hara, Blawnox, Harmar, Cheswick, Springdale, East Deer, and Tarentum with service levels similar to those on the existing East Busway.
- AV8: Busway from East Liberty to Lower Burrell** - The final Allegheny Valley Corridor Alternative, AV8, is shown in **Exhibit 5-5**. It is a new branch of the East Busway similar to that in alternative AV7 that travels on the south shore of the Allegheny River. The new section of busway begins near East Liberty and travels along the Brilliant Branch to the AVR mainline where it continues to Lower Burrell. AV8 extends the East Busway's area of service to Verona, Oakmont, Plum, New Kensington, Arnold, and Lower Burrell with service that would be similar to the existing East Busway service.

Exhibit 5-5: Allegheny Valley Corridor Alternatives AV7/AV8



5.3.1.2 Qualitative Evaluation of Allegheny Valley Corridor Alternatives

The evaluation of the Allegheny Valley Corridor Alternatives began by focusing on the use of specific railroad rights-of-way. Those alternatives that primarily utilized the AVR right-of-way were labeled as Allegheny Valley South while those that utilized the NS Conemaugh Line on the north side of the Allegheny River were labeled as Allegheny Valley North. Several advantages and disadvantages were associated with the each alternative as follows:

Allegheny Valley South Alternatives – AV1, AV4, and AV8

- **Advantages:** As the host railroad, the AVR welcomes the implementation of commuter rail passenger service for AV1 and possibly light rail for AV4 within its railroad right-of-way. This is a very important issue with regard to implementing transit service and key to use of an existing railroad right-of-way. The implementation of a commuter rail alternative also received considerable positive public interest expressed by the general public, local officials, and the railroad owner, as these alternatives all provide opportunities to improve transit choices, reduce congestion, and preserve/protect resources.
- **Disadvantages:** AV1, AV4, and AV8 provide service along the south side of the Allegheny River which is the less populated area compared to the north side of the Allegheny River. The existing AVR railroad alignment and facilities would require significant upgrades to bring the railroad to a state of good repair for implementation of a quality commuter rail or light rail transportation system. AV8, as a busway facility, was seen as less likely to be accommodated by the railroad

since it is a non-rail option and would require a significant change to the physical characteristics of the right-of-way.

Allegheny Valley North Alternatives – AV2, AV3, AV5, AV6, and AV7

- **Advantages:** These alternatives make use of the existing NS Conemaugh Line, a quality railroad facility that is in a state of good repair as evidenced by the moderate number of daily freight trains. Commuter passenger operations could operate on the alignment but only with Norfolk Southern dispatching permission. These alternatives reasonably satisfy several of the evaluation criteria and study needs.
- **Disadvantages:** Norfolk Southern's use of the Conemaugh Line for freight operations could have a significant impact on the implementation of commuter rail service. Extensive negotiations would be required with Norfolk Southern before commuter train service would be implemented. Major track and signal improvements would be required to accommodate both passenger and freight operations.

Disposition: The Allegheny Valley Corridor rail alternatives that primarily use the AVR right-of-way (AV1 and AV4) were selected to move forward in the study process due to their compatibility with the existing freight alignment and operations, and the host railroad's interest in accommodating such a service. AV1, as a commuter rail alternative, could operate with freight operations while AV4 would require a temporal separation from freight activities. Of the eight alternatives discussed above for the Allegheny Valley Corridor, AV1 and AV4 provide the best opportunities to evaluate the impact of major transit service improvements in the corridor.

5.3.2 EAST BUSWAY CORRIDOR

As illustrated in **Exhibit 5-1**, the East Busway Corridor extends from downtown Pittsburgh to several locations in the eastern and southeastern suburbs including Plum, Monroeville, Trafford, McKeesport, and Versailles. The corridor contains the heavily urbanized communities located along the existing East Busway including East Liberty, Homewood, Wilksburg, Edgewood, and Swissvale as well as the suburban areas of Plum, Monroeville, Trafford, and Versailles. Existing infrastructure in the corridor includes the East Busway, NS Pittsburgh Main Line, and the Union Railroad. Both railroads are active and provide freight rail service. Major roadways in the corridor include I-376 (Parkway East), US Routes 22 and 30, and State Routes 48, 130, 148. The nine East Busway Corridor alternatives, numbered EB1 through EB9, are shown in **Exhibit 5-6** and include four light rail and five busway alternatives.

5.3.2.1 Description of Alternatives

- **EB1: Light Rail from downtown Pittsburgh to Oakland and Plum** - EB1 is a conversion of the existing East Busway to light rail, with service to Oakland and Plum. **Exhibit 5-7** shows the general alignment from Downtown through the Strip District and onto the East Busway near 26th Street. From this point, the East Busway would be converted to light rail to Wilksburg and Swissvale where the line would extend along NS right-of-way to East Pittsburgh. From East Pittsburgh it would utilize Union Railroad (URR) right-of-way for its approach to Plum. This alternative would also extend into Oakland by converting the Neville Ramp to light rail for access to the CSX right-of-way and the approach to the CMU area south of the Schenley Tunnel. EB1 would

provide frequent, all-day light rail service to downtown Pittsburgh, the Strip District, Polish Hill, Oakland, Shadyside, East Liberty, Wilkinsburg, Edgewood, Swissvale, Rankin, North Braddock, Braddock, Turtle Creek, Monroeville, Penn Hills and Plum. Service levels would be similar to existing busway operation.

Exhibit 5-6: East Busway Corridor Long List Alternatives

Alt.	Mode	From	To	Primary Right-of-Way	Length (Miles)
EB1	Light Rail	Downtown Pittsburgh	Oakland and Plum	Norfolk Southern and Union RR	22
EB2	Light Rail	Downtown Pittsburgh	Trafford	Norfolk Southern	17
EB3	Light Rail	Downtown Pittsburgh	McKeesport and Versailles	Norfolk Southern and CSX	20
EB4	Busway	East Busway at Swissvale	Plum	Norfolk Southern and Union RR	22
EB5	Busway	East Busway at Swissvale	Trafford	Norfolk Southern	9
EB6	Busway	East Busway at Swissvale	McKeesport and Versailles	Norfolk Southern and CSX	12
EB7	Busway	East Busway at East Liberty	Plum	PA 380/ Frankstown Road	11
EB8	Light Rail	Convention Center	Murrysville	I-376/US22/US30	21
EB9	Busway	East Busway at Swissvale	Murrysville	I-376/US22	13

- EB2: Light Rail from downtown Pittsburgh to Trafford** - As shown in **Exhibit 5-7**, EB2 is similar to EB1 with the conversion to light rail from the Downtown to East Pittsburgh. However, at East Pittsburgh the alignment of EB2 would follow the NS mainline to Trafford, where it would terminate. Light rail service would be extended to downtown Pittsburgh, the Strip District, Polish Hill, Oakland, Shadyside, East Liberty, Wilkinsburg, Edgewood, Swissvale, Rankin, North Braddock, Braddock, Turtle Creek, Wilmerding, Pitcairn, and Trafford. Service levels would be similar to EB1.
- EB3: Light Rail from downtown Pittsburgh to McKeesport and Versailles** - EB3 (see **Exhibit 5-7**) is similar to EB2 from Downtown to East Pittsburgh, however, at this point, the alignment would turn south onto CSX right-of-way for its approach to McKeesport and Versailles. Light rail service would be provided frequently and all day to downtown Pittsburgh, the Strip District, Polish Hill, Oakland, Shadyside, East Liberty, Wilkinsburg, Edgewood, Swissvale, Rankin, North Braddock, Braddock, East Pittsburgh, North Versailles, McKeesport, and Versailles.
- EB4: Busway from Swissvale to Plum** - EB4, as illustrated in **Exhibit 5-8**, is an extension of the existing East Busway from Swissvale along NS right-of-way to East Pittsburgh and from East Pittsburgh along Union RR right-of-way to Plum. Service would continue to Oakland from the East Busway via the Neville Ramp and City Streets. Existing East Busway trunkline bus routes would be extended to Rankin, North Braddock, Braddock, East Pittsburgh, Turtle Creek, Monroeville, Penn Hills, and Plum. Service levels would be similar to existing busway operation.
- EB5: Busway from Swissvale to Trafford** - EB5, as illustrated in **Exhibit 5-8**, is similar to EB4 up until East Pittsburgh, from there it would travel to Trafford along NS mainline right-of-way. Service would be extended to Turtle Creek, Wilmerding, Pitcairn, and Trafford. Service levels would be similar to existing busway operation.

Exhibit 5-7: East Busway Corridor Alternatives EB1/EB2/EB3/EB8

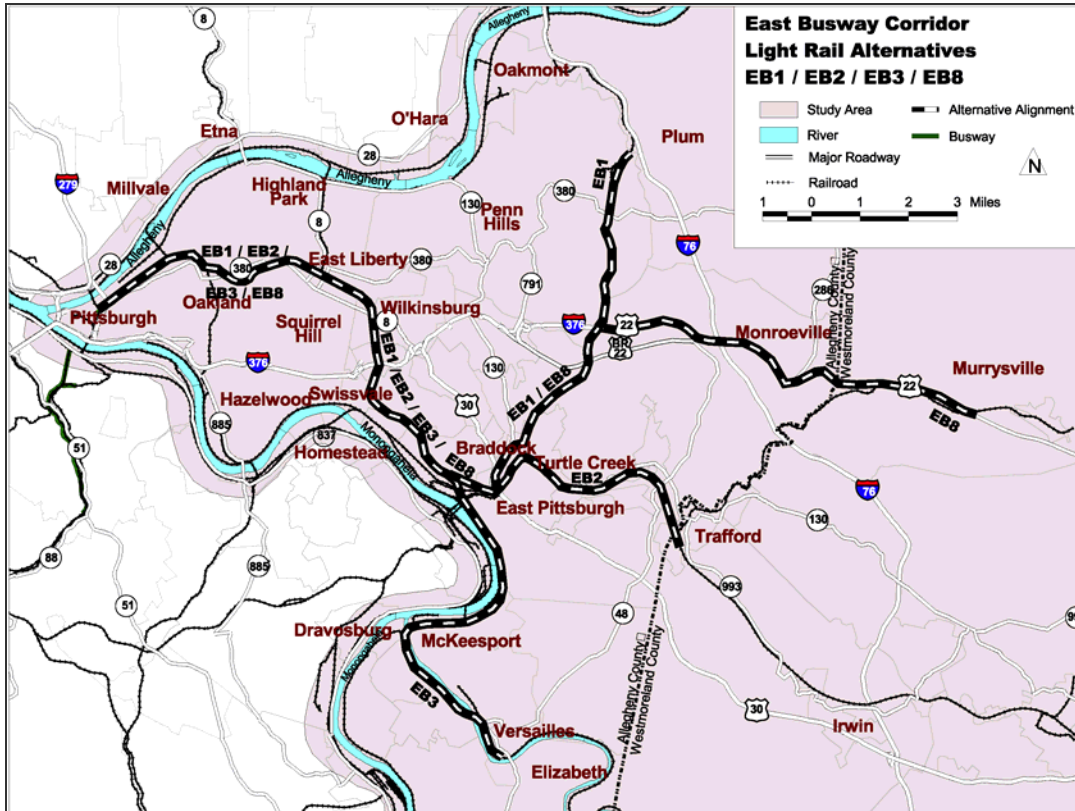
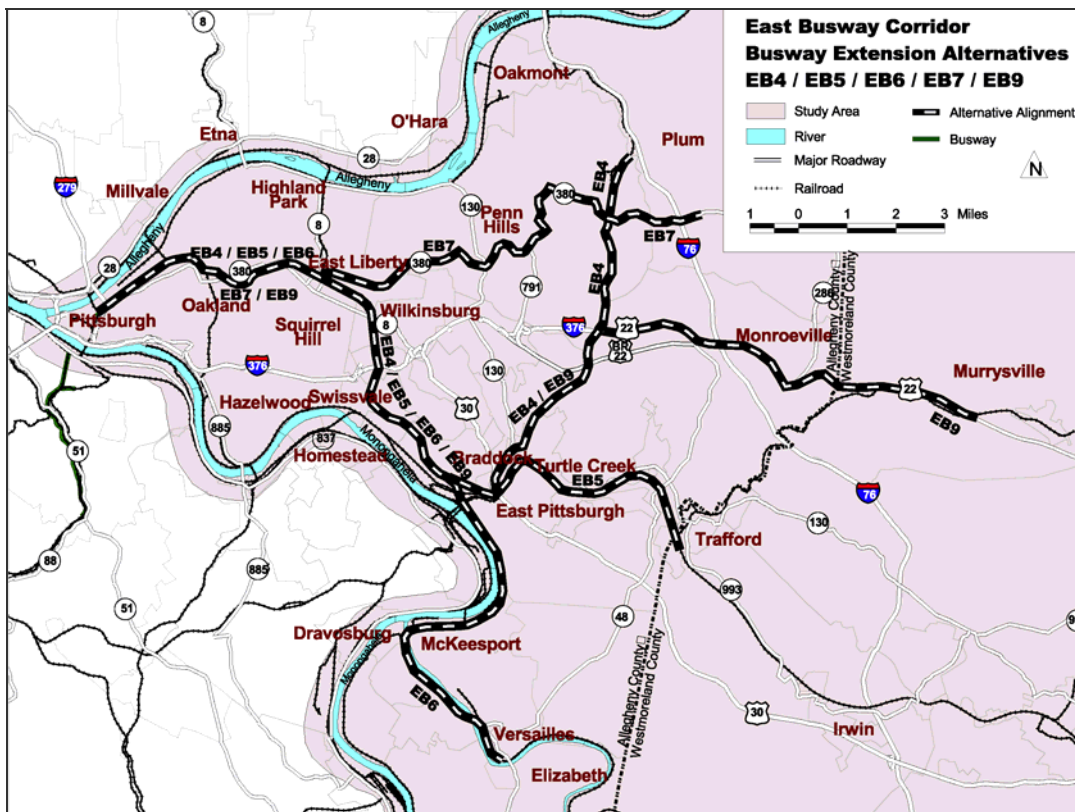


Exhibit 5-8: East Busway Corridor Alternatives EB4/EB5/EB6/EB7/EB9



- **EB6: Busway from Swissvale to McKeesport and Versailles** - EB6, as shown in **Exhibit 5-8**, is similar to EB5 with the exception that it extends the East Busway from East Pittsburgh to McKeesport and Versailles via CSX right-of-way. Busway service would be extended to North Versailles, McKeesport, and Versailles. Service levels would be similar to existing busway service.
- **EB7: Busway from East Liberty to Plum** - This alternative is an extension of the East Busway from East Liberty along Bennett Street and SR380/Frankstown Road to Plum (see **Exhibit 5-8**). Bus routes on the extension would operate with service frequencies similar to the existing busway. Busway service would be extended to the areas of Penn Hills and Plum.
- **EB8: Light Rail from Convention Center to Murrysville** - EB8 is identical to EB1, as shown in **Exhibit 5-7**, but is a conversion of the East Busway to light rail and an extension to the Plum/Monroeville area. However, EB8 would extend farther, from the Monroeville/Plum area to Murrysville along US22. Light rail service from Monroeville to Murrysville would be less frequent than for Downtown to Monroeville, given the lower population and employment densities in Murrysville.
- **EB9: Busway from Swissvale to Murrysville** - EB9 (shown in **Exhibit 5-8**) is identical to EB4 from Downtown to Monroeville with an extension of the East Busway or express bus service to Murrysville along US22 through Monroeville and Murrysville. East Busway service would be extended to Murrysville, with adjustments to frequency to account for the lower population and employment densities in the suburban areas.

5.3.2.2 Qualitative Evaluation of East Busway Alternatives

The first step in the evaluation of the East Busway Corridor Alternatives was to pair the alternatives by their primary rights-of-way and origin and termination points when possible as follows:

- **EB1 and EB4** – East Busway facility from Downtown to Monroeville and Plum as a conversion to light rail and as a busway extension.
- **EB2 and EB5** – East Busway facility from Downtown to Trafford as a conversion to light rail and as a busway extension.
- **EB3 and EB6** – East Busway facility from Downtown to McKeesport/Versailles as a conversion to light rail and as a busway extension.
- **EB7** – Extension of the existing East Busway from East Liberty to Plum.
- **EB8 and EB9** – East Busway facility from Downtown to Murrysville as a conversion to light rail and as a busway facility.

Advantages and disadvantages were associated with the each alternative as follows:

Alternatives EB1 and EB4

- **Advantages:** Provides good comparison of light rail versus busway service on the existing East Busway, a consideration that has been requested by some individuals in the East. The alternatives provide access to key activity centers such as Downtown, Oakland, and Monroeville.
- **Disadvantages:** Access to Oakland, the third largest activity center in Pennsylvania, may be difficult with a fixed guideway facility due to the intensity of surrounding development. A

difficult approach would be required for the Monroeville Mall area, near Plum, due to large elevation differences in relation to the Union Railroad right-of-way. Use of the NS and Union Railroad rights-of-way for passenger service would depend on future negotiations and operating agreements with both railroads.

Disposition: **EB1** and **EB4** were recognized as good opportunities for transit and were retained as part of the Short List for further consideration and analysis. The SRSC requested that both alternatives be evaluated to Monroeville Mall in place of Plum to provide focus on this key activity center.

EB2/EB5 and EB3/EB6

- **Advantages:** Provides a comparison of light rail versus busway service on the existing East Busway. The alternatives do provide a new transit choice for travelers between these areas and downtown Pittsburgh.
- **Disadvantages:** Trafford and Versailles are not key activity centers nor major residential areas in the study area and as such, do not exhibit the same potential as the other alternatives that connect to key activity centers. As a result, these alternatives were perceived as having less potential to attract ridership.

Disposition: EB2/EB5 and EB3/EB6 were recognized as fair opportunities for transit but were not retained as part of the Short List for further consideration and analysis.

EB7

- **Advantages:** No specific advantages were identified by the technical and steering committees or the public during the study. Although this alternative provides a transit option within the study area, it is not as attractive as the others considered for this corridor.
- **Disadvantages:** The primary disadvantage to this alternative was its need for new right-of-way along Bennett Street and Frankstown Road for the extension of the East Busway guideway. Major impacts to existing communities, businesses, and residential areas would be required to attain the necessary right-of-way for a busway extension. Additionally, this alternative did not link key activity centers and was perceived as having less potential to attract ridership than others in the corridor. No significant advantages in relation to the environment, congestion, quality of life, and connections were identified for this alternative in comparison to the others in the corridor.

Disposition: EB7 was not retained as part of the Short List for further consideration and analysis.

EB8/EB9

- **Advantages:** These alternatives illustrated the potential to provide a good alternative to the automobile given that each connects key activity centers within the study area and rapidly developing suburban areas in Monroeville and Murrysville. The potential for transit oriented development exists from Monroeville to Murrysville with the implementation of a convenient and effective transit investment.
- **Disadvantages:** The primary disadvantage to these alternatives is their need for right-of-way along US 22 between Monroeville and Murrysville. Obtaining the necessary right-of way for a

busway or light rail extension could result in significant negative impacts to existing businesses and residences.

Disposition: Despite their moderate advantages, EB8 and EB9 were retained for further consideration and analysis as part of the Short List based on their ability to connect key activity centers, offer an alternative to the automobile, and influence transit oriented development in suburban and rural areas of the study corridor. Additionally, input from the public outreach process indicated a need to consider a transit investment to these outer communities of the study area. The study team and the SRSC agreed that either EB8 (light rail) or EB9 (busway) would be tested depending on the performance of EB1 (light rail) and EB4 (busway).

5.3.3 SPINE LINE CORRIDOR

This corridor extends from downtown Pittsburgh to Oakland, Squirrel Hill and Wilkinsburg, and to Greenfield, Hazelwood, and Homestead. Oakland is a major activity center with extensive high-density development. The outlying communities feature moderate density urban development patterns that are predominantly residential. Existing rail infrastructure consists of the CSX railroad. Major roadways in the corridor include Centre Avenue, Penn Avenue, Liberty Avenue, Forbes Avenue, Fifth Avenue, Boulevard of the Allies, Bigelow Boulevard, Second Ave, S.R. 885, and S.R. 837. Roadways are congested during peak periods, and the presence of several educational and medical institutions increases off-peak traffic volumes.

The four Spine Line alternatives, numbered SL1 through SL4, are shown in **Exhibit 5-9** and include four light rail alternatives.

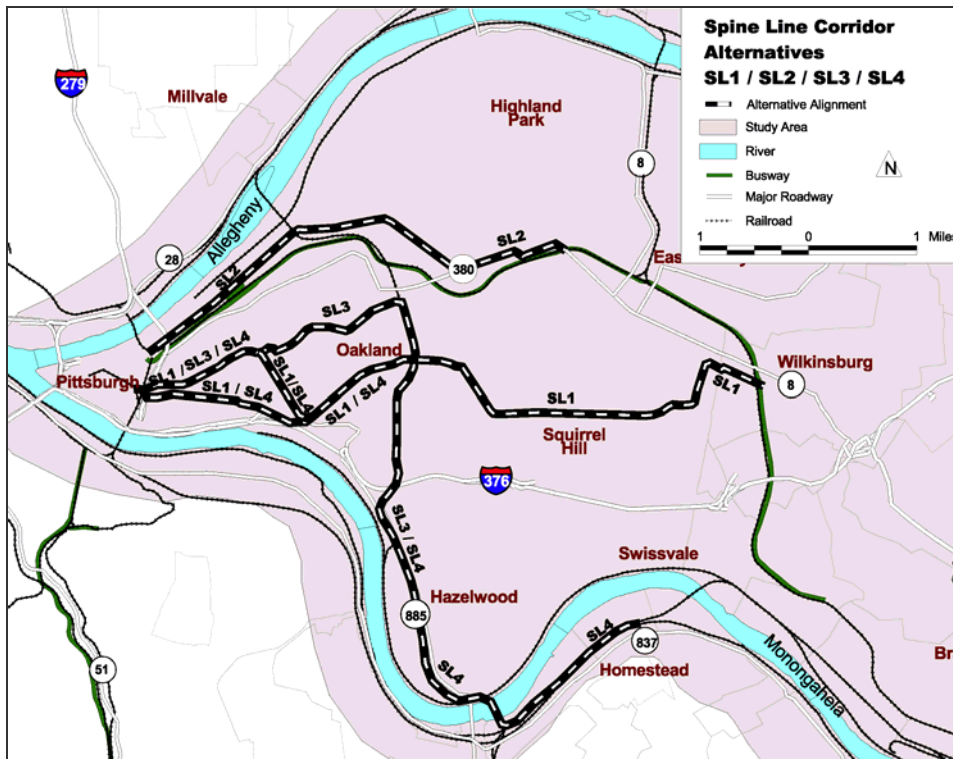
Exhibit 5-9: Spine Line Corridor Long List Alternatives

Alt.	Mode	From	To	Primary Right-of-Way	Length (Miles)
SL1	Light Rail	Steel Plaza	Wilkinsburg	Centre/Colwell, Forbes/5 th and Penn	6
SL2	Light Rail	Convention Center	East Liberty	Penn/Liberty, Baum/Centre and Penn	4
SL3	Light Rail	Steel Plaza	Hazelwood	Centre and CSX Panther Hollow	6
SL4	Light Rail	Steel Plaza	Homestead (Waterfront)	Centre/Colwell and CSX Panther Hollow	9

5.3.3.1 Description of Alternatives

- SL1: Light Rail from Steel Plaza to Wilkinsburg** - SL1 (shown in **Exhibit 5-10**) begins at the Steel Plaza Station of the existing "T", and travels underground, east under either Centre Avenue or Colwell Avenue to Forbes or Fifth Avenue through Oakland. (To connect to Forbes or Fifth Avenue from Centre Avenue it extends southeast from approximately Centre and Kirkpatrick Street to a point near Craft Avenue on Forbes or Fifth Avenue). From this point, the alignment continues under Forbes Avenue to Wilkinsburg Station on the East Busway. The alignment traverses downtown Pittsburgh, Oakland, Squirrel Hill, Frick Park, and Wilkinsburg.
- SL2: Light Rail from the Convention Center to East Liberty** - SL2 (shown in **Exhibit 5-10**) begins at the Convention Center and travels on either Liberty or Penn Avenue through the Strip District to Baum Boulevard near Bloomfield with the remainder of the route on Penn Avenue to the East Liberty station on the East Busway. This alignment is very close to the East Busway for much of its route, but would be in city streets rather than an exclusive, grade-separated guideway.
- SL3: Light Rail from Steel Plaza to Hazelwood** - SL3 (shown in **Exhibit 5-10**) begins at the Steel Plaza Station of the "T" and travels underground eastward below Centre Avenue through the Hill District to just beyond Craig Street, where it turns south at-grade into the CSX right-of-way and continues south through Oakland and Panther Hollow to Greenfield and Hazelwood.
- SL4: Light Rail from Steel Plaza to Homestead** – SL4 (shown in **Exhibit 5-10**) is an extension of SL3, as it follows the same alignment as SL3 from Steel Plaza to Hazelwood, but then continues south on the CSX right-of-way through Hazelwood and over the CSX bridge to the south shore of the Monongahela River. From this point it continues on CSX right-of-way at-grade to the Waterfront and Homestead areas.

Exhibit 5-10: Spine Line Corridor Alternatives SL1/SL2/SL3/SL4



5.3.3.2 Qualitative Evaluation of Spine Line Alternatives

The evaluation of the four Spine Line Corridor Alternatives examined each separately with respect to alignments, and origin and termination points. Advantages and disadvantages associated with each alternative are as follows:

SL1

- **Advantages:** Provides a high quality transit choice and significantly improves access between the two primary activity centers in the Pittsburgh region – Oakland and downtown Pittsburgh. Transit travel times are expected to decrease given that this alternative would operate unrestricted in an underground guideway. Auto and bus congestion could be improved with the implementation of SL1. This alternative also has the ability to conveniently link people and activity centers, not only with service to Oakland and Downtown, but also with Squirrel Hill, Wilkinsburg and the East Busway Wilkinsburg station.
- **Disadvantages:** Construction of an underground light rail system from downtown Pittsburgh to Wilkinsburg would be costly.

Disposition: **SL1** was retained for the further consideration and analysis in the Short List based on its ability to connect Oakland and downtown Pittsburgh with a high quality transit service. Public outreach efforts indicated a strong public preference for the continued analysis and evaluation of this alternative.

SL2

- **Advantages:** Provides a new transit choice between downtown Pittsburgh and East Liberty with an at-grade light rail operation. This alternative could foster redevelopment of the East Liberty area with a new investment in transit.
- **Disadvantages:** Although this alternative connects the Downtown with East Liberty, it does not provide a quality connection to Oakland which is a key consideration for any alternative proposed in the Spine Line Corridor, and duplicates the East Busway. In addition, with this alternative proposed at-grade along existing roadways, its reliability and speed would be significantly decreased due to impacts caused by automobile congestion and intersections, thereby resulting in a negative effect on attracting ridership.

Disposition: **SL2** was not retained as part of the Short List for further consideration and analysis based on its inability to connect Oakland and the impacts expected from at-grade operation.

SL3

- **Advantages:** Provides a new transit choice between downtown Pittsburgh, Oakland and Hazelwood. This alternative has the ability to foster redevelopment in the Hazelwood area with a new station and the potential for transit oriented development. Minimizes costs for a grade-separated right-of-way in Oakland.
- **Disadvantages:** Although this alternative connects the Downtown with Oakland, it does not provide an ideal east-west connection since it travels north-south through Oakland along the CSX railroad right-of-way just below Neville Street. This alternative does not maximize the

ability to reduce congestion, conveniently connect activity centers, and improve transit choices due to poor accessibility in the corridor.

Disposition: SL3 was not included in the Short List for further consideration and analysis based on its inability to ideally connect Oakland and the lack of a connection to the Homestead/Waterfront area.

SL4

- **Advantages:** Provides a high quality transit choice and significantly improves access between the two primary activity centers in the Pittsburgh region, Oakland and downtown Pittsburgh with an east/west connection. Transit travel times are expected to decrease, given that this alternative would operate unrestricted in underground guideway and use CSX right-of-way into Hazelwood and Homestead. Auto and bus congestion could be improved with the implementation of SL4. This alternative also has the ability to conveniently link people and activity centers with its connection to the Homestead/Waterfront area, Oakland, and downtown Pittsburgh. Use of the CSX right-of-way for a portion of the alignment would reduce construction costs as compared to a fully underground alignment.
- **Disadvantages:** Construction of an underground light rail system from downtown Pittsburgh to Oakland would be costly. Unlike SL1, this alternative does not serve Squirrel Hill, or provide a connection to the East Busway Wilkinsburg station.

Disposition: SL4 was retained for further consideration and analysis in the Short List based on its ability to connect Oakland, downtown Pittsburgh and Homestead with a high quality transit service. As with SL1, public outreach efforts indicated a strong preference for the continued analysis and evaluation of this alternative.

5.3.4 MONONGAHELA VALLEY CORRIDOR

This corridor extends from downtown Pittsburgh to Clairton and Versailles along the Monongahela and Youghiogheny Rivers. Extensive railroad rights-of-way exist in the corridor, some of which are still active; the NS Monongahela Line extends from Station Square in Pittsburgh to beyond the study area limits on the southern shore of the Monongahela River. The CSX Railroad parallels the NS on the northern shore and has right-of-way on most portions of the southern shore and along the Youghiogheny River. The Union Railroad has some right-of-way on both sides of the Monongahela River, but none west of Rankin. Major roadways providing access to the area include S.R. 837 on the south side of the Monongahela River, S.R. 885, and several local roads.

The seven Monongahela Valley alternatives, numbered MV1 through MV7, are shown in **Exhibit 5-11** and include four commuter rail, two light rail and one busway alternative.

Exhibit 5-11: Monongahela Valley Corridor Long List Alternatives

Alt.	Mode	From	To	Primary Right-of-Way	Length (Miles)
MV1	Commuter Rail	Station Square	Clairton	NS	18
MV2	Commuter Rail	Station Square	McKeesport and Versailles	CSX	20
MV3	Commuter Rail	Penn Station	McKeesport and Versailles	NSnd CSX Panther Hollow	22
MV4	Commuter Rail	Millvale	McKeesport and Versailles	CSX Panther Hollow	21
MV5	Light Rail	Convention Center	Rankin and Etna	CSX Panther Hollow	11
MV6	Light Rail	Station Square	Clairton	NS	18
MV7	Busway	Station Square	Clairton	NS	18

5.3.4.1 Description of Alternatives

- MV1: Commuter Rail from Station Square to Clairton** - MV1, shown in **Exhibit 5-12**, begins at Station Square, on the south shore of the Monongahela River, near downtown Pittsburgh and follows the existing NS right-of-way for its entire route to Clairton, almost directly parallel to the Monongahela River. Communities served by this alternative include: South Side, Baldwin, West Homestead, Homestead, Munhall, Whitaker, West Mifflin, Dravosburg, Jefferson, and Clairton. As with commuter rail alternatives in other corridors, service levels would be 30 to 60 minutes in the peak and 90 to 120 minutes in the off-peak.
- MV2: Commuter Rail from Station Square to McKeesport and Versailles** - This alternative, shown in **Exhibit 5-13** begins at Station Square and follows the NS right-of-way through the South Side, Baldwin, West Homestead, Homestead, and Munhall before crossing the Monongahela River on the existing CSX bridge near Homestead. From this point, it follows the CSX right-of-way through Swissvale, Rankin, North Braddock, Braddock, North Versailles, and McKeesport, where it turns southeast on the southern shore of the Youghiogheny to Versailles. Service levels for this alternative would be similar to MV1.
- MV3: Commuter Rail from Penn Station to McKeesport and Versailles** - As shown in **Exhibit 5-13**, MV3 begins at Penn Station in downtown Pittsburgh and follows the NS right-of-way to Bloomfield, where it turns south onto the CSX right-of-way through Oakland, Greenfield, Hazelwood, Glen Hazel, Swissvale, Rankin, Braddock, North Braddock, and McKeesport. It continues along the southern shore of the Youghiogheny River to Port Vue, then crosses the river to its end point at Versailles. As a commuter rail alternative, it would have similar service levels to MV1 and MV2.
- MV4: Commuter Rail from Millvale to McKeesport and Versailles** - MV4, as shown in **Exhibit 5-13**, begins in Millvale, on the north shore of the Allegheny River and follows CSX right-of-way to the CSX Bridge at 33rd Street where it crosses the Allegheny River and continues south on CSX right-of-way through Oakland and Panther Hollow. From there the alignment is identical to that of alternative MV3 to Versailles. The service provided by this alternative would be similar to that of MV3.

Exhibit 5-12: Monongahela Valley Alternatives MV1/MV5/MV6/MV7

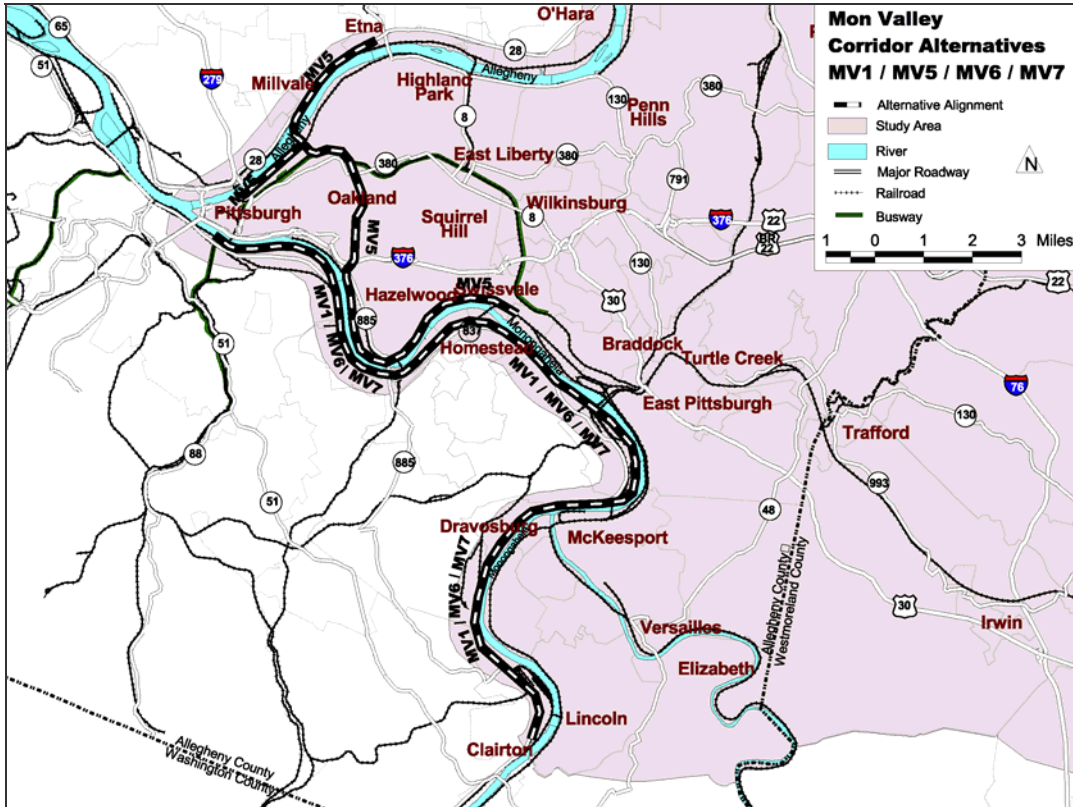
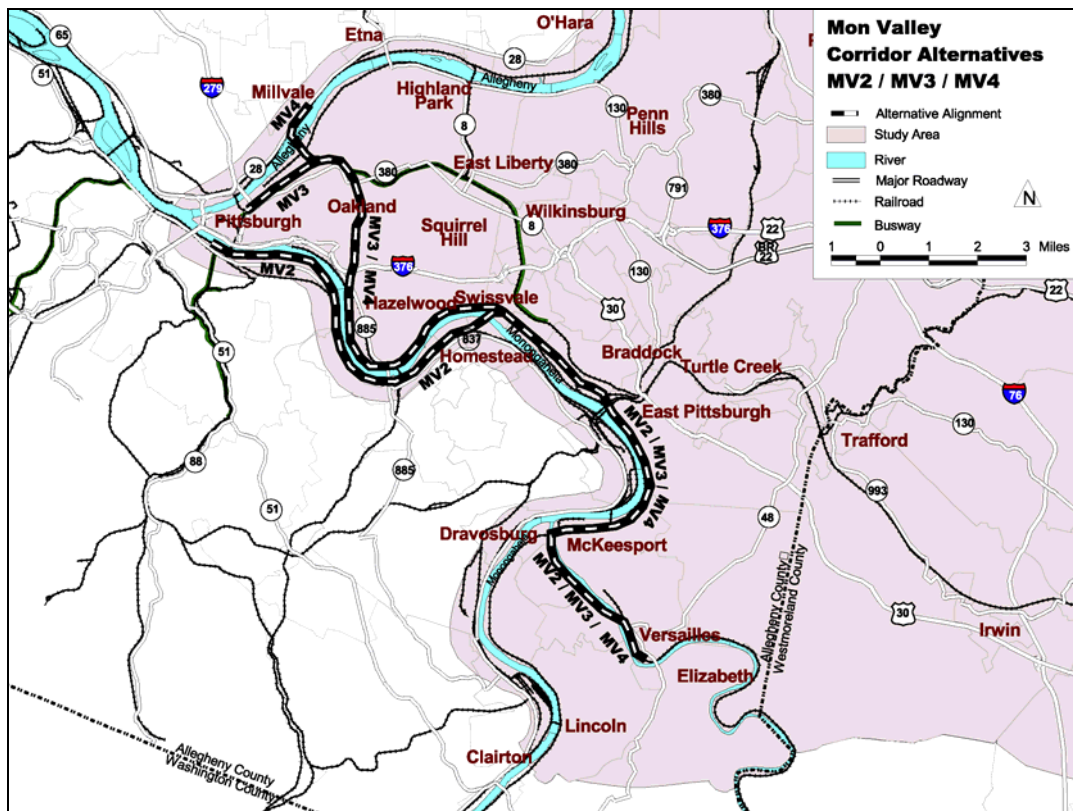


Exhibit 5-13: Monongahela Valley Alternatives MV2/MV3/MV4



- **MV5: Light Rail from the Convention Center to Rankin and Etna** - This is the shortest of all the Monongahela Valley Alternatives, measuring only about 11 miles in length between the Convention Center in downtown Pittsburgh, Rankin, and Etna. Beginning in downtown Pittsburgh, it travels east along the AVR right-of-way to the 33rd Street Bridge where it splits into two branches, one to Etna, on the north shore of the Allegheny River, and one to Rankin in the Monongahela Valley. The Branch to Etna crosses the Allegheny River on the 33rd Street CSX Bridge and travels through Millvale on CSX right-of-way to Etna. The southern branch of this alternative turns south on CSX right-of-way at 33rd Street and continues to Bloomfield, Oakland, Swissvale, and Rankin (see **Exhibit 5-12**). As a light rail alternative, service levels would be frequent and all day.
- **MV6: Light Rail from Station Square to Clairton** - MV6, shown in **Exhibit 5-12**, follows an alignment identical to that of MV1 from Station Square, along the south shore of the Monongahela River to Clairton via NS right-of-way. The difference between the two alternatives is that MV6 is a light rail alternative and proposes more frequent service than MV1. As a light rail alternative, service levels would be frequent and all day.
- **MV7: Busway from Station Square to Clairton** - This alternative, shown in **Exhibit 5-12**, has the same alignment as alternatives MV1 and MV6, but is proposed as a busway with a fully separated right-of-way for bus service to Clairton in the Monongahela Valley. Service levels would be similar to MV6.

5.3.4.2 Qualitative Evaluation of Monongahela Valley Alternatives

The first step in the evaluation of the Monongahela Valley Corridor Alternatives was to combine the alternatives on the south side of the Monongahela River that utilize the CSX and NS railroad rights-of-way. The remaining alternatives were evaluated separately:

- **MV1, MV2, MV6, and MV7** – Commuter rail, light rail, and busway from Station Square to Clairton primarily on the south side of the Monongahela River.
- **MV3 and MV4** – Commuter rail from the Amtrak Station in Pittsburgh to McKeesport/Versailles and from Millvale to McKeesport/Versailles.
- **MV5** – Light rail from Convention Center to Etna and Rankin.

Advantages and disadvantages associated with the each alternative:

MV1, MV2, MV6, and MV7

- **Advantages:** These alternatives make use of existing railroad right-of-way and provide a new transit choice in the study corridor. MV1 and MV2 as commuter rail alternatives would have the greatest advantage to coexisting with the heavy freight operations since the rolling stock would be Federal Railroad Administration (FRA) compliant (proper vehicle body strength to operate simultaneously with freight).
- **Disadvantages:** These alternatives provide only fair access to key activity centers and they do not directly connect to downtown Pittsburgh. The light rail and busway alternatives, MV6 and MV7, would be less attractive for use of the existing railroad alignments. Light rail would require the construction of additional tracks or temporal separation of operations, while the busway would need a separate guideway along side the existing freight tracks/alignment. The

NS and CSX lines in this corridor are among the busiest in the Pittsburgh region and implementing commuter rail on these rights-of-way would be extremely difficult and costly.

Disposition: **MV1/MV2/MV6/MV7** were not retained as part of the Short List for further consideration and analysis. Overall, the study team determined that the probability of utilizing the existing right-of-way was poor for the implementation of a quality transit service. Additionally, because these alternatives are on the southern extreme of the study area, it was recognized that they could more appropriately be analyzed further in subsequent planning studies focused on the southern Pittsburgh region.

MV3 and MV4

- **Advantages:** These alternatives provide fair connections to key activity centers with MV3 connecting Downtown, Oakland and McKeesport while MV4 connects Millvale, Oakland and McKeesport. Each alternative proposes the use of existing CSX railroad right-of-way with MV3 utilizing both the NS and CSX rights-of-way. Both alternatives have a fair ability to reduce congestion in downtown Pittsburgh and provide the closest access by commuter rail by serving Penn Station.
- **Disadvantages:** MV3 has a poor potential to attract ridership and improve travel times due to its infrequent commuter rail service even though it provides a direct connection to Downtown at Penn Station. Although MV4 provides a north-south connection, it has poor access to key activity centers with its terminating points in Millvale and McKeesport/Versailles and would likely have a low potential to attract reasonable levels of ridership. Additionally, this alternative does not have a direct connection to downtown Pittsburgh.

Disposition: **MV3 and MV4** were not retained as part of the Short List of Alternatives for further consideration and analysis as neither was considered a quality transit opportunity in the corridor.

MV5

- **Advantages:** MV5 provides fair access to key activity centers with connections to Downtown, Oakland and other areas such as Millvale and McKeesport. It provides an attractive alternative to the auto with the ability to attract ridership due to its more frequent service levels when compared to the commuter rail alternatives in this corridor. MV5 would also provide frequent service to Downtown from activity centers to the east, north, and south. The north-south connection and alignment was suggested through the public outreach and agency coordination efforts and incorporated into the Long List of Alternatives. MV5 builds upon the future Convention Center station where it would connect to the existing "T" and utilizes existing CSX right-of-way from Millvale to McKeesport.
- **Disadvantages:** MV5 does not provide optimum accessibility to Oakland as it would travel north to south in the CSX right-of-way through Oakland. Additionally, MV5 utilizes a portion of CSX right-of-way from the Glenwood bridge area along the north shore of the Monongahela River to McKeesport that is a heavily used freight line.

Disposition: **MV5** was retained as part of the Short List of Alternatives for further consideration and analysis as it provides the best opportunity in the Monongahela Valley Corridor for transit with a north-south connection combined with access to the Downtown and Oakland.

5.3.5 NORFOLK SOUTHERN CORRIDOR

This corridor extends from downtown Pittsburgh to the City of Greensburg, a distance of approximately 33 miles. The Norfolk Southern corridor connects the dense development in Pittsburgh and Greensburg and points in-between that range from heavily urbanized areas to suburban areas and small towns including Wilksburg, East Pittsburgh, Trafford, Irwin, and Jeannette. The rail infrastructure consists primarily of the NS Pittsburgh Main Line that provides frequent freight rail service. Roadway facilities provide extensive coverage in the corridor and include US Route 30 and State Route 130.

The only proposed alternative for this corridor is a commuter rail service as illustrated in **Exhibit 5-14**.

Exhibit 5-14: Norfolk Southern Long List Alternative

Alt.	Mode	From	To	Primary Right-of-Way	Length (Miles)
NS1	Commuter Rail	Penn Station	Greensburg	Norfolk Southern	33

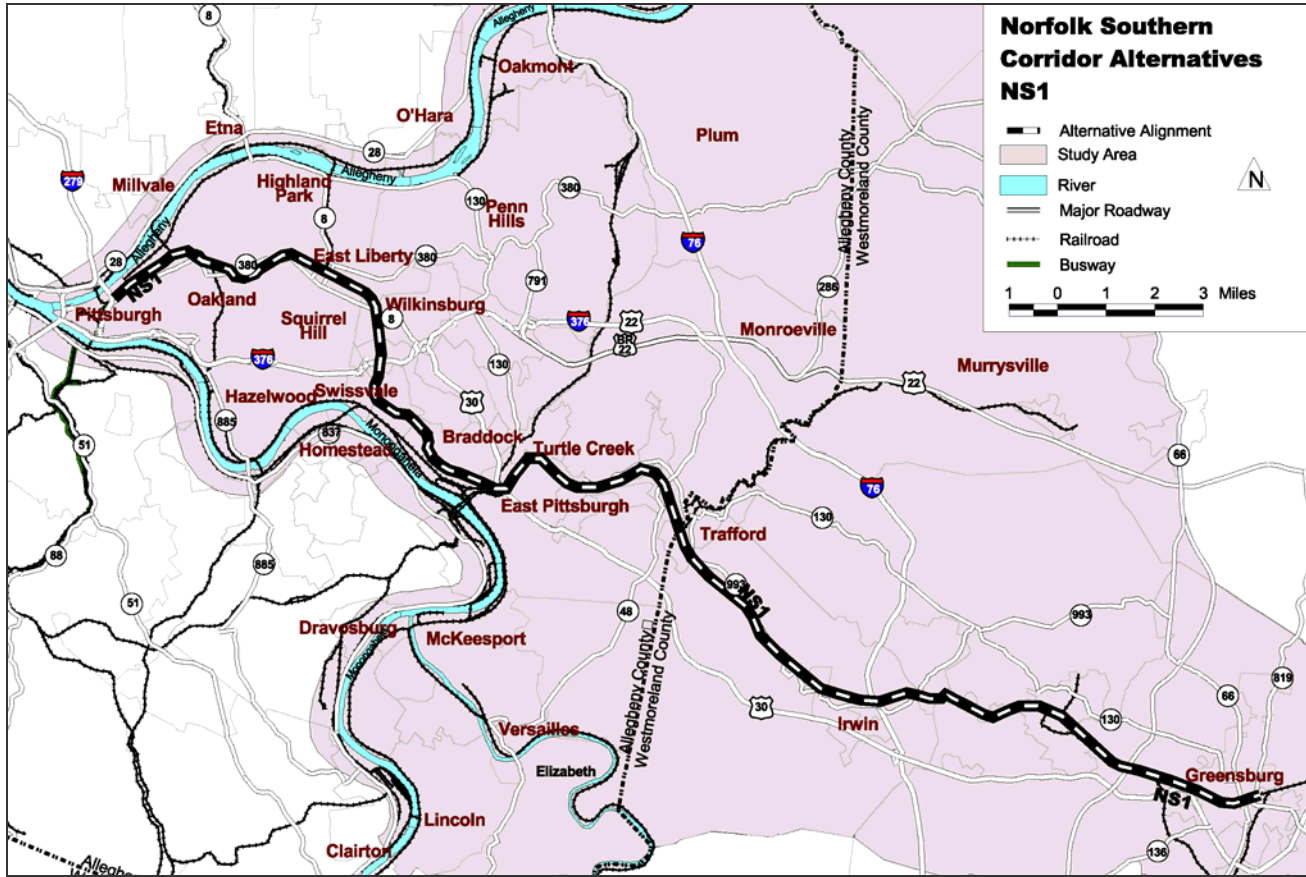
Description of Alternative

- **NS1: Commuter Rail from Pittsburgh to Greensburg** – NS1, as shown in **Exhibit 5-15**, begins at Amtrak Station in downtown Pittsburgh, and follows NS right-of-way the entire distance to Greensburg. Between downtown Pittsburgh and Swissvale it parallels the East Busway through the communities of Polish Hill, Bloomfield, Shadyside, East Liberty, Larimer, Point Breeze, Wilksburg, Edgewood, and Swissvale, then continues through Rankin, North Braddock, Braddock, Turtle Creek, Wilmerding, Pitcairn, Monroeville, Trafford, North Huntingdon, Irwin, Manor, Hempfield, Jeannette, and Greensburg. Service levels would be 30 to 60 minutes in the peak and 90 to 120 minutes in the off-peak.

5.3.5.1 Qualitative Evaluation of Norfolk Southern Corridor Alternative

This alternative was not evaluated since no other alternatives were identified in this corridor. As a result, it was retained for further analysis.

Exhibit 5-15: Norfolk Southern Corridor Alternative NS1



5.4 SHORT LIST ALTERNATIVES

Based on the long list evaluation, the Short List alternatives are presented in **Exhibit 5-16** and renamed with a two-part abbreviation designating their corridor and mode as follows:

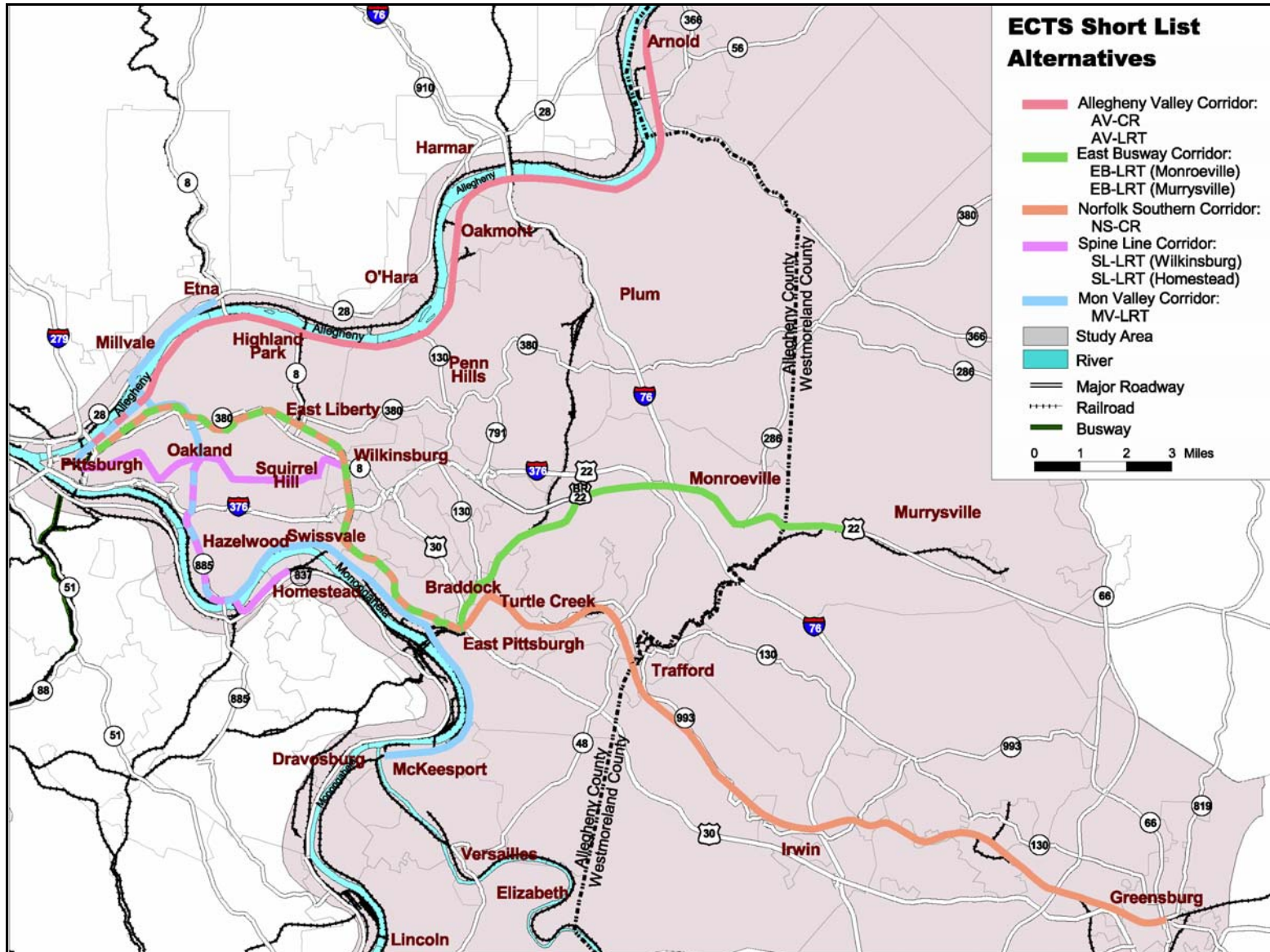
Exhibit 5-16: Short List of Alternatives and Naming Convention

Long List Name	Description	New Short List Name
AV1	Allegheny Valley Commuter Rail	AV-CR
AV4	Allegheny Valley Light Rail	AV-LRT
EB1 and EB8	East Busway - Light Rail to Monroeville/Murrysville	EB-LRT (Monroeville/Murrysville)
EB4 and EB9	East Busway - Busway to Monroeville/Murrysville	EB-BW (Monroeville/Murrysville)
SL1	Spine Light Rail to Wilkinsburg	SL-LRT (Wilkinsburg)
SL4	Spine Light Rail to Homestead	SL-LRT (Homestead)
MV5	Monongahela Valley Light Rail	MV-LRT
NS1	Norfolk Southern Commuter Rail	NS-CR
TSM	Transportation Systems Management	TSM

Exhibit 5-17 illustrates the general location of the short list alternatives in the study corridor. The short list alternatives meet transportation and community needs for the study area that were identified during the first round of public outreach as follows:

- **AV-CR** – Commuter Rail from downtown Pittsburgh to Lower Burrell via the AVR. The alternative provides a new transit choice that increases the quality of amenities while utilizing an existing transportation resource, the AVR right-of-way. AV-CR has the potential to reduce congestion on Route 28 and Allegheny River Boulevard and provides an opportunity to coordinate station planning with community plans in the corridor and recent initiatives in New Kensington. AV-CR provides a moderate improvement to linking people and activity centers given the requirement for a transfer to access Downtown.
- **AV-LRT** – Light Rail from downtown Pittsburgh to Lower Burrell via the AVR that provides a new transit choice that increases the quality of amenities while utilizing an existing transportation resource, the AVR right-of-way. AV-LRT has the potential to reduce congestion on Route 28 and Allegheny River Boulevard and provides an opportunity to coordinate station planning with community plans in the corridor and recent initiatives in New Kensington. AV-LRT provides a significant improvement to linking people and activity centers, and reducing Downtown congestion. The light rail would improve the direct connection currently provided by local bus routes to Downtown and the existing “T” at Steel Plaza with a faster ride unaffected by roadway congestion, an easier transfer to the “T” for travel to the North Shore and South Hills, and a decrease in the number of vehicles on busy roads.
- **EB-LRT (Monroeville/Murrysville)** – Light Rail from downtown Pittsburgh to Oakland and Monroeville via NS and Union Railroad rights-of-way with the possibility of continued service to Murrysville via Route 22. This alternative utilizes existing transportation resources such as the NS and Union Railroad rights-of-way. Additionally, this alternative has the potential to reduce congestion along the Parkway East (I-376) and Route 22 with a convenient and high quality service from Monroeville/Murrysville to Downtown. Opportunities also exist to coordinate station planning with community plans in the corridor and recent initiatives in East Liberty. It also provides an improvement to linking people and activity centers, and reducing downtown congestion given the direct connection to Downtown with the existing “T” at Steel Plaza. The light rail would improve the direct connection currently provided by local bus routes to Downtown, the existing “T” at Steel Plaza, and Oakland with a faster ride unaffected by roadway congestion, an easier transfer to the “T” for travel to the North Shore and South Hills, and a decrease in the number of vehicles on busy roads.
- **EB-BW (Monroeville/Murrysville)** – East Busway Extension from Swissvale to Monroeville via NS and Union Railroad rights-of-way and from Monroeville to Murrysville via Route 22. This alternative utilizes existing transportation resources such as the East Busway which is already in operation and the NS and Union Railroad rights-of-way for the approach to Monroeville. Additionally, this alternative has the potential to reduce congestion along the Parkway East and Route 22 with a convenient and high quality service from Monroeville/Murrysville to Downtown similar to EB-LRT (Murrysville/Monroeville). Opportunities also exist to coordinate station planning with community plans in the corridor including recent initiatives in East Liberty. This alternative would provide an improvement to linking people and activity centers given the direct connections to Downtown and Oakland, and would have the ability to reduce auto congestion in Downtown with a minor increase in bus volumes.

Exhibit 5-17: Short List Build Alternative Corridors



- **SL-LRT (Wilkinsburg)** – Light Rail from Downtown to Wilkinsburg via Centre Avenue and Oakland. This alternative would provide a new transit choice with frequent service in the study corridor with direct access to the Hill District, Soho, Oakland, Squirrel Hill and Wilkinsburg. The quality of service and amenities at station stops would be enhanced with the implementation of a new fixed guideway investment. Opportunities would also exist to coordinate station planning with community plans in the corridor including recent initiatives in Oakland. This alternative would provide a significant improvement to linking people and activity centers given the improved connection between Oakland and Downtown, two of the largest activity centers in the state. In addition, this alternative would have the ability to reduce auto and bus congestion between Oakland and Downtown. The light rail would improve the direct connection currently provided by local bus routes to Downtown, the existing “T” at Steel Plaza, and Oakland with a faster ride unaffected by roadway congestion, an easier transfer to the “T” for travel to the South Hills, a one-seat ride to the North Shore, and a decrease in the number of vehicles on busy roads.
- **SL-LRT (Homestead)** – Light Rail from Steel Plaza to Homestead via Centre Avenue or Colwell Street and Hazelwood utilizing CSX right-of-way through Panther Hollow. This alternative would be similar to SL-LRT(Wilkinsburg) in meeting the study needs. However, since SL-LRT(Homestead) travels south from Oakland through Hazelwood to Homestead along CSX railroad right-of-way, it would provide opportunities in these areas to enhance economic development and quality of life and while utilizing existing transportation resources. The light rail would improve the direct connection currently provided by local bus routes to Downtown and the existing “T” at Steel Plaza from Oakland with a faster ride unaffected by roadway congestion, an easier transfer to the “T” for travel to the South Hills, a one-seat ride to the North Shore, a decrease in the number of vehicles on busy roads, and would add a new, high-quality service between Hazelwood and Oakland. This alternative also provides the ability to coordinate with recent community planning efforts in Hazelwood.
- **MV-LRT** – Light Rail from the Convention Center to McKeesport and Etna via AVR and CSX rights-of-way. The original MV-LRT was extended to McKeesport from Rankin based on input received from the public which expressed a significant desire to test transit opportunities as far as McKeesport. This alternative would provide a new transit choice with frequent service in the study corridor with direct access from Downtown to the Strip District, Millvale, Etna, Oakland, Hazelwood, Rankin and McKeesport. In addition, this alternative would offer a north-south connection from Etna through Oakland to McKeesport. The quality of service and amenities at station stops would be enhanced along with opportunities to coordinate station planning with community plans in the corridor including recent initiatives in Hazelwood and Rankin. This alternative would provide a significant improvement to linking people and activity centers between Etna, McKeesport, Oakland and Downtown. The light rail would improve the direct connections currently provided by local bus routes with a faster ride unaffected by roadway congestion, an easier transfer to the “T” for travel to the South Hills, and a decrease in the number of vehicles on busy roads.
- **NS-CR** – Commuter Rail from downtown Pittsburgh to Greensburg via NS right-of-way that would provide an improved transit choice and service periods especially for commuters. This alternative would also have the potential to reduce congestion on Routes 22, 30 and I-376 between Greensburg and downtown Pittsburgh with its high quality commuter rail service while utilizing an existing transportation resource, the NS right-of-way. In addition, this alternative would provide opportunities to enhance economic development and quality of life in older urban areas (e.g. Jeannette) and would offer improved connections to other transit services in downtown Pittsburgh. This alternative also provides the ability to coordinate with recent planning efforts in Greensburg.

- **TSM** – The Transportation Systems Management Alternative consists of lower cost improvements to the existing transit system, and will be further defined in the Short List (see Section 6.4.1).

Each of the short listed alternatives meets the needs of the study since they would encourage the use of public transit, efficient land use policies and reduce auto dependency and their emissions.

6 ANALYSIS OF SHORT LIST ALTERNATIVES

The short list of alternatives was analyzed in further detail to estimate potential ridership, cost to implement the alternative and the annual operation and maintenance expense. Each estimate gave greater detail to the alternative and in some cases, made apparent where the alignment, service levels, station locations or other attributes of an alternative needed to be modified. Sections 6.1 through 6.3 describe the methodologies for estimating ridership and costs, while Section 6.4 provides details for each of the attributes.

6.1 TRAVEL DEMAND ESTIMATION METHODOLOGY

SPC developed travel demand estimates for each of the alternatives using the regional travel demand model. SPC utilizes the MINUTP software package to model the regional transportation system. Population, employment, and household forecasts are developed by SPC using a separate, integrated economic-demographic forecasting model known as REMI (Regional Economic Models, Inc.). Updates to the Long Range Plan utilize REMI to revise projections of these socio-economic indicators, providing the basis for modeling the transportation activity within the region. ECTS used base year (1997) estimates from Cycle 6 and created forecasts for the planning year (2025). **Exhibit 6-1** summarizes Cycle 6 estimates of population, employment, and households.

Exhibit 6-1: Cycle 6 Regional Population, Household, and Employment Forecasts

County	Population			Households			Employment		
	1997	2025	% Change	1997	2025	% Change	1997	2025	% Change
Allegheny	1,280,593	1,422,232	11.1%	522,500	609,367	16.6%	830,507	959,205	15.5%
Pittsburgh	344,506	359,968	4.5%	142,567	155,006	8.7%	398,560	448,013	12.4%
Non-Pittsburgh	936,087	1,062,264	13.5%	379,933	454,361	19.6%	431,947	511,192	18.3%
Armstrong	73,576	83,985	14.1%	28,697	34,452	20.1%	26,341	29,291	11.2%
Beaver	185,684	214,104	15.3%	72,565	87,846	21.1%	66,603	77,060	15.7%
Butler	169,190	265,545	57.0%	62,261	101,358	62.8%	80,927	107,437	32.8%
Fayette	145,031	160,970	11.0%	56,633	65,890	16.3%	51,134	73,296	43.3%
Greene	42,209	53,071	25.7%	15,222	20,129	32.2%	14,394	24,392	69.5%
Indiana	89,179	93,138	4.4%	31,421	34,552	10.0%	38,610	45,584	18.1%
Washington	205,809	249,359	21.2%	80,113	101,707	27.0%	91,687	103,718	13.1%
Westmoreland	374,686	451,161	20.4%	147,418	188,016	27.5%	166,162	183,935	10.7%
Total	2,565,957	2,993,565	16.7%	1,016,830	1,243,317	22.3%	1,366,365	1,603,918	17.4%

Travel simulations for the nine-county SPC travel model region are produced with a standard four-step chain of transportation models developed by SPC for MINUTP processing. The four steps include trip generation, trip distribution, modal split, and travel assignment models. The models were calibrated with data obtained in a small-scale home-interview survey conducted in 1990 and an onboard transit survey conducted in 1996. Travel was simulated for 2025 based on socio-economic data from SPC's Cycle 6 forecasts discussed above.

First, the model was run for the study No-Build alternative that included the current transportation network with the programmed transportation projects in the Year 2025 LRP (except for Maglev); see

Section 5.1 for more details. The results of the No-Build alternative provide the basis for comparison of measures such as system-wide transit riders and new transit trips attracted to each of the build alternatives.

Next, the SPC regional travel demand model was applied for each of the build alternatives. The ECTS alternatives were coded into the transportation network, and their operating characteristics including frequency of service, travel time on each link (i.e. between each station), and fare assumptions were defined. Modifications to the existing system were also coded and varied from minor bus reroutings and connections with the new alternative to complete elimination of certain routes. Proposed park & ride facilities at specific stations were coded for each alternative.

A separate model run was prepared for each alternative to isolate their potential benefits. The model results were then analyzed and reviewed with the results presented in Section 6.4.

6.2 CAPITAL COST ESTIMATION METHODOLOGY

The following section describes the approach used to estimate conceptual level capital costs. For each new alternative, estimates were prepared at a level commensurate with the planning nature of the ECTS study. However, they are detailed enough to indicate substantial cost differences between alternatives and to allow for long range plan budgeting. Future studies would refine these estimates utilizing a higher level of engineering to convert unknown items and allowances to specifically known and identified costs.

The investments considered primarily fall into the following three modes: Light Rail Transit, Commuter Rail, and Busway/BRT. Accordingly, a database of cost units was developed for each mode that, when applied, would include all costs associated with the implementation of an alternative. Capital cost units are segregated into specific capital asset categories including Guideway, Trackwork, Facilities, Systems, Stations, Special Conditions, Mobilization, Contingency, Administrative Soft Costs, Vehicles, and Property. Unit costs were developed using various local and national sources. Wherever available and applicable, local source data from recent projects was utilized. This was supplemented with data from other similar projects across the country, utilizing specific project information, federally provided cost databases, and RS Means Heavy Construction Cost Data, a regularly updated collection of construction costs nationwide. Sources of capital cost information include:

- PAAC Stage I and II Light Rail
- PAAC MLK Jr. East Busway Extension (Swissvale)
- PAAC West Busway
- PAAC Spine Line Corridor Study
- PAAC MLK, Jr. East Busway LRT Conversion Study
- FTA Fixed Guideway Heavy Rail and Light Rail Capital Cost Studies
- PAAC North Shore Connector Estimates
- St. Louis Metrolink System
- SEPTA Schuylkill Valley Metro (SVM) MIS/DEIS
- Riverside County (California) San Jacinto Branchline
- RS Means Heavy Construction Cost Data

Unit costs from prior projects or studies were inflated to current year values and costs from other cities were adjusted using location factors developed by RS Means to account for location related variations

in costs. All unit costs were reviewed with PAAC Engineering staff and, where necessary, adjusted based on recent construction cost data information or differing local conditions.

The various cost asset categories and components include:

- **Guideway:** Consists of preparatory work, as well as the civil and structural components on which the investment will operate, including clearing and grubbing, earthwork, drainage, bridges, tunnels, elevated structure, and retaining walls. For rail alternatives, this category includes the trackbed – made up of fill and sub-ballast, and for bus alternatives, it includes the pavement surface and subgrade.
- **Trackwork:** Includes the removal of track, upgrade of existing track, new track construction (ballasted, embedded, or directly fixed), as well as special trackwork (e.g. turnouts, crossovers).
- **Facilities:** Includes vehicle storage and maintenance facilities, as well as expansion or modification to existing operations control centers.
- **Systems:** Includes train control, communication, traction power (electrification) systems, and grade crossing protection. This category applies primarily to rail alternatives.
- **Stations:** Includes all station components such as platforms and shelters, as well as supporting infrastructure such as park & ride facilities, bus bays, and drop-off areas.

These categories comprise the hard construction assets for which specific quantities were estimated. The remaining construction items below (Special Conditions, Mobilization, and Contingency) are estimated as percentage add-ons based on experience from similar projects nationwide.

- **Special Conditions:** This category includes elements not included in other categories and not covered by contingency factors, yet large enough to be identifiable. They include utility relocation, environmental protection and mitigation, maintenance of, and urban design and landscaping costs, each at approximately 2-5% of specific hard costs.
- **Mobilization:** Mobilization costs are typically incurred as a separate bid item and have been itemized as a result. They cover the costs for setting up the work site, as well as for the movement and storage of heavy equipment and materials and are estimated as approximately 3% of construction and special conditions costs.
- **Contingency:** A 30% contingency has been applied to the construction related categories above. This is included to plan for presently unknown circumstances that may not be evident at this stage of planning and conceptual engineering. As alternatives proceed into more refined stages of development, the contingency percentage would decrease as the project becomes more defined.

Vehicles, Right-of-Way and Soft Costs represent other non-construction cost categories as follows:

- **Vehicles:** Includes costs for the design and manufacturing of light rail vehicles, commuter rail coaches, cab cars, and locomotives, and buses.
- **Right-of-Way:** Includes the acquisition of property for the construction of guideway, stations, and facilities. Given the conceptual nature of this study, these allowances are subject to future negotiation and refinement.
- **Soft Costs (Project Implementation):** Soft costs comprise a significant portion of the total cost of the project. This category covers engineering and design, construction management, project management, agency costs, and insurance costs. They are based on PAAC experience from recent projects.

Annualized Capital Costs

Capital costs were annualized in order to compare normalized costs of different alternatives. This is required by the FTA for projects requesting federal funding, and is a method of accounting for depreciation. Items requiring frequent replacement could, in the long run, be more expensive than similar items requiring higher initial investments, but less frequent replacement. Annualization allows an even comparison of different projects through normalization of capital expenditures by their useful life. To annualize the capital costs for the Short List Alternatives, the cost of each item, such as vehicles, track, signals and structures, was multiplied by an annualization factor specified by the FTA and the lifecycle of the asset. The annualization factors are based on a 7.0 percent discount rate, as prescribed by the Office of Management and Budget. Soft costs (mobilization, contingency, soft costs, etc.) were added directly onto the cost of each capital item prior to annualization.

6.3 OPERATING & MAINTENANCE COST METHODOLOGY

The annual operating and maintenance costs (O&M) of the short-listed alternatives were calculated on the basis of three variables – vehicle miles, vehicle or train hours, and the number of vehicles deployed in daily peak service. Unit costs for each variable were based on PAAC O&M cost data, with one exception discussed below (i.e. commuter rail). Unit costs for each variable were multiplied by service level quantities to estimate O&M costs for each alternative. These estimates also include transit system network savings based on changes to existing bus service affected by proposed new service.

Although all O&M estimates utilized the three-variable methodology, separate and distinct approaches were utilized for light rail, commuter rail, and bus alternatives as discussed below along with unit cost assumptions. Unit costs were developed from information in the 2001 National Transit Database (NTD) for PAAC and WCTA and inflated at an annual rate of 3% to represent 2002 dollars.

Rail-Service Levels: Vehicle miles, vehicle/train hours, and peak vehicles were calculated for each alternative. The first step in estimating service levels was to develop an initial run time and service frequency for each alternative. Service levels were calculated as follows:

Vehicle Miles: The calculation of vehicle miles was based on the following formula:

$$\begin{aligned} \text{Daily Vehicle Miles} &= \text{Hours of Operation} \times \text{Frequency} \times \text{Cycle Length} \times \text{Cars per Train} \\ &= [\text{Hours/Day}] \times [\text{Train Cycles/Hour}] \times [\text{Miles/Cycle}] \times [\text{Vehicles/Train}] \end{aligned}$$

Hours of operation are consistent with current PAAC service standards for comparable routes and are based on: 19 hours per day, Monday through Friday, inclusive of 3 hours of morning peak service and 3 hours of evening peak service. Short-turn service, when required, was assumed to operate only in weekday peak periods. Weekend and holiday operating hours were set at 19 hours, with service levels equivalent to weekday off-peak levels.

Service frequencies and number of cars per train varied among alternatives, and were based on an initial projected ridership and mode. Since ridership is estimated based on, among other things, the characteristics of the service headways, initial determinations of each alternative's headway was entered into the ridership model based on the type of service (i.e. commuter rail, light rail, or bus). Service characteristics were reviewed and refined based on final ridership estimates and train lengths

were sized accordingly. In cases where only a portion of the proposed alternative's route had inadequate capacity, short-turn services were added, a more cost-effective method of increasing capacity as opposed to the lengthening of trains. Short-turns serve only that portion of a route that required additional capacity.

Calculation of vehicle miles was performed individually for peak and off-peak periods and for short-turn services on weekdays. The sum was then multiplied by 254, the number of days in a calendar year with normal weekday service. Weekend service was calculated based on 19 hours of off-peak service over 111 Saturdays, Sundays and holidays. Annual vehicle miles were calculated by summing annual weekday and weekend/holiday vehicle miles. To account for non-revenue operations such as deadheading vehicles to and from yards and operator training, annual service levels were increased by 2%.

Vehicle and Train Hours: Calculation of vehicle and train hours followed the general formulas:

$$\begin{aligned} \text{Daily Train Hours} &= \text{Hours of Operation} \times \text{Frequency} \times \text{Cycle Time} \\ &= [\text{Hours/Day}] \times [\text{Train Cycles/Hour}] \times [\text{Hours/Cycle}] \end{aligned}$$

$$\begin{aligned} \text{Daily Vehicle Hours} &= \text{Daily Train Hours} \times \text{Cars per Train} \\ &= [\text{Train Hours/Day}] \times [\text{Vehicles/Train}] \end{aligned}$$

Hours of operation, frequencies and number of cars per train were taken from the vehicle mile calculations since the quantities are identical. Cycle time estimation included a run time analysis for each alternative, resulting in an end-to-end run time for each route. To obtain the cycle time, the one-way run time was multiplied by two plus layover time. The layover time must be sufficient for the operator to prepare the vehicle for travel in the opposite direction and for a few minutes to rest (minimum of 10-15 percent of the run time depending on the length of the route). The layover time also adds flexibility into the schedule so that one unexpected delay does not cascade, affecting operations all day. Additionally, the layover time was used to adjust cycle time to a quantity divisible by the service headway. This ensures that each vehicle starts exactly one headway period after the preceding vehicle.

Once the cycle times were developed, the general formulas shown above were used to calculate daily vehicle hours or train hours for each alternative. Similar to the vehicle mile calculations, vehicle and train hours were each increased by 2% to account for non-revenue movements.

The decision to use either vehicle hours or train hours for the calculation of O&M costs was based on the service characteristics of an alternative. Hourly quantities were used to estimate the hours worked by operators, and when multiplied by the appropriate unit cost, account for salaries of operators and fringe benefits. A multi-car train with personnel in each car would use vehicle hours to approximate operators' working hours. A train with multiple cars and one operator would use train hours. For the Short List of Alternatives, it was assumed that all light rail alternatives would require only one operator per train resulting in the use of train hours to estimate O&M costs. It was assumed that commuter rail services would have an engineer and conductors, based on the average unit cost from the peer systems. Commuter rail O&M cost estimations, therefore, used vehicle hours.

Peak Vehicles: Calculation of peak vehicle requirements followed the general formulas:

$$\begin{aligned} \text{Peak Vehicles} &= \text{Peak Trains} \times \text{Cars per Train} \\ &= [\text{Trains}] \times [\text{Vehicles/Train}] \end{aligned}$$

$$\begin{aligned} \text{Peak Trains} &= \text{Cycle Time} \times \text{Frequency} \\ &= [\text{Hours/Cycle}] \times [\text{Train Cycles/Hour}] \end{aligned}$$

Note that both peak trains and peak vehicles were rounded up to the next highest integer. For example, if peak vehicles were calculated to be 2.1 trains, 3 trains would be the actual requirement since it is impossible to configure 2.1 trains.

Bus/Busway Service Levels: Vehicle mile and hour quantities used in the estimation of O&M costs for bus services were taken directly from the output of the SPC ridership model. The model includes all bus routes for the existing network and produces vehicle miles and hours for an average weekday based on service frequency, route length and travel speeds. The model does not provide quantities for weekend/holiday days, so the weekday quantities were annualized by a factor that would account for the decrease in service on those days. The factor was calculated by taking system-wide scheduled PAAC vehicle hours and vehicle miles for a year and dividing them by the quantities operated in one weekday; this produced a number by which a weekday quantity can be multiplied to produce an annual quantity. Since the model also does not provide peak vehicles as an output, they were scaled from existing levels by averaging the percent change in system-wide vehicle hours and vehicle miles and applying that average increase to the number of peak vehicles in the No-Build alternative.

Unit Cost Development: O&M unit costs for light rail and bus modes were calculated for each service level variable from data obtained in the PAAC and WCTA 2001 National Transit Database (NTD) reports. O&M unit costs for commuter rail modes were calculated for each service level variable from data obtained in the 2001 NTD report published annually by FTA. The NTD provides O&M costs segregated under four cost categories:

- Vehicle Operation Costs – (e.g. operators)
- Vehicle Maintenance Costs – (e.g. mechanics, fuel)
- Non-vehicle Maintenance Costs – (e.g. maintenance of buildings/grounds)
- General and Administrative Costs – (e.g. marketing, accounting, human resources)

The NTD also provided annual service levels that directly relate to these cost categories, including:

- Vehicle Hours – drive vehicle operation costs
- Vehicle Miles – drive vehicle maintenance costs
- Peak Vehicles – drive non-vehicle maintenance costs

Based on this information, unit costs for each mode were estimated by dividing the specific cost category (i.e. vehicle operation costs) by the related annual service level (i.e. vehicle hours). The resulting unit costs were multiplied by the estimated service levels for each alternative to estimate daily and annual O&M costs.

Light rail and bus/busway unit costs were based on actual 2001 PAAC and WCTA data from existing light rail, bus, and busway operations. Since PAAC does not currently operate commuter rail service, unit costs were based on three commuter rail operations chosen from other cities. Unit costs for vehicle hour, vehicle mile, and peak vehicle were calculated for each and averaged to achieve a reasonable O&M cost estimating approach given the conceptual nature of the proposed commuter rail alternatives. The three peer systems chosen for this representation were Florida Tri-County Commuter Rail, Southern California Regional Rail Authority (Metrolink) and Virginia Railway Express because they are all diesel hauled passenger services, operating primarily in peak service periods.

Existing Bus Network Changes: Modifications were made to the existing bus network based on the type of service proposed for each alternative. Changes to O&M costs for the existing bus network were based on unit costs derived from the PAAC and WCTA 2000 NTD report.

Bus network changes were extensive for light rail alternatives since light rail provided a higher capacity replacement for peak and all-day bus services. For each light rail alternative, a bus route that duplicated the proposed light rail line, or a portion of it, was deleted or truncated. Those that were nearby, but not duplicative, were kept intact to avoid decreasing transit service for existing riders.

The commuter rail alternatives were targeted primarily at commuters. For each of these alternatives, the existing bus network was modified to delete or truncate any bus service providing duplicate, commuter service. Due to the low frequency of proposed commuter rail service, especially off-peak, all-day bus services were left unchanged.

The changes to the existing bus network for the busway/BRT alternative included the introduction of new routes and rerouting other routes onto the busway at the nearest entrance where it would not reduce the area of service.

6.4 ALTERNATIVE ATTRIBUTES

The Short List of Alternatives includes the TSM, and eight build alternatives. Each alternative is described in detail below and summarized again in **Exhibit 6-36**.

6.4.1 TRANSPORTATION SYSTEM MANAGEMENT (TSM) ALTERNATIVE

The TSM Alternative was developed for each corridor within the study area in an effort to identify the best opportunities for lower cost improvements to the existing transit system. The objective was to test a number of ideas gathered through the public outreach process including new north/south services, improved service frequencies on selected existing routes, new routes to major employment centers, additional park & ride lots and new incline opportunities. The TSM alternatives were developed to provide a "first look" at the potential opportunities that should be considered in future phases of study (e.g. AA/DEIS) where TSM development and evaluation is required. However, depending on the future availability of operating and capital funds, one or more of the TSM alternatives could be implemented independently of future phases of the proposed build alternatives. The following improvements were defined and coded into the SPC travel demand model to determine market potential only:

City of Pittsburgh / Oakland

- New bus service from Lawrenceville to Polish Hill – 61st and Butler Streets to 40th Street, Penn Avenue, Liberty Avenue, over the Bloomfield Bridge to Bigelow Boulevard and Heron Avenue
- New incline from 21st Street and Liberty Avenue in the Strip District to the Hill District at Bedford Avenue and Whiteside
- Increase frequency of PAAC bus route 54C to every 15 minutes
- Increase speed of all bus routes between Oakland and Downtown assuming priority movements for buses

Monongahela Valley

- Service increase on routes 60A, 60E, 60P, 60T to approximately every 45-60 minutes
- Service increase on routes 75B and 75D to approximately every 30 minutes
- Service increase on routes 51A, 51B, 56U, 60B, 60K, 60M, and 74A to approximately every 20-30 minutes
- Service increase on bus routes 58C, 58P and 58V to approximately every 15 minutes during peak periods

Allegheny Valley

- Service increase on bus route 1A
- Extension of every other trip on bus route 500 to RIDC

Eastern Suburbs

- Service increase on route 68A
- New bus service from New Kensington to Monroeville via S.R. 366, S.R. 286, and U.S. 22

Westmoreland County

- Service increase on all WCTA routes between Greensburg and Pittsburgh to every 30 minutes in the peak and 60-90 minutes off-peak
- New bus service from Greensburg to the Sony Plant in Mount Pleasant
- Additional park & ride facilities at Downtown Greensburg, Route 22/66 Interchange, Murrysville, Route 30 (Hempfield), Irwin, North Huntingdon, and Route 30 East (Carpenter Lane)

The TSM alternatives illustrated significant opportunities for improved transit service from a market potential perspective and as such will play an important role in subsequent phases of study for any build alternatives that move forward to the next steps of project development. As any of the sub-corridors proceed to additional studies, the TSM opportunities identified herein will be further refined in order to provide a corridor specific comparison between the TSM and build alternatives. The analysis will include ridership, capital and operating costs, travel time savings and environmental impacts as appropriate for the level of analysis that will be performed (e.g. AA, DEIS). It should be noted that the TSM alternatives could move forward independently of the build alternatives should funding become available.

6.4.2 ALLEGHENY VALLEY CORRIDOR – COMMUTER RAIL (AV-CR)

General Description

This alternative consists of commuter rail service between downtown Pittsburgh and Arnold, Westmoreland County. The alignment would be located in the existing AVR right-of-way, which parallels the southern shore of the Allegheny River. Service would be provided at-grade between the Strip District and Arnold, traversing Lawrenceville, Verona, Oakmont, New Kensington and Arnold, as shown in **Exhibit 6-2**.

Technology

Diesel locomotives capable of push-pull operation would be utilized to propel coach and cab cars to transport passengers. Push-pull capability simplifies operation and reduces the time required to prepare a train to reverse its travel direction. The engineer can operate the train from either the locomotive, if it is in the front of the train, or from a small cab at the other end of the train, with controls that are linked to the locomotive in the rear of the train. The proposed commuter rail service could operate only as far west as 16th Street; a rubber-tired shuttle would provide access to downtown Pittsburgh in a 24-minute loop from 16th Street to Stanwix Street, near Gateway Center. Diesel locomotive push-pull rolling stock was proposed due to its compliance with FRA vehicle strength standards to allow flexibility and simultaneous operation with freight trains.

Service and Travel Time Characteristics

Commuter rail service would operate every 30 minutes in the peak periods and every 90 minutes during the off-peak periods. Total end-to-end travel time would be approximately 34 minutes. Operation of the bus shuttle, from 16th Street to Downtown, would be timed to meet incoming trains in the morning and outbound trains in the evening. Travel between the 16th Street Station and other destinations within the Golden Triangle could require up to 5 minutes in transfer time plus approximately 5 minutes additional in travel time on the bus shuttle. Other modifications would be made to fixed-route bus services, as listed in **Exhibit 6-3**, to increase transfer opportunities and eliminate duplications of service.

The travel time for this alternative is 10-15 minutes less than the currently operating Route 78A bus between Arnold and downtown Pittsburgh, a 15-23% reduction in transit travel time.

ATTRIBUTES AT-A-GLANCE

Commuter rail with service from Downtown Pittsburgh (16th Street/Strip District) to Arnold in Westmoreland County.



AVR ROW in Oakmont

General Description:

Mode:

Commuter Rail – Diesel Locomotive & Coaches

Length:

18.3 miles

Stations Served:

*16th Street
40th Street (Park + Ride)
62nd Street (P+R)
Washington Blvd. (P+R)
Sandy Creek (P+R)
Verona (P+R)
Oakmont
New Kensington (P+R)
Arnold*

Service Characteristics:

Travel Time:

34 minutes (Downtown – Arnold)

Peak / Off-Peak Headway:

30 minutes / 90 minutes

Projected Daily Riders:

6,700

New Transit Riders:

2,600

Cost Estimates (2002 Dollars):

O&M Costs:

\$8.8 million / year

Capital Costs:

\$258 million

Ridership

The SPC travel demand model projected 6,700 daily boardings in the year 2025 for this alternative.

Exhibit 6-3: Changes to Existing Bus Service (AV-CR)

Route	Change
AVN	Replace with Commuter Rail Service
5A/C	Reroute to stop at New Kensington Commuter Rail Station
78A	Truncate at Oakmont Commuter Rail Station - Remove service between Oakmont and downtown Pittsburgh
500	Add Service to 62nd Street Commuter Rail Station

* The above service changes were assumed as part of the ECTS analysis for this alternative. A more detailed assessment of service changes will be undertaken for this corridor should it be considered in future studies.

O&M Costs

As illustrated in **Exhibit 6-4**, O&M costs for AV-CR were based on three variables including annual vehicle hours, annual vehicle miles, and daily peak vehicles. Quantities were estimated based on a 34-minute run time, 18.3-mile length between Arnold and Downtown, daily service period from 5:00 am to 12:00 am for 254 weekdays and 111 weekend days and holidays. Train lengths were based on the estimated ridership during the peak of the peak period, which required five coach cars during peak periods and two coach cars during off-peak periods. These quantities were then multiplied by their appropriate unit costs to arrive at incremental annual O&M costs for each service level as provided under "Change in Annual Cost" in **Exhibit 6-4**. Approximately \$10.9 million would be required for operation and maintenance of the commuter rail service with a savings of about \$2.1 million from reductions in bus service (after the addition of the Downtown bus shuttle) that would otherwise be duplicative. The result is an overall system-wide increase in O&M costs of approximately \$8.8 million annually for AV-CR.

Exhibit 6-4: Net O&M Costs (AV-CR)

	Commuter Rail			Existing Bus		
	Annual Vehicle Hours	Annual Vehicle Miles	Daily Peak Vehicles	Annual Vehicle Hours	Annual Vehicle Miles	Daily Peak Vehicles
Change in Annual Quantities	34,356	837,361	15 coach cars	-25,337	-332,839	-11
Unit Costs	\$131.73	\$2.25	\$300,307.70	\$39.70	\$1.53	\$49,507.16
Change in Annual Cost	\$4.5 m	\$1.9 m	\$4.5 m	-\$1.0 m	-\$0.51 m	-\$0.55 m
Total Change in Annual Cost	\$10.9 m			-\$2.1 m		
Grand Total	\$8.8 million					

Capital Costs

The capital costs for this alternative are shown in **Exhibit 6-5** and include a complete upgrade of the existing track, new passing sidings, a train control and communication system, full grade crossing protection, nine new stations, park & ride facilities, a fleet of 4 diesel locomotives (3 plus 1 spare) and 18 coach/cab cars (15 plus 3 spares) with a maintenance facility, contingency and soft costs, as discussed in Section 6.2. These costs would support a modern commuter rail system similar to other recently implemented systems across the country with a full 30-year service life, as required for potential FTA New Starts projects. Given this level of investment and anticipated level of service, these costs assume the purchase of the AVR right-of-way and thereby ensuring the preservation of the

investment and reliability of the commuter operation without impediments caused by freight operations. A general allowance was included for acquisition of the railroad right-of-way and property needs for stations and facilities.

Exhibit 6-5: Capital Costs (AV-CR)

Category	Cost
<i>Guideway</i>	\$ 5.1 m
<i>Trackwork</i>	\$ 20.0 m
<i>Facilities</i>	\$ 11.0 m
<i>Systems</i>	\$ 19.4 m
<i>Stations</i>	\$ 22.3 m
<i>Special Conditions and Mobilization</i>	\$ 10.4 m
<i>Contingency</i>	\$ 26.5 m
<i>Vehicles</i>	\$ 41.0 m
<i>Soft Costs</i>	\$ 50.7 m
<i>Right-of-Way</i>	\$ 51.5 m
TOTAL COST	\$ 258.0 m
<i>ANNUALIZED COST</i>	<i>\$ 20.6 m</i>

The hard capital costs of this alternative inclusive of guideway, trackwork, facilities, systems, stations, contingency, and special conditions and mobilization are estimated at \$115 million. The procurement of vehicles (new) would add an additional \$41 million with property costs for stations, parking, and railroad right-of-way totaling \$51 million. Soft costs in the form of all remaining engineering, design, management, construction oversight, and insurance is estimated at \$51 million for a total capital cost of \$258 million. Annualized costs are estimated at \$20.6 million.

Advantages and Disadvantages of AV-CR

The following provides a general discussion of this alternative's advantages and disadvantages based on needs and technical/operational/institutional issues:

Advantages

- Utilizes existing railroad right-of-way
- Residential impacts would be minimal
- Minimal noise impacts due to limited off-peak service and elevation differences
- Provides high quality transit option with a limited-stop commuter service
- Potential to reduce peak period congestion in the corridor
- Serves two counties with a high quality fixed guideway transit investment

Disadvantages

- Many grade crossings in the Strip District and Lawrenceville, resulting in potential for pedestrian/automobile conflicts requiring closure or control
- Large elevation differences between track level and residential areas would make walk-up access difficult in some areas
- Does not provide direct access to downtown Pittsburgh, requiring riders to transfer via a shuttle bus
- Commuter rail is a labor intensive and more costly mode due to industry labor requirements (e.g. engineers and conductors)
- New maintenance and yard facilities would be required
- Land available for park & ride lots is limited in this corridor

Alternative Options

In an effort to test the potential for implementing an interim, lower cost commuter rail service in the Allegheny Valley Corridor, the following options were developed:

Option 1 – Starter System: This option assumes a lower service level with trains operating every 60 minutes during the peak instead of every 30 minutes. This would reduce rolling stock requirements and eliminate one of the two passing sidings. This option also assumes that right-of-way would not be purchased, and instead, a track usage fee would be applied to the operating costs. Furthermore, a full vehicle maintenance facility and yard would be replaced with a minimal facility and yard with certain heavy maintenance functions outsourced to another railroad maintenance facility in the region. Finally, the station investments would be significantly reduced to “barebones” platforms and shelters with reductions in park & ride provisions. The resulting system would have the following attributes:

- Service: 60-minute peak and 90-minute off-peak
- Capital Cost: \$131 million (49% less than AV-CR)
- O&M Costs: \$5.3 million annually (14% less than AV-CR)
- Daily Boardings: 1,900 (72% less than AV-CR)

Option 2 – Minimal Investment: This option would have drastically reduced service with only two trains inbound in the morning, and two returning outbound trains in the afternoon. Capital investment reductions would be similar to Option 1 with additional cutbacks including minimal trackbed upgrades, no passing tracks, no signal system, fewer park & ride spaces and used rolling stock. In addition this option assumes a 50% reduction in soft costs and contingency costs which provide a significantly reduced capacity for project management, engineering, design and unforeseen construction impacts and costs that are difficult to assess at this level of planning. The attributes of this option are as follows:

- Service: two trains in am peak direction and pm peak direction
- Capital Cost: \$64 million (75 % less than AV-CR)
- O&M Costs: \$2.6 million annually (70% less than AV-CR)
- Daily Boardings: 800 (88% less than AV-CR)

This option could be considered as a mitigation measure for construction on Route 28 and implemented for a limited period of time. However, this option would not be recommended as a major investment and would not be eligible for federal New Start program funds based on its limited capital asset life expectancy.

It should be noted that for both options above, some foregone investments will likely reemerge in the form of upgrades and improvements that will be required after a short period of operation.

6.4.3 ALLEGHENY VALLEY CORRIDOR – LIGHT RAIL TRANSIT (AV – LRT)

General Description

This alternative proposes a light rail line between downtown Pittsburgh and Arnold, Westmoreland County, primarily along the existing AVR right-of-way. In Downtown, the service would begin at the existing underground Steel Plaza Station and follow the North Shore Connector Project’s extension of the “T” to the underground Convention Center station. From that point, the alignment would curve northeast into the Strip District, emerge near 14th Street and remain at-grade in the AVR right-of-way to Arnold, the same general alignment as AV-CR (see **Exhibit 6-6**).

Technology

Service would be provided with light rail vehicles that are electrically propelled from an overhead catenary power supply, similar to the existing PAAC “T” operation in the South Hills and Downtown. The vehicles would have the ability to operate individually and as trains with multiple vehicles coupled together and controlled by a single operator.

Service and Travel Time Characteristics

Peak service would be provided every 10 minutes, with off-peak service every 20 minutes. The total end-to-end travel time would be 37 minutes. Changes would be made to PAAC bus routes, as listed in **Exhibit 6-7**, to eliminate duplicative service.

Travel time between Arnold and downtown Pittsburgh would be 23 minutes faster on the light rail line than on the existing 78A bus route between Arnold and downtown Pittsburgh, a 38% reduction in transit travel time.

Ridership

The SPC travel demand model projected approximately 18,200 daily boardings by the year 2025.

ATTRIBUTES AT-A-GLANCE

Light Rail Transit with service from downtown Pittsburgh (Steel Plaza Station) to Arnold in Westmoreland County.



AVR ROW in Oakmont

General Description:

Mode:

Light Rail Transit – At-grade beyond CBD

Length:

19.0 miles

Stations Served:

<i>Steel Plaza*</i>	<i>62nd Street (P+R)</i>
<i>Convention Center**</i>	<i>Washington Blvd. (P+R)</i>
<i>14th Street</i>	<i>Sandy Creek (P+R)</i>
<i>21st Street</i>	<i>Verona (P+R)</i>
<i>31st Street</i>	<i>Oakmont</i>
<i>40th Street (P+R)</i>	<i>New Kensington (P+R)</i>
<i>51st Street</i>	<i>Arnold</i>

* - existing station, ** - North Shore Connector Project

Service Characteristics:

Travel Time:

37 minutes (Downtown – Arnold)

Peak / Off-Peak Headway:

10 minutes / 20 minutes

Projected Daily Riders:

18,200

New Transit Riders:

9,000

Cost Estimates (2002 Dollars):

O&M Costs:

\$16.3 million / year

Capital Costs:

\$804 million

Exhibit 6-6: Allegheny Valley Corridor - Light Rail Transit (AV-LRT)

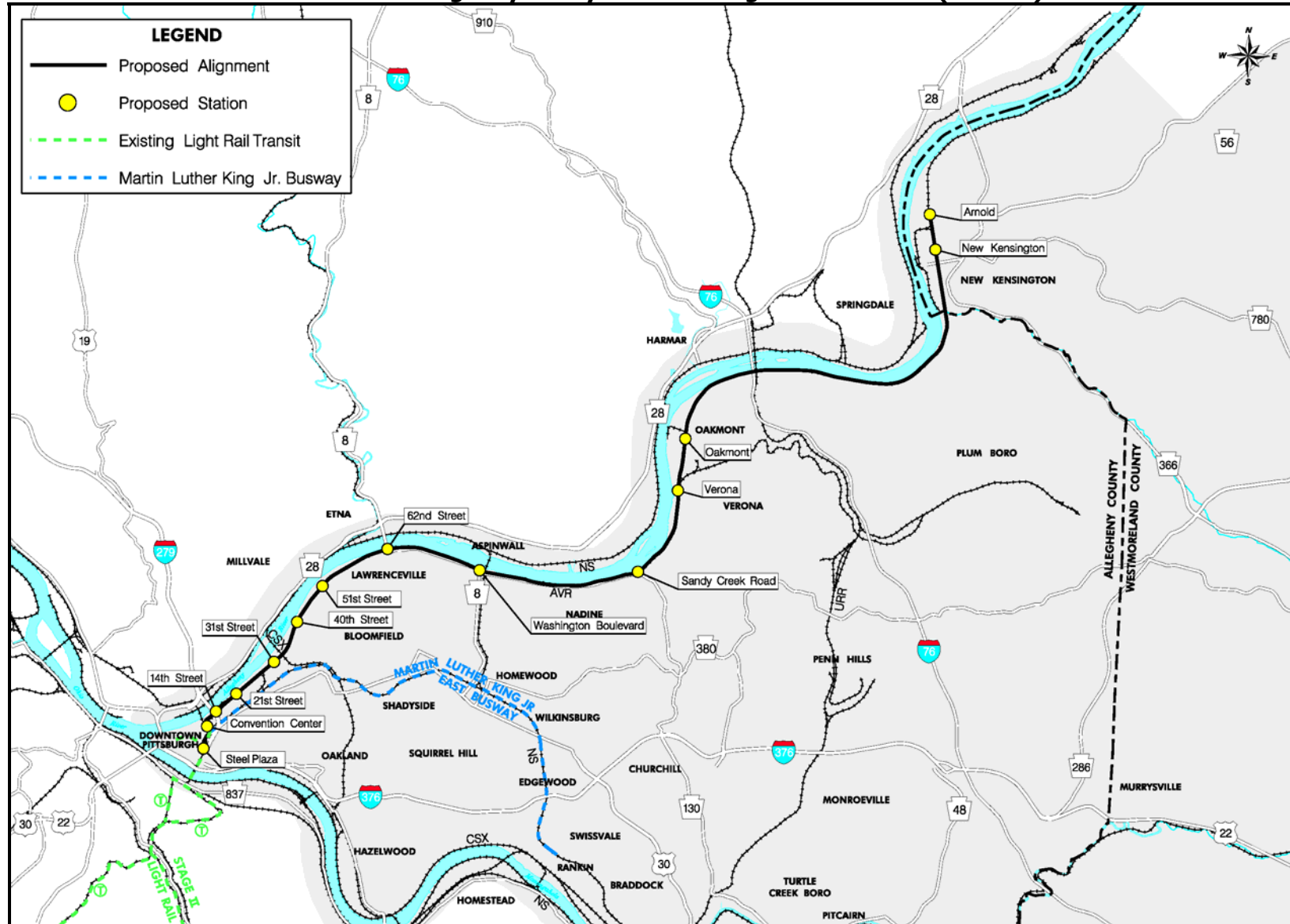


Exhibit 6-7: Changes to Existing Bus Service (AV-LRT)

Route	Change
AVN	Replace with Light Rail Service
5A/C	Reroute to stop at New Kensington Light Rail Station
500	Add Service to 62nd Street Light Rail Station
77A, 78A	Truncate at the Oakmont Rail Station for Transfer to Light Rail Service

* The above service changes were assumed as part of the ECTS analysis for this alternative. A more detailed assessment of service changes will be undertaken for this corridor should it be considered in future studies.

O&M Costs

As illustrated in **Exhibit 6-8**, O&M costs for AV-LRT were based on three variables discussed in Section 6.3 including annual train hours, annual vehicle miles, and daily peak vehicles. Quantities were estimated based on a 35-minute run time, 19-mile route length between Arnold and Downtown, daily service period from 5:00 am to 12:00 am for 254 weekdays and 111 weekend days and holidays. For additional capacity in the peak, service was also estimated for a short-turn operation between the Convention Center and 62nd Street to relieve peak loadings, a 4.4-mile trip with an 11-minute run time. Train lengths were based on the estimated ridership during the peak of the peak period, which required two cars during peak periods and one car during off-peak periods between Arnold and Downtown, and two cars on the peak period short-turn service. Quantities were multiplied by their appropriate unit costs to arrive at incremental annual O&M costs for each service level as provided under "Change in Annual Cost" in Exhibit 6-8. Approximately \$18.5 million would be required for operation and maintenance of the light rail service with a savings of about \$2.2 million from reductions in bus service that would otherwise be duplicative or unnecessary. The result is an overall system-wide increase in O&M costs of approximately \$16.3 million annually for AV-LRT.

Exhibit 6-8: Net O&M Costs (AV-LRT)

	Rail			Port Authority Bus		
	Annual Train Hours	Annual Vehicle Miles	Daily Peak Vehicles	Annual Vehicle Hours	Annual Vehicle Miles	Daily Peak Vehicles
Change in Annual Quantities	42,285	1,502,434	26	-27,329	-332,839	-12
Unit Costs	\$69.53	\$6.09	\$246,059.83	\$39.70	\$1.53	\$49,507.16
Change in Annual Cost	\$2.9 m	\$9.2 m	\$6.4 m	-\$1.1 m	-\$0.51 m	-\$0.59 m
Total Change in Annual Cost	\$18.5 m			-\$2.2 m		
Grand Total	\$16.3 million					

Capital Costs

Capital cost estimates for this alternative, summarized in **Exhibit 6-9**, include a short tunnel extension from the Convention Center Station to an area near 14th Street in the Strip District, and a full double-tracked, electrified light rail system to Arnold. In addition, estimates include costs for expansion of the existing single-track tunnel between Steel Plaza and Convention Center to double track. Track costs also include a dual-gauge track that would allow freight service to continue to operate at night to serve existing freight customers on the AVR. Overall, 18.9 out of 19.3 miles would be new alignment, with 12 new stations, several of which would include extensive park & ride facilities.

The hard capital costs of this alternative inclusive of guideway, trackwork, facilities, systems, stations, contingency, and special conditions and mobilization are estimated at \$463 million. The procurement

of 30 light rail vehicles (26 plus 4 spares) would add an additional \$99 million and costs for stations, parking, and railroad related property would total \$56 million. Soft costs in the form of all remaining engineering, design, management, construction oversight and insurance is estimated at \$185 million for a total capital cost of \$804 million. Annualized costs are estimated at \$64.0 million.

Exhibit 6-9: Capital Costs (AV-LRT)

Category	Cost
<i>Guideway</i>	\$ 64.3 m
<i>Trackwork</i>	\$ 77.5 m
<i>Facilities</i>	\$ 21.5 m
<i>Systems</i>	\$ 65.7 m
<i>Stations</i>	\$ 84.4 m
<i>Special Conditions and Mobilization</i>	\$ 42.9 m
<i>Contingency</i>	\$ 106.9 m
<i>Vehicles</i>	\$ 99.0 m
<i>Soft Costs</i>	\$ 185.3 m
<i>Right-of-Way</i>	\$ 56.1 m
TOTAL COST	\$ 804.0 m
<i>ANNUALIZED COST</i>	<i>\$ 64.0 m</i>

Advantages and Disadvantages of AV-LRT

The following provides a general discussion of this alternative's advantages and disadvantages based on needs and technical/operational/institutional issues:

Advantages

- Uses existing right-of-way
- Supports redevelopment in the Allegheny Valley, a current goal of communities in the corridor
- Potential to offer significant transit travel time savings in the Allegheny Valley
- Potential to reduce congestion on roadways in the corridor
- Provides frequent service transit option with seven new stations in the City of Pittsburgh and direct connection to Downtown
- Serves two counties with high quality fixed guideway transit investment

Disadvantages

- Large elevation differences between track level and residential areas would make walk-up access difficult in some areas
- Many grade crossings in the Strip District and Lawrenceville, resulting in potential for pedestrian/automobile conflicts requiring closure or control
- Compatibility with existing freight vehicles is limited due to lower light rail vehicle strength
- Land available for park & ride lots is limited in this corridor

6.4.4 EAST BUSWAY CORRIDOR – LIGHT RAIL TRANSIT (EB-LRT MONROEVILLE)

General Description

This alternative consists of a light rail system that would run from downtown Pittsburgh to Monroeville with a spur to Oakland. The main line would begin at the existing underground Steel Plaza Station and follow the North Shore Connector Project’s extension of the “T” to the proposed underground Convention Center Station. The alignment would surface near 14th Street and operate at-grade through the Strip District, along the AVR right-of-way, to approximately 23rd Street. At 23rd Street the alignment would turn southward and join the existing East Busway just before the Herron Avenue station. The new alignment from the Convention Center to Herron Avenue would be approximately 2 miles in length. From this point the East Busway would be converted to an exclusive light rail right-of-way to Swissvale. Approximately 6.7 miles of new alignment would be constructed for light rail service to Monroeville Mall along the NS Railroad right-of-way to East Pittsburgh and Union Railroad right-of-way past Keystone Commons, through Turtle Creek and toward the Monroeville Mall. Access to the Monroeville Mall would be achieved with a retained cut structure that would climb the hillside from the Union Railroad to the south side of the existing parking lot.

The spur to Oakland would be constructed by converting the Neville ramp to rail structure and extending it along the CSX right-of-way through to the Schenley Tunnel (see **Exhibit 6-10**). The alignment would terminate near Carnegie Mellon University just south of the Schenley Tunnel.

Technology

Service would be provided with light rail vehicles that are electrically propelled from an overhead catenary power supply, similar to the existing PAAC “T” operation in the South Hills and Downtown. The vehicles would have the ability to operate individually and as trains with multiple vehicles coupled together and controlled by a single operator.

Service and Travel Time Characteristics

Three main services would be operated for this alternative and would include travel between downtown Pittsburgh and Monroeville; downtown Pittsburgh and Oakland; and, Oakland and Monroeville. All three services would operate on 10-minute peak headways and 15-minute off-peak headways. Since two services would operate simultaneously on all of the alignment, the combined headways would be 5 minutes in the peak periods and 7.5 minutes in the off-peak periods.

ATTRIBUTES AT-A-GLANCE

Light Rail Transit from Downtown Pittsburgh (Steel Plaza) to Oakland and Monroeville with an option to extend to Murrysville



NS ROW at Braddock

General Description:

Mode:

Light Rail Transit – At-grade/Partially elevated

Length:

16.1 miles (Steel Plaza – Monroeville)

1.9 miles (Herron Avenue – Oakland)

Stations Served:

<i>Steel Plaza*</i>	<i>Edgewood (P+R)</i>
<i>Convention Center**</i>	<i>Roslyn</i>
<i>14th Street</i>	<i>Swissvale (P+R)</i>
<i>21st Street</i>	<i>Braddock (P+R)</i>
<i>Herron Avenue*</i>	<i>Keystone Comns.(P+R)</i>
<i>UPMC Shadyside</i>	<i>Monroeville Mall (P+R)</i>
<i>Negley Ave. (P+R)*</i>	
<i>East Liberty (P+R)*</i>	<i>Oakland Spur Only:</i>
<i>Homewood</i>	<i>Centre Ave.*</i>
<i>Wilkinsburg (P+R)*</i>	<i>CMU</i>
<i>Hamnett</i>	

* - existing station (T/East Busway),

** - North Shore Connector Project

Service Characteristics:

Travel Time:

39 minutes (Downtown to Monroeville)

13 minutes (Downtown to Oakland)

32 minutes (Oakland to Monroeville)

Peak / Off-Peak Headway:

10 / 15 - (Downtown to Monroeville Mall)

10 / 15 - (Downtown to Oakland)

10 / 15 - (Oakland to Monroeville Mall)

Projected Daily Riders:

42,900

New Transit Riders:

9,300

Cost Estimates (2002 Dollars):

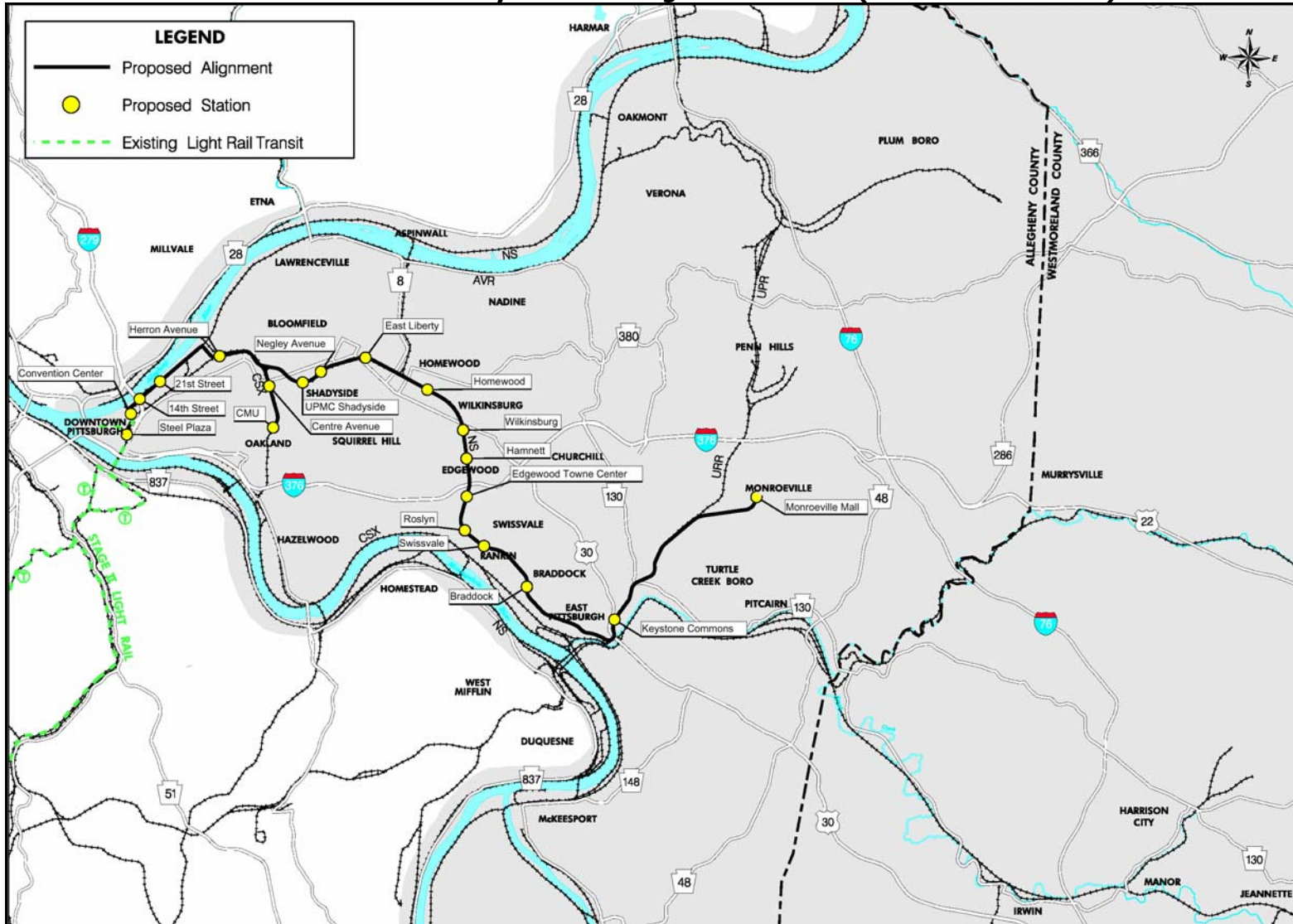
O&M Costs:

\$25.0 million / year

Capital Costs:

\$1.3 billion

Exhibit 6-10: East Busway Corridor - Light Rail Transit (EB-LRT Monroeville)



The three services are further described below:

- **Downtown to Monroeville** - This service, from downtown Pittsburgh to Monroeville, would be the longest of the three, 16.1 miles long. A total of 17 stations would be served with a one-way runtime of 39 minutes. From the existing Steel Plaza "T" station the service would travel to Monroeville as detailed in the General Description of this alternative. This route would not serve Oakland.
- **Downtown to Oakland** - This service would also originate at the Steel Plaza "T" station and travel via the Strip District and the former East Busway right-of-way to just east of the Herron Avenue Station, as detailed in the general description. At this point, Pittsburgh to Oakland service leaves the main alignment and turns onto the Oakland Spur near Bloomfield, traveling along CSX right-of-way. Two stations on this spur are provided at Centre Avenue and CMU. The entire route between downtown Pittsburgh and CMU would be 4.3 miles long, serve a total of 7 stations, and have a one-way travel time of 13 minutes.
- **Oakland to Monroeville** – Service between Oakland and Monroeville would be 13.9 miles long, with 14 stations and a 32-minute one-way travel time. Originating at the CMU Station, the route would join the main alignment and then proceed to the Monroeville Mall.

Since the busway would be replaced with a light rail line and mixed operation of buses and light rail on the alignment would not be possible, all bus routes that currently use the busway would be rerouted, truncated at the new light rail stations, or fully replaced by the light rail service. Changes that would be made to the existing bus network are summarized below in **Exhibit 6-11**.

Exhibit 6-11: Changes to Existing Bus Service (EB-LRT Monroeville)

Route	Change
EBA,EBO,EBX,63A,63B,68B, 68X,73B,78C,83B,88A,W	Replace with Light Rail Service
58C,58P,58V	Truncate at Swissvale for Transfer to Light Rail Service
68J,68G,78A,78E,GC,HP,M,MP, P,PG,T,U, 68D, 68F	Truncate at Wilkinsburg for Transfer to Light Rail Service
74B,LP	Truncate at East Liberty for Transfer to Light Rail Service
G,GR	Reroute along Penn Avenue to Wilkinsburg Station, Truncate at Wilkinsburg
77U	Reroute on Frankstown Road to 5th Avenue
100	Reroute along Bigelow Boulevard, Craig Street and 5th Avenue
AV,AVN,93A,3M	Reroute to Downtown via Route 28, Veteran's Bridge, 7th Avenue, Liberty Ave and Gateway Center
D,DB,R	Reroute on Penn and Liberty Avenues
68A	Reroute from Monroeville Mall to downtown Pittsburgh via Business Route 22
61A,61B,79A,79B,81B	Increase service frequency
WCTA 2F	Truncate at Monroeville Mall for Transfer to Light Rail
WCTA 1F, 4	Truncate at Keystone Commons for Transfer to Light Rail

* The above service changes were assumed as part of the ECTS analysis for this alternative. A more detailed assessment of service changes will be undertaken for this corridor should it be considered in future studies.

Travel from Monroeville to downtown Pittsburgh would be 21 – 26 minutes faster on the light rail than via the current 67A bus route, but only 9 minutes faster than existing route 68A, depending on time of day. Light rail service would decrease transit travel times by 36-40% between Monroeville and Wilkinsburg.

Ridership

The estimated ridership for the East Busway light rail, determined by the SPC travel demand model's analysis of the alignment and service characteristics described above, is 42,900 daily riders by the year 2025. Additionally, the system-wide effects of the light rail would be an increase in transit usage by approximately 9,300 trips per day.

O&M Costs

As illustrated in **Exhibit 6-12**, O&M costs for EB-LRT (Monroeville) were based on three variables including annual train hours, annual vehicle miles and daily peak vehicles, as described in Section 6.3. Quantities were estimated based on a daily service period from 5:00 am to 12:00 am for 254 weekdays and 111 weekend days and holidays, with the following characteristics for the three services:

- Downtown to Oakland: 13-minute run time and 4.3-mile trip length
- Downtown to Monroeville: 39-minute run time and 17.4-mile trip length
- Oakland to Monroeville: 32-minute run time and 13.9-mile trip length

Train lengths were based on the estimated ridership during the peak of the peak period, which required three cars for Downtown-Monroeville and two cars for both Downtown-Oakland and Oakland-Monroeville service peak trains. During off-peak periods, only one car was required on each train. These quantities were then multiplied by their appropriate unit costs to arrive at incremental annual O&M costs for each service level. Costs were totaled under "Change in Annual Cost" in **Exhibit 6-12** along with costs for an additional short-turn service. Following a comparison of the scheduled service to the predicted ridership, it was determined that additional capacity would be required in the peak periods between Steel Plaza and Wilkinsburg. The short-turn service, between Steel Plaza and Wilkinsburg, is 7.3 miles long, has a 20-minute run time and requires three cars per train in the peak periods only. Approximately \$47.1 million would be required for operation and maintenance of the light rail service with a savings of about \$22.1 million from reductions in bus service that would otherwise be duplicative. The result is an overall system-wide increase in O&M costs of approximately \$25.0 million annually for EB-LRT (Monroeville).

Exhibit 6-12: Net O&M Costs (EB-LRT Monroeville)

	Rail			Port Authority Bus			WCTA Bus		
	Annual Train Hours	Annual Vehicle Miles	Daily Peak Vehicles	Annual Vehicle Hours	Annual Vehicle Miles	Daily Peak Vehicles	Annual Vehicle Hours	Annual Vehicle Miles	Daily Peak Vehicles
Change in Annual Quantities	117,686	3,718,188	66	-267,032	-3,976,380	-100	-6,217	-117,304	-5
Unit Costs	\$69.53	\$6.09	\$246,059.83	\$39.70	\$1.53	\$49,507.16	\$31.35	\$0.28	\$39,052.91
Change in Annual Cost	\$8.2 m	\$22.7 m	\$16.2 m	-\$10.6 m	-\$6.1 m	-\$5.0 m	-\$0.19 m	-\$0.03 m	-\$0.18 m
Total Change in Annual Cost	\$47.1 m			-\$21.7 m			-\$0.40 m		
Grand Total	\$25.0 million								

Capital Costs

The capital cost estimate for this alternative covers costs for new construction at either end of the existing busway, as well as costs for the conversion of the existing busway right-of-way. Costs include a short tunnel section after the Convention Center station, as well as the expansion of a single-track tunnel section between Steel Plaza and the Convention Center Station. The new alignment between the ends of the existing Busway at Swissvale to Monroeville Mall requires extensive walls and elevated structures through the East Pittsburgh/Turtle Creek area and the approach to Monroeville Mall which is at a higher elevation. Costs for the spur to Oakland include an underground station below Centre Avenue, widening of the tunnel for double track, and a new station near Forbes Avenue south of the Schenley Tunnel. The breakdown of costs by major category is presented in **Exhibit 6-13**.

Exhibit 6-13: Capital Costs (EB-LRT Monroeville)

Category	Cost
<i>Guideway</i>	\$ 187.6 m
<i>Trackwork</i>	\$ 36.7 m
<i>Facilities</i>	\$ 51.2 m
<i>Systems</i>	\$ 56.5 m
<i>Stations</i>	\$ 132.1 m
<i>Special Conditions and Mobilization</i>	\$ 75.2 m
<i>Contingency</i>	\$ 161.8 m
<i>Vehicles</i>	\$ 250.8 m
<i>Soft Costs</i>	\$ 285.3 m
<i>Right-of-Way</i>	\$ 36.1 m
TOTAL COST	\$1,273.3 m
<i>ANNUALIZED COST</i>	<i>\$ 102.5 m</i>

In total, construction costs (including guideway, trackwork, facilities, systems, stations, special conditions, mobilization, and contingency), estimated at \$701.1 million, would include installation of a double track, fully signalized, and electrified light rail system over approximately 18 miles of new alignment with 17 new or modified stations in addition to Steel Plaza and the Convention Center stations. Costs cover extensive new or expanded park & ride provisions at several stations. The frequent service levels and high ridership demand for this alternative would require an estimated fleet of 76 light rail vehicles (66 plus 10 spares), adding \$250.8 million to the cost. Costs for new vehicle facilities are included in the construction cost above. Property for the new portions of the alignment, as well as for stations and parking, are estimated to cost an additional \$36.1 million. Soft costs for engineering, design, management, oversight, and insurance would add \$285.3 million, bringing the total estimated implementation cost to \$1,273.3 million.

Advantages and Disadvantages of EB-LRT (Monroeville)

The following provides a general discussion of this alternative's advantages and disadvantages based on needs and technical/operational/institutional issues:

Advantages

- Provides connection to "T", Oakland, Downtown, and the North Shore
- Reduces travel times from eastern portion of study area
- Replaces diesel buses with electrically propelled light rail vehicles
- Combines many bus routes into one single high capacity rail service

Disadvantages

- Creates severe service disruptions during conversion to a light rail facility

- Replaces an existing, well functioning transit facility between Downtown and Swissvale
- Short-turning many buses at the light rail line stations might have neighborhood impacts, other bus routes would be continued in mixed traffic
- Adds a transfer into many riders' trips
- Requires a new maintenance facility
- Benefits of clean running diesel buses will not be realized, given new EPA regulations in 2006
- Serves only a small section of Oakland, versus several locations with the existing street running bus service

Alternative Options

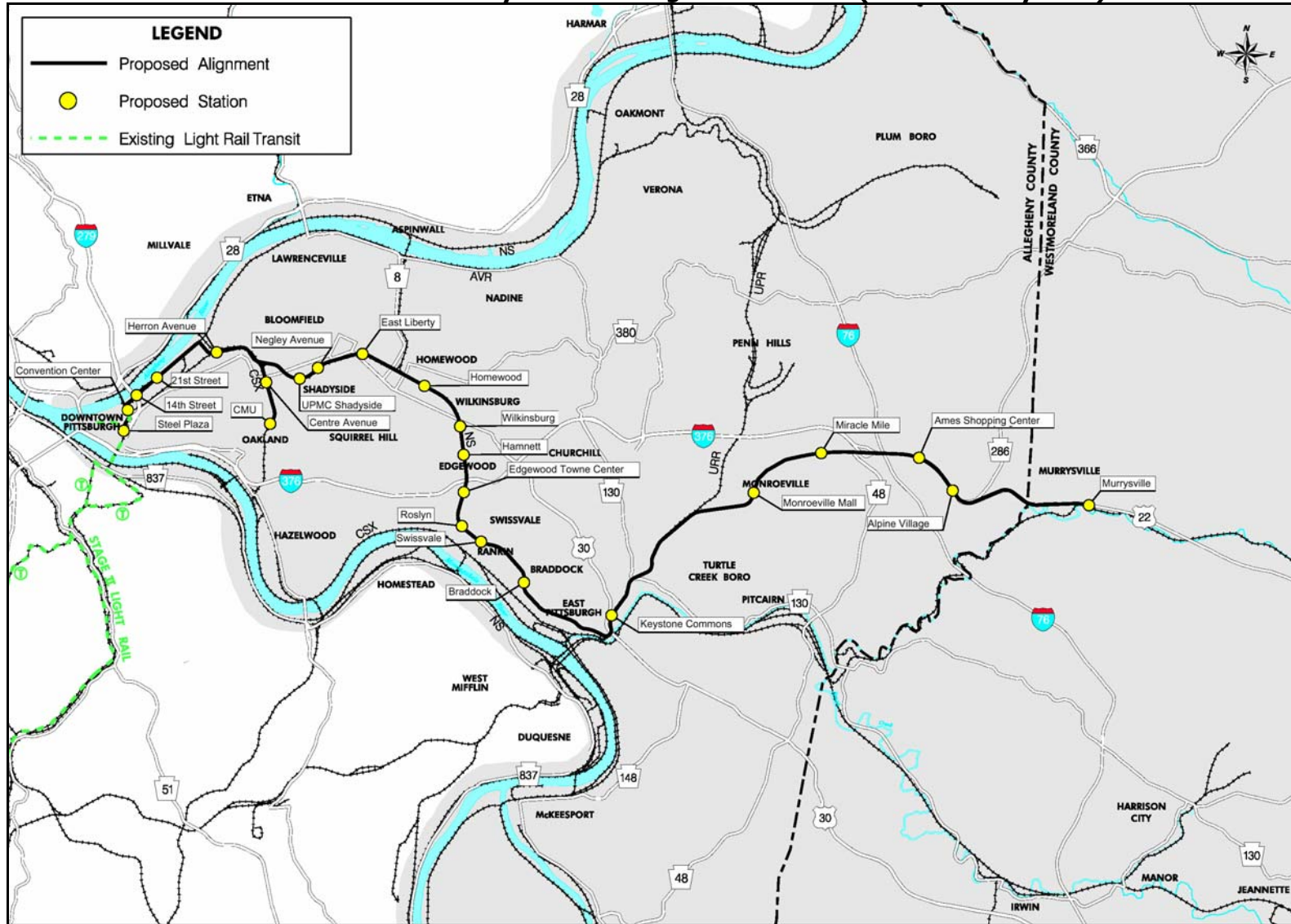
In an effort to test the potential for implementing a future high quality service out to Murrysville, Alternative EB-LRT (Monroeville) was extended from Monroeville to Murrysville as follows:

Option 1 – EB-LRT (Murrysville): This option was analyzed beyond Monroeville to Murrysville via Route 22, as illustrated in **Exhibit 6-14**. The extension would be approximately 6.2 miles long with 4 additional stations. Operation would be similar to the original alternative, with three services operating on 10 and 15 minute peak and off-peak headways with the service from Downtown to Monroeville extended to Murrysville. Train consists would be identical to the original alternative. An on-site investigation determined that alignment options beyond Monroeville would be difficult with limited to no room for a separate and exclusive right-of-way. Following Route 22 at-grade would be extremely disruptive and would hinder the light rail operation in numerous conflict locations. Given these constraints, the extension was investigated as a fully-elevated section to achieve the maximum performance for the light rail service. EB-LRT (Murrysville) would have the following attributes:

- Service: 10-minute peak and 15-minute off-peak headways
- Capital Costs: \$2,014.9 million (58% greater than EB-LRT (Murrysville))
- O&M Costs: \$33.3 million annually (33% greater than EB-LRT (Murrysville))
- Daily Boardings: 46,700 (9% greater than EB-LRT (Murrysville))

Option 1 represents the high end of potential costs to implement this alternative in an effort to maximize ridership potential. During subsequent phases of study, the need for a fully-elevated alignment would be studied further to identify areas for reducing overall infrastructure costs.

Exhibit 6-14: East Busway Corridor - Light Rail Transit (EB-LRT Murrysville)



6.4.5 EAST BUSWAY CORRIDOR – BUSWAY EXTENSION (EB-BW Monroeville)

General Description

This alternative would be a 6.6-mile extension of the East Busway from Swissvale to Monroeville Mall via NS and Union Railroad rights-of-way (see **Exhibit 6-15**). Currently, the East Busway parallels the NS right-of-way from Penn Station in downtown Pittsburgh to Swissvale. From Swissvale, this alternative would continue along NS right-of-way to East Pittsburgh, where it would turn northwards and follow the Union Railroad right-of-way toward Monroeville. Access to the Monroeville Mall would be achieved with elevated structure that would climb the hillside from the Union Railroad to the south side of the existing parking lot. Note that the EB-BW (Murrysville) alternative was not analyzed as part of the Short List evaluation since EB-LRT (Murrysville) was chosen to provide the best opportunity to test fixed guideway transit to this portion of the study area.

Technology

The Busway would provide an exclusive right-of-way for service with standard 40-foot and articulated diesel buses, as currently operated on the existing busway and in the study area. New vehicles required for the expanded service levels of this alternative would meet future EPA diesel emission standards that are expected to reduce pollutants significantly.

Service and Travel Time Characteristics

Several line-haul and skip-stop services would be provided on the busway by existing exclusive routes. Several local routes would also use the busway to provide express service to downtown Pittsburgh once they enter the Busway, similar to current operations. The primary line-haul services would operate on 10-minute peak and 15-minute off-peak headways, skip-stop services would operate every 12-15 minutes in the peak and every 30 minutes in the off-peak, and all would operate a Downtown loop on city streets from Penn Station into the Golden Triangle and back.

- **Downtown to Monroeville:** Service would be provided by both line-haul and skip-stop routes between downtown Pittsburgh and Monroeville Mall, a distance of approximately 15.6 miles. A total of 14 stations would be served on both the existing busway and the extension to Monroeville. The one-way run time for the busway portion of these services only, would be approximately 32 to 42 minutes, with up to an additional 6 minutes to reach areas farther Downtown.

ATTRIBUTES AT-A-GLANCE

Extension of the existing East Busway from Swissvale, to Monroeville providing service between Downtown and Monroeville Mall.



East Busway Extension near Roslyn Station

General Description:

Mode:

Busway

Length:

15.6 miles total

6.6 miles new (Swissvale – Monroeville)

Stations Served:

Penn Station Hamnett*

Herron Avenue Edgewood Towne Ctr.*

*UPMC Shadyside** Roslyn†*

Negley Avenue‡ Swissvalé

East Liberty‡ Braddock

Homewood Keystone Commons (P+R)

Wilkinsburg† Monroeville Mall (P+R)

* - Existing East Busway Station

** - New station on existing East Busway

Service Characteristics:

Travel Time:

42 minutes (Downtown to Monroeville Mall)

8 minutes (Downtown to Oakland)

38 minutes (Oakland to Monroeville Mall)

Peak / Off-Peak Headways:

10 / 15 - (Downtown to Monroeville Mall)

10 / 15 - (Downtown to Oakland)

10 / 15 - (Oakland to Monroeville Mall)

Projected Daily Riders:

41,500

New Transit Riders:

8,400

Cost Estimates (2002 Dollars):

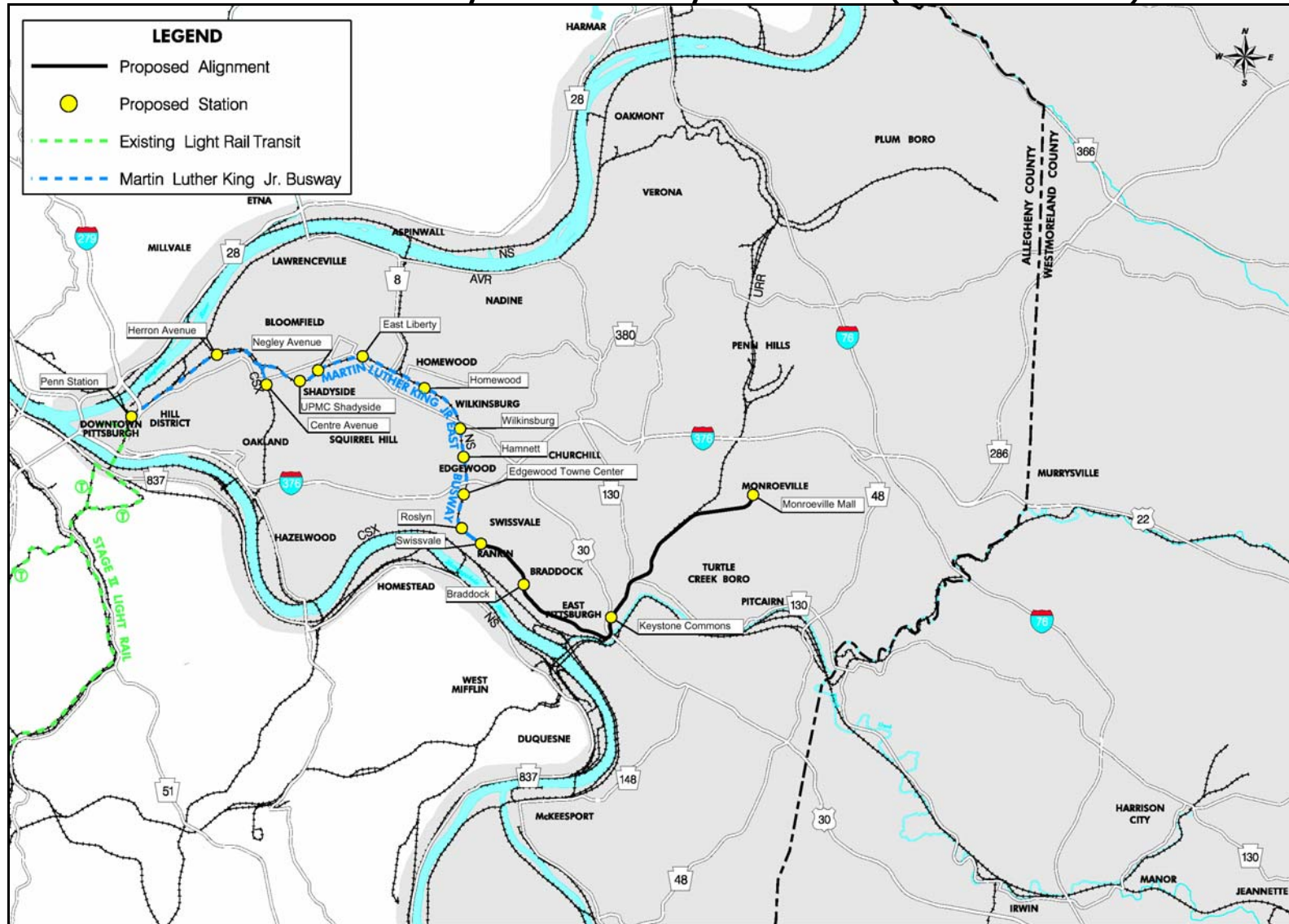
O&M Costs:

\$8.4 million / year

Capital Costs:

\$368 million

Exhibit 6-15: East Busway Corridor - Busway to Monroeville (EB-BW Monroeville)



- **Downtown to Oakland:** Line-haul service would be provided between downtown Pittsburgh and Oakland, a distance of approximately 4.3 miles. A total of 3 stations would be served on existing busway with additional access in Downtown and Oakland. The one-way run time for the busway portion of this service only, would be approximately 8 minutes, with up to an additional 6 minutes to reach areas father Downtown.
- **Oakland to Monroeville:** Service would be provided between Oakland and Monroeville Mall, a distance of approximately 13.9 miles. A total of 13 stations would be served with a one-way run time of approximately 38 minutes.

Changes would be made to the existing bus service to reroute them onto the Busway where beneficial, and service frequencies would be changed on some routes. The proposed bus service changes included in EB-BW (Monroeville) are listed in **Exhibit 6-16**.

Travel between Downtown and Monroeville on the busway extension would be approximately 34 minutes faster than existing local bus service that does not use the Busway (56% faster) and on average 5 minutes faster than the services that currently use the existing portion of the Busway (16% faster).

Exhibit 6-16: Changes to Existing Bus Service (EB-BW Monroeville)

Route	Change
68J, 68F	Enter Busway at Keystone Commons
68K	NEW ROUTE: Would start at Keystone Commons, and run as Forest Hills Express via original routing of 68J and 68F to downtown Pittsburgh (Electric Avenue to Ardmore Avenue/SR30 to Wilkinsburg and East Busway to downtown Pittsburgh)
68A	Enters Busway at Monroeville Mall
EBA, EBO	Increase Service to 10-minute headway all day
EBX, EBY	EBX along with new EBY, will alternate stops on the East Busway between Monroeville Mall and downtown Pittsburgh
WCTA Service on SR22	Off-peak service would stop at Monroeville Mall, then enter Busway to downtown Pittsburgh
Other WCTA Routes	Enter East Busway at Keystone Commons rather than Wilkinsburg

* The above service changes were assumed as part of the ECTS analysis for this alternative. A more detailed assessment of service changes will be undertaken for this corridor should it be considered in future studies.

Ridership

According to the SPC travel demand model, the extension of the East Busway to Monroeville Mall would bring the total number of daily boardings on the East Busway to approximately 41,500 by the year 2025. Additionally, the daily boardings on the region's transit system would increase by 8,400.

O&M Costs

As illustrated in **Exhibit 6-17**, O&M costs for EB-BW were based on three variables including annual vehicle hours, annual vehicle miles, and daily peak vehicles for all buses in the PAAC and WCTA network, as discussed in Section 6.3. Quantities were estimated from the SPC travel demand model with the 6.6-mile busway extension coded from Swissvale to Monroeville and the following service levels for the PAAC and WCTA bus networks:

- Line-haul from Downtown to Monroeville: 42-minute run time and 15.6-mile trip length
- Line-haul from Downtown to Oakland: 8-minute runtime and 4.3-mile trip length

- Skip-Stop from Downtown to Monroeville: 32-minute runtime and 15.6-mile trip length

As with other alternatives, daily service periods extended from 5:00 am to 12:00 am for 254 weekdays and 111 weekend days and holidays (combined weighted factor of 298). These quantities were multiplied by their appropriate unit costs to arrive at incremental annual O&M costs for each service level as provided under "Change in Annual Cost" in **Exhibit 6-17**. The systemwide increase in operation and maintenance costs would total approximately \$7.8 million annually for PAAC and \$3.0 million annually for WCTA based on the changes to service specified in **Exhibit 6-16**. The total change in O&M costs for EB-BW (Monroeville) would be \$10.9 million.

Exhibit 6-17: Net O&M Costs (EB-BW Monroeville)

	Port Authority Bus			WCTA Bus		
	Annual Vehicle Hours	Annual Vehicle Miles	Daily Peak Vehicles	Annual Vehicle Hours	Annual Vehicle Miles	Daily Peak Vehicles
Change in Annual Quantities	114,785	940,259	37	44,376	718,084	37
Unit Costs	\$39.70	\$1.53	\$49,507.16	\$31.35	\$0.28	\$39,052.91
Change in Annual Cost	\$4.6 m	\$1.4 m	\$1.8 m	\$1.4 m	\$0.20 m	\$1.4 m
Total Change in Annual Cost	\$7.9 m			\$3.0 m		
Grand Total	\$10.9 million					

Capital Costs

Capital cost estimates were developed for a 6.6-mile extension of the current East Busway facility from Swissvale to the Monroeville Mall. The alignment for this extension is nearly identical to that proposed for the equivalent light rail alternative discussed previously, generally paralleling the NS and Union Railroads. It should be noted that this estimate is for construction of a stand-alone busway to Monroeville that does not utilize the proposed Mon-Fayette Expressway, which would directly parallel the alignment for over three miles. A moderate reduction in capital costs may be possible by implementing a joint alignment with the Mon-Fayette Expressway.

Capital costs for this extension cover extensive structures and retaining walls through the East Pittsburgh/Turtle Creek community and elevated approach to Monroeville Mall. The costs also include a new two-lane cartway and three new stations with extensive park & ride facilities. Hard construction costs for this 6.6 mile extension, as shown in **Exhibit 6-18**, are estimated at \$225 million. Based on the proposed level of service, and in particular on the high travel demand generated by this service, an additional 84 bus vehicles (74 plus 10 spares) would be required at an estimated cost of \$28 million. Soft costs for engineering, design, management, oversight, and insurance are estimated at \$86 million. Costs for railroad right-of-way and other property for stations and parking of \$29 million bring the total implementation cost of the extension to \$368 million. As a phased option, construction only to Keystone Commons would cost approximately \$230 million.

Exhibit 6-18: Capital Costs (EB-BW Monroeville)

Category	Cost
<i>Guideway</i>	\$ 84.3 m
<i>Trackwork</i>	\$ 0.3 m
<i>Facilities</i>	\$ 18.5 m
<i>Systems</i>	\$ 0.0 m
<i>Stations</i>	\$ 63.4 m
<i>Special Conditions and Mobilization</i>	\$ 6.7 m
<i>Contingency</i>	\$ 51.9 m
<i>Vehicles</i>	\$ 27.7 m
<i>Soft Costs</i>	\$ 86.1 m
<i>Right-of-Way</i>	\$ 28.7 m
TOTAL COST	\$ 367.6 m
<i>ANNUALIZED COST</i>	\$ 31.5 m

Advantages and Disadvantages of EB-BW (Monroeville)

The following provides a general discussion of this alternative's advantages and disadvantages based on needs and technical/operational/institutional issues:

Advantages

- Utilizes and improves an existing right-of-way
- Decreases travel times from Monroeville and surrounding areas to Downtown
- Construction would not substantially affect existing service on the East Busway
- Maintains operational flexibility of the busway for local, express, and trunkline services

Disadvantages

- Minor increase in bus traffic
- Portion of alignment between Keystone Commons and Monroeville Mall is expensive due to elevated structure requirements

6.4.6 SPINE LINE CORRIDOR – LIGHT RAIL TO WILKINSBURG (SL-LRT WILKINSBURG)

General Description

This alternative, as illustrated in **Exhibit 6-19**, proposes an underground light rail line from the North Shore, through downtown Pittsburgh to Wilkinsburg following the general alignment of Centre Avenue, Forbes Avenue, and Braddock Avenue. The service would be designed to coordinate with the North Shore Connector Project in that it would begin at Allegheny Avenue, travel through the North Shore area of the City of Pittsburgh on a mixture of elevated and at-grade guideway and tunnel beneath the Allegheny River into downtown Pittsburgh where it would connect to the "T" at Gateway Center and continue on to Steel Plaza. From this point, it would travel the remainder of the way entirely underground, under Centre Avenue to approximately Kirkpatrick Street, then southeast to the intersection of Forbes and Craft Avenues. At this point it would continue beneath Forbes Avenue through Oakland and Squirrel Hill, then under Braddock Avenue and Brashear Street to the East Busway Wilkinsburg Station. This alternative assumes the North Shore Connector would be completed and operational.

Technology

Service would be provided with light rail vehicles that are electrically propelled from an overhead catenary power supply, similar to the existing PAAC "T" operation in the South Hills and Downtown. The vehicles would have the ability to operate individually and as trains with multiple vehicles coupled together and controlled by a single operator.

Service and Travel Time Characteristics

Peak service would be provided every 5 minutes and off-peak service every 7.5 minutes. End-to-end travel time from North Shore to Wilkinsburg would be approximately 23 minutes. To coordinate the PAAC bus service with the new light rail line several modifications listed in **Exhibit 6-20** were made to reduce duplications in service with the introduction of light rail service.

Travel time on SL-LRT (Wilkinsburg) would be 17 minutes less than the existing on-street bus Route 61A between Wilkinsburg and downtown Pittsburgh, a 34% reduction in transit travel time.

Ridership

The SPC travel demand model projected 39,400 daily trips on the new light rail line in the year 2025.

ATTRIBUTES AT-A-GLANCE

Light Rail Transit from Downtown Pittsburgh (North Shore) through the Hill District to Oakland and Wilkinsburg



Existing "T" (Light Rail)

General Description:

Mode: *Light Rail Transit – Fully Underground*
 Length: *8.4 miles (Downtown - Wilkinsburg)*

Stations Served:
*Allegheny** Forbes/Craft (P+R)*
*North Shore** Forbes/Atwood*
Gateway Center Schenley Plaza*
Wood Street Forbes/Morewood*
Steel Plaza Forbes/Murray*
Civic Arena Forbes/Braddock
Dinwiddie St. Wilkinsburg (P+R)
Soho Street

* - existing station, ** - North Shore Connector Project

Service Characteristics:

Travel Time: *23 minutes (Downtown - Wilkinsburg)*
 Peak / Off-Peak Headway: *5 minutes / 7 ½ minutes*
 Projected Daily Riders: *39,400*
 New Transit Riders: *8,900*

Cost Estimates (2002 Dollars):

O&M Costs: *\$12.3 million / year*
 Capital Costs: *\$2.5 billion*

Exhibit 6-19: Spine Line Corridor - Light Rail to Wilkinsburg (SL-LRT Wilkinsburg)

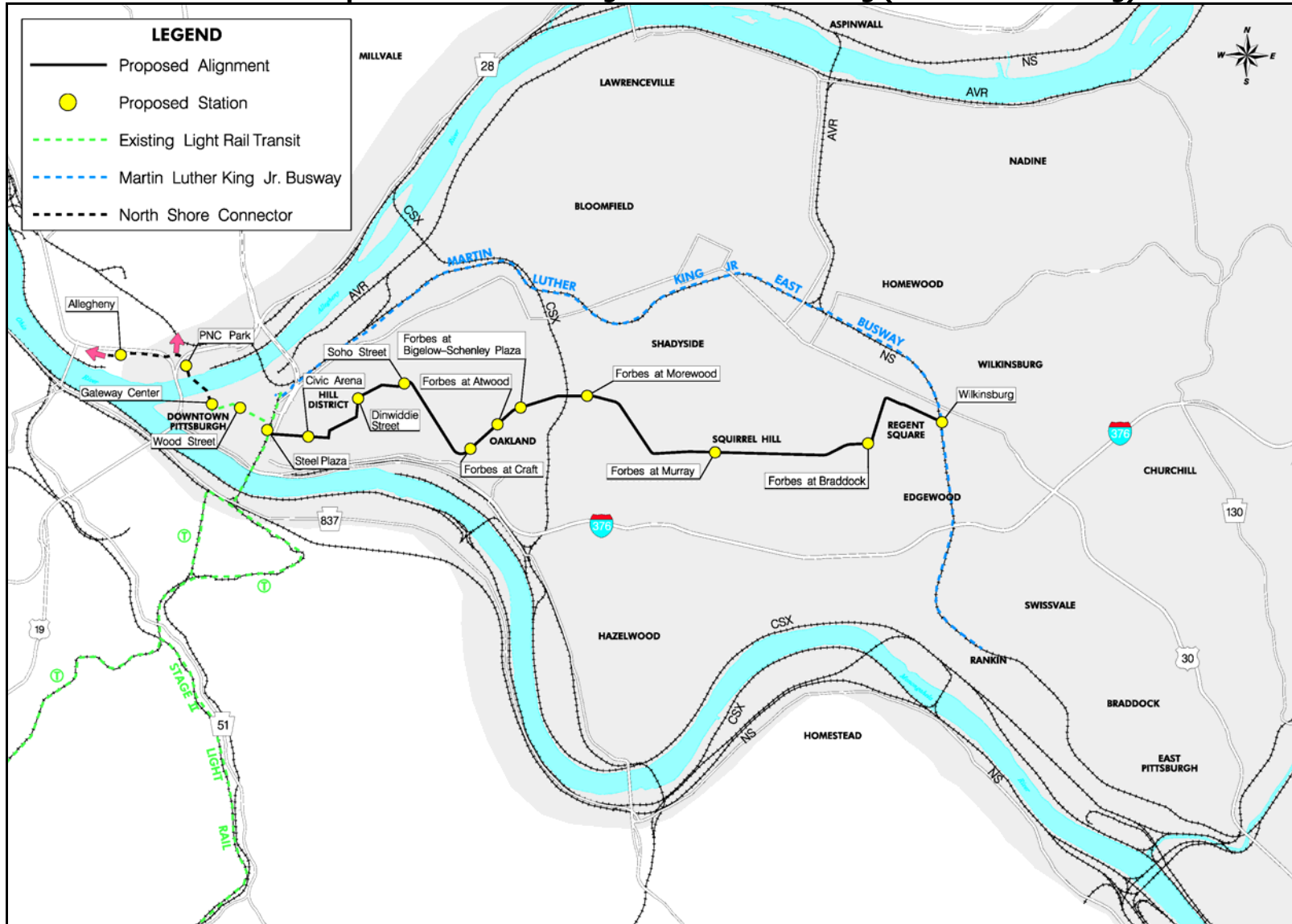


Exhibit 6-20: Changes to Existing Bus Service (SL-LRT Wilkinsburg)

Route	Change
61A	Replace with Light Rail Service
61C	Truncate at Forbes at Murray for Transfer to Light Rail Service
67A,67C,67E,67F	Truncate at Forbes at Morewood Murray for Transfer to Light Rail Service
71A,71C	Truncate at Forbes at Craft Murray for Transfer to Light Rail Service

* The above service changes were assumed as part of the ECTS analysis for this alternative. A more detailed assessment of service changes will be undertaken for this corridor should it be considered in future studies.

O&M Costs

As illustrated in **Exhibit 6-21**, O&M costs for SL-LRT (Wilkinsburg) were based on the three variables presented in Section 6.3, including annual train hours, annual vehicle miles, and daily peak vehicles. Quantities were estimated based on a 23-minute run time, 8.4-mile length between Wilkinsburg and the North Shore, daily service period from 5:00 am to 12:00 am for 254 weekdays and 111 weekend days and holidays. Train lengths were based on the estimated ridership during the peak of the peak period, which required two cars during peak periods and one car during off-peak periods. These quantities were then multiplied by their appropriate unit costs to arrive at incremental annual O&M costs for each service level as provided under "Change in Annual Cost" in **Exhibit 6-21**. As a result, approximately \$22.7 million would be required for operation and maintenance of the light rail service with a savings of about \$10.4 million from reductions in bus service that would otherwise be duplicative. The result is an overall system-wide increase in O&M costs of approximately \$12.3 million annually.

Exhibit 6-21: Net O&M Costs (SL-LRT Wilkinsburg)

	Rail			Port Authority Bus		
	Train Hours	Vehicle Miles	Peak Vehicles	Vehicle Hours	Vehicle Miles	Peak Vehicles
Change in Annual Quantities	87,138	1,366,920	34	-180,623	-1,140,817	-30
Unit Costs	\$69.53	\$6.09	\$246,059.83	\$39.70	\$1.53	\$49,507.16
Change in Annual Cost	\$6.1 m	\$8.3 m	\$8.4 m	-\$7.2 m	-\$1.7 m	-\$1.5 m
Total Change in Annual Cost	\$22.7 m			-\$10.4 m		
Grand Total	\$12.3 million					

Capital Costs

For a variety of reasons including the nature of the surrounding development, and the high level of service necessary to effectively carry the passenger demand, the SL-LRT (Wilkinsburg) has been designed for the purpose of this study as a fully underground alternative. The new alignment from Wilkinsburg and Oakland to Downtown was also tied into the existing "T" light rail system with service operating through Downtown to the North Shore. Provisions were made in the cost estimate for improvements and modifications to the existing system that would allow for this through service. This includes a new signal system capable of 40 trains per hour per direction, lengthening of existing stations to allow for 3 car trains, and a grade-separated junction south of Steel Plaza to minimize conflicts where the Spine Line and South Hills services converge. The construction cost for these upgrades, as well as for 7.3 miles of new tunnel alignment with 10 new underground stations and a

new maintenance facility is estimated at \$1,693 million. An estimated fleet of 40 light rail vehicles (34 plus 6 spares) adds \$132 million. Costs for property (primarily for stations) of \$31 million, and for engineering, design, management, oversight, and insurance of \$641 million bring the total estimated implementation cost of this alternative to \$2,497 million. Capital Costs are shown by category in **Exhibit 6-22**.

Exhibit 6-22: Capital Costs (SL-LRT Wilkinsburg)

Category	Cost
<i>Guideway</i>	\$ 617.2 m
<i>Trackwork</i>	\$ 27.4 m
<i>Facilities</i>	\$ 26.8 m
<i>Systems</i>	\$ 74.2 m
<i>Stations</i>	\$ 364.6 m
<i>Special Conditions and Mobilization</i>	\$ 192.2 m
<i>Contingency</i>	\$ 390.7 m
<i>Vehicles</i>	\$ 132.0 m
<i>Soft Costs</i>	\$ 641.1 m
<i>Right-of-Way</i>	\$ 30.6 m
TOTAL COST	\$2,496.7 m
<i>ANNUALIZED COST</i>	<i>\$ 188.7 m</i>

Advantages and Disadvantages of SL-LRT (Wilkinsburg)

The following provides a general discussion of this alternative's advantages and disadvantages based on needs and technical/operational/institutional issues:

Advantages

- Allows transfers between the Light Rail Service and the East Busway at Wilkinsburg and the "T" at Steel Plaza
- Not affected by street traffic and stoplights in Oakland
- Provides frequent, high quality service all day
- Potential to reduce bus traffic on the streets of Oakland and the Golden Triangle

Disadvantages

- Construction costs are high because of large stretch of underground alignment
- Causes major disruption during construction
- Connecting to the existing "T" at Steel Plaza would be difficult
- Requires a new maintenance facility

Alternative Options

Given the high capital expense associated this underground alternative, cost estimates for three variations were developed in an effort to identify lower cost and phased implementation options.

- **Option 1:** This option would phase the project, which would not change the overall cost, but would distribute it over two phases, including initial construction to Oakland, followed by a future extension to Wilkinsburg. The total capital cost for the initial phase to Oakland is estimated at approximately \$1.5 billion, or close to 60 percent of the implementation of the entire alternative. The second phase for the remaining 40 percent is estimated at approximately \$1.0 billion.
- **Option 2:** This option considered the cost savings of an at-grade operation through Oakland with no extension to Wilkinsburg. The feasibility of an at-grade operation and the related impacts to

automobile and pedestrian traffic require further analysis in subsequent phases of study. From a general capital cost standpoint, as much as \$300 million could be saved by constructing the line at-grade through Oakland for at total approximate capital cost of \$1.2 billion. However, assuming the same service levels, a portion of the capital cost savings could be offset by higher vehicle requirements due to longer operating times at-grade. The ridership for this option would need to be tested during the next phase of study to determine the necessary service level. O&M costs and ridership were not estimated for this alternative.

- **Option 3:** This option considered at-grade construction from Downtown to Oakland with no extension to Wilksburg. The capital costs were estimated at approximately \$600 million (or approximately \$900 million and 36% less than the underground scenario), but again, longer running times could increase vehicle requirements if the ridership required the same level of service as the original, underground alternative. The feasibility of such an operation and potential impacts should also be carefully analyzed during a subsequent phase of study. The costs of the variations presented here are intended to be order-of-magnitude guidelines of potential savings to guide the definition of future studies. O&M costs and ridership were not estimated for this alternative.

6.4.7 SPINE LINE CORRIDOR – LIGHT RAIL TO HOMESTEAD (SL-LRT HOMESTEAD)

General Description

This alternative proposes a light rail line from the North Shore to Homestead in the Monongahela Valley via Downtown, Oakland, and Hazelwood (see **Exhibit 6-23**). From Allegheny Avenue in the North Shore, this alternative would follow the same underground alignment as SL-LRT (Wilksburg) to Oakland at Craig Street. At Craig Street, it would turn south and emerge from a portal onto CSX right-of-way, which it would follow at-grade through Panther Hollow, Greenfield, and Hazelwood. The alignment would cross the Monongahela River to West Homestead on a new bridge near the Glenwood Bridge, and continue along another CSX right-of-way, paralleling the south shore of the Monongahela River to the Homestead/Waterfront area, serving both the new development and the established community there. The total length of the alignment would be approximately 9.7 miles.

Technology

Service would be provided with light rail vehicles that are electrically propelled from an overhead catenary power supply, similar to the existing PAAC “T” operation in the South Hills and Downtown. The vehicles would have the ability to operate individually and as trains with multiple vehicles coupled together and controlled by a single operator.

Service and Travel Time Characteristics

This alternative would provide peak service on the light rail line every 5 minutes and off-peak service every 7.5 minutes. Several changes to the existing bus network, summarized in **Exhibit 6-24**, would be implemented to coordinate and feed into the proposed light rail service and avoid duplication between modes.

Travel from the North Shore to Homestead would be 18 minutes shorter on the light rail than on existing bus route 61C, a 43% reduction in transit travel time.

Ridership

SPC’s travel demand model projected approximately 35,700 daily boardings by 2025.

ATTRIBUTES AT-A-GLANCE

Light Rail Transit from downtown Pittsburgh (North Shore) through the Hill District to Oakland, Hazelwood and Homestead/Waterfront Area.



The Waterfront in Homestead

General Description:

- Mode: Light Rail Transit – Partial Underground
 - Length: 9.7 miles (Downtown - Homestead)
 - Stations Served:

Allegheny**	Forbes/Craft (P+R)
North Shore**	Forbes/Atwood
Gateway Center*	Craig Street
Wood Street*	Greenfield Avenue (P+R)
Steel Plaza*	Tecumseh Street
Civic Arena	Glenwood Bridge (P+R)
Dinwiddie St.	Waterfront (P+R)
Soho Street	
- * - Existing station, ** - North Shore Connector Project

Service Characteristics:

- Travel Time: 24 minutes (Downtown - Homestead)
- Peak / Off-Peak Headway: 5 minutes / 7 ½ minutes
- Projected Daily Riders: 35,700
- New Transit Riders: 8,500

Cost Estimates (2002 Dollars):

- O&M Costs: \$23 million / year
- Capital Costs: \$1.9 billion

Exhibit 6-23: Spine Line Corridor - Light Rail to Homestead (SL-LRT Homestead)

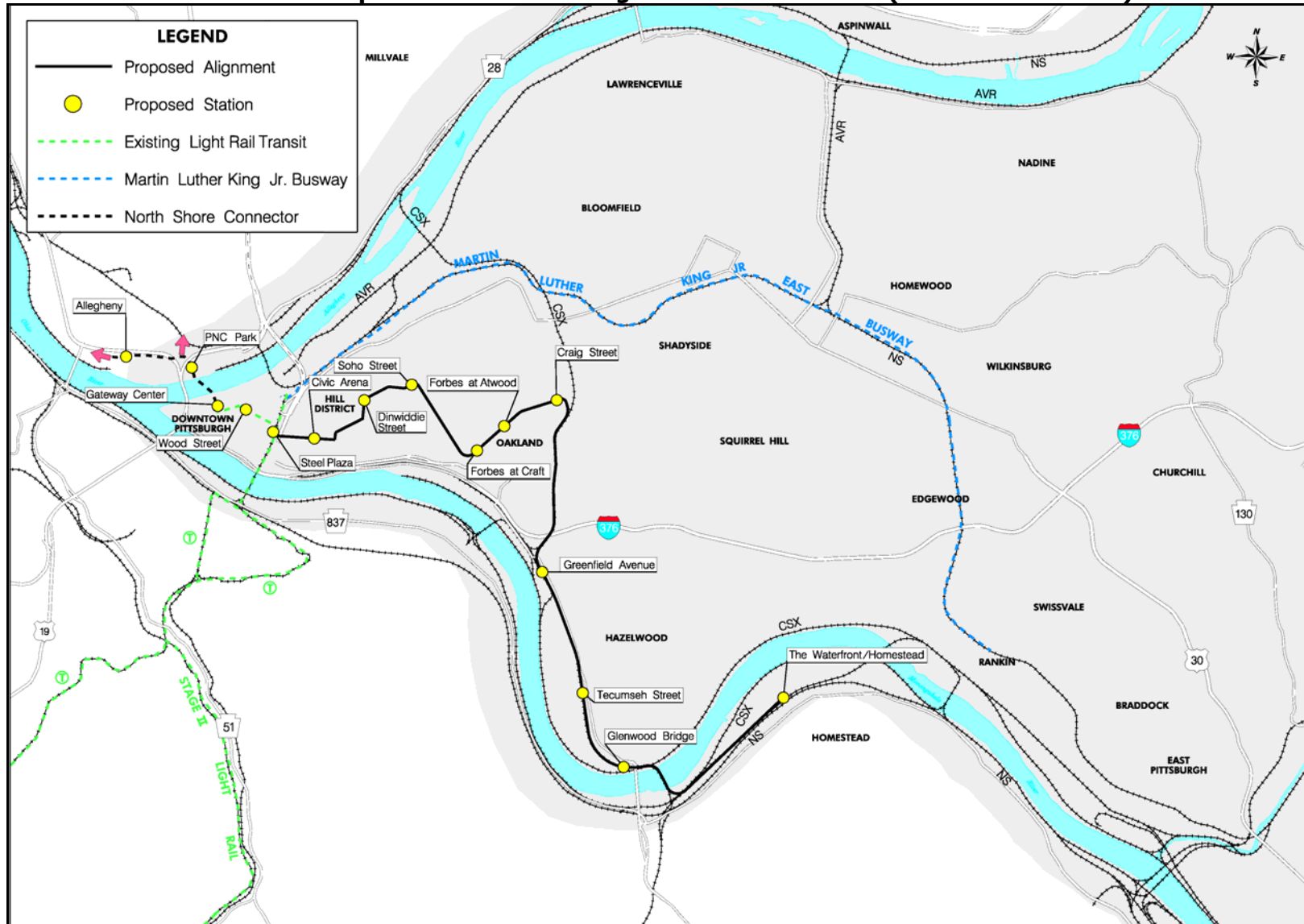


Exhibit 6-24: Changes to Existing Bus Service (SL-LRT Homestead)

Route	Change
56U,61A,61C,67A,67C,67E,71A,71B,71C	Truncate at Forbes at Craft for Transfer to Light Rail Service
56E	Truncate at Greenfield St for Transfer to Light Rail Service

* The above service changes were assumed as part of the ECTS analysis for this alternative. A more detailed assessment of service changes will be undertaken for this corridor should it be considered in future studies.

O&M Costs

As illustrated in **Exhibit 6-25**, O&M costs for SL-LRT (Homestead) were based on three variables including annual train hours, annual vehicle miles and daily peak vehicles. Quantities were estimated based on a 24-minute run time, 9.7-mile length between Homestead and the North Shore, daily service period from 5:00 am to 12:00 am for 254 weekdays and 111 weekend days and holidays. Train lengths were based on the estimated ridership during the peak of the peak period, which required three cars during peak periods and one car during off-peak periods. These quantities were then multiplied by their appropriate unit costs to arrive at incremental annual O&M costs for each service level as provided under "Change in Annual Cost" in **Exhibit 6-25**. Approximately \$30.4 million would be required for operation and maintenance of the light rail service with a savings of about \$7.4 million from reductions in bus service that would otherwise be duplicative. The result is an overall system-wide increase in O&M costs of approximately \$23.0 million annually.

Exhibit 6-25: Net O&M Costs (SL-LRT Homestead)

	Rail			Port Authority Bus		
	Annual Train Hours	Annual Vehicle Miles	Daily Peak Vehicles	Annual Vehicle Hours	Annual Vehicle Miles	Daily Peak Vehicles
Change in Annual Quantities	87,138	1,942,232	51	-128,643	-793,458	-22
Unit Costs	\$69.53	\$6.09	\$246,059.83	\$39.70	\$1.53	\$49,507.16
Change in Annual Cost	\$6.1 m	\$11.8 m	\$12.5 m	-\$5.1 m	-\$1.2 m	-\$1.1 m
Total Change in Annual Cost	\$30.4 m			-\$7.4 m		
Grand Total	\$23.0 million					

Capital Costs

Capital costs for this alternative would be identical to SL-LRT (Wilkinsburg) between Downtown and Oakland. The at-grade construction beyond Oakland in the CSX right-of-way would significantly reduce costs in comparison to SL-LRT (Wilkinsburg). Provisions were made in the cost estimate for improvements and modifications to the existing system that would allow for this through service. This includes a new signal system capable of 40 trains per hour per direction, lengthening of existing stations to allow for 3 car trains, and a grade-separated junction south of Steel Plaza to minimize conflicts where the Spine Line and South Hills services converge. The construction cost for these upgrades, as well as for 3.1 miles of new tunnel alignment, upgrading 5.1 miles of existing, at-grade track, construction of 6 new underground stations, 4 new at-grade stations, and a new maintenance facility is estimated at \$1,204 million. A fleet of 59 vehicles (51 plus 8 spares) would add \$195 million and property costs are estimated at approximately \$28 million. Soft costs for engineering, design, management, oversight, and insurance are estimated at \$466 million, bringing the total cost of the alternative to \$1,893 million, as illustrated in **Exhibit 6-26**.

Exhibit 6-26: Capital Costs (SL-LRT Homestead)

Category	Cost
<i>Guideway</i>	\$ 374.3 m
<i>Trackwork</i>	\$ 26.5 m
<i>Facilities</i>	\$ 39.3 m
<i>Systems</i>	\$ 79.1 m
<i>Stations</i>	\$ 272.4 m
<i>Special Conditions and Mobilization</i>	\$ 134.7 m
<i>Contingency</i>	\$ 277.9 m
<i>Vehicles</i>	\$ 194.7 m
<i>Soft Costs</i>	\$ 465.6 m
<i>Right-of-Way</i>	\$ 28.1 m
TOTAL COST	\$1,892.5 m
<i>ANNUALIZED COST</i>	\$ 146.9 m

Advantages and Disadvantages of SL-LRT (Homestead)

The following provides a general discussion of this alternative's advantages and disadvantages based on needs and technical/operational/institutional issues:

Advantages

- Allows transfers to the "T" at Steel Plaza
- Not affected by street traffic and stoplights in Oakland
- Provides frequent, high quality service all-day
- Potential to reduce bus traffic on the streets of Oakland and the Golden Triangle
- Serves Hazelwood, where redevelopment efforts are currently underway
- Uses existing rights-of-way from Oakland to Homestead

Disadvantages

- Construction costs are high because of large stretch of underground alignment
- Causes major disruption during construction
- Connection to the "T" at Steel Plaza would be very difficult
- Requires a new maintenance facility

Alternative Options

Given the high capital expense associated with this underground alternative, cost estimates for three variations were developed in an effort to identify lower cost and phased implementation options.

- **Option 1:** This option considered phasing the project, which would not change the overall cost, but would distribute it over two phases, including initial construction to Oakland, followed by a future extension to Homestead. The total capital cost for the initial phase to Oakland is estimated at approximately \$1,430 million, approximately 76 percent of the implementation of the entire alternative. Approximately \$463 million would be required for implementation of the second phase.
- **Option 2:** This option considered the cost savings of an at-grade operation through Oakland with no extension to Homestead. The feasibility of such an operation and the related impacts to automobile and pedestrian traffic require further analysis in subsequent phases of study. However, from a capital cost standpoint, approximately \$300 million could be saved by constructing the line at-grade through Oakland for a total capital cost of approximately \$1.1 billion. Some of the savings may be offset by higher vehicle requirements, assuming the same service level as the original alternative, due to longer operating times. Ridership would have to be tested for this option during

the next phase of study to determine the required service levels. O&M costs and ridership were not estimated for this alternative.

- **Option 3:** This option considered at-grade construction from Downtown to Oakland with no extension to Homestead. The capital costs were estimated at approximately \$600 million (or approximately \$900 million and 36% less than the underground scenario), but again, longer running times could increase vehicle requirements if the ridership required the same level of service as the original, underground alternative. The feasibility of such an operation and potential impacts should also be carefully analyzed during a subsequent phase of study. The costs of the variations presented here are intended to be order-of-magnitude guidelines of potential savings to guide the definition of future studies. O&M costs and ridership were not estimated for this alternative.

6.4.8 MONONGAHELA VALLEY CORRIDOR – LIGHT RAIL TRANSIT (MV-LRT)

General Description

This alternative proposes a light rail line from Steel Plaza in downtown Pittsburgh with branches to McKeesport and Etna, as illustrated in **Exhibit 6-27**. From Steel Plaza the alignment would follow the North Shore Connector Project’s underground extension of the “T” to just beyond the Convention Center, then continue at-grade through the Strip District along the AVR right-of-way. East of a station at 31st Street, the alignment would climb to the existing elevated CSX line at 33rd Street, where the two branches would split and turn either south to McKeesport or north to Etna.

The southern branch, to McKeesport, would travel from the 33rd Street Bridge around Polish Hill, under the Bloomfield Bridge, through the Schenley Tunnel, Oakland and Panther Hollow to the north shore of the Monongahela River in Greenfield and Hazelwood. From Hazelwood it would continue at-grade along the north shore of the Monongahela River on CSX right-of-way through Swissvale, Rankin, Braddock and North Braddock to McKeesport. The total length of the southern branch would measure 17.5 miles.

The northern branch, to Etna, would turn north at 33rd Street on the CSX Bridge and cross to the north shore of the Allegheny River, passing over Washington’s Crossing, before descending to CSX right-of-way at-grade to Millvale and Etna. From Steel Plaza to Etna, the total length of the alignment would be 5.3 miles. The 2 miles between Downtown and 33rd Street would be shared by both branches.

Technology

Service would be provided with light rail vehicles that are electrically propelled from an overhead catenary power supply, similar to the existing PAAC “T” operation in the South Hills and Downtown. The vehicles would have the ability to operate individually and as trains with multiple vehicles coupled together and controlled by a single operator.

Service and Travel Time Characteristics

The two branches would operate every 10 minutes in the peak and every 20 minutes in the off-peak. Between Steel Plaza and 31st Street, the two branch services would combine to provide 5-minute peak and 10-minute off-peak headways. One-way travel time from Downtown Pittsburgh to McKeesport would be 36 minutes and 14 minutes from Downtown to Etna.

ATTRIBUTES AT-A-GLANCE

Light Rail Transit from downtown Pittsburgh (Steel Plaza Station) through Strip District with branches to McKeesport (with service to Oakland) and Etna.



CSX ROW at Bloomfield Bridge

General Description:

Mode:

Light Rail Transit – At-grade beyond CBD

Length:

17.5 miles (Downtown – McKeesport)

5.3 miles (Downtown – Etna)

Stations Served:

<u>Main Line</u>	<u>McKeesport Branch</u>
<i>Steel Plaza*</i>	<i>Centre Avenue</i>
<i>Convention Center**</i>	<i>Oakland/CMU</i>
<i>14th Street</i>	<i>Greenfield Ave. (P+R)</i>
<i>21st Street</i>	<i>Tecumseh Street</i>
<i>31st Street</i>	<i>Glenwood Br. (P+R)</i>
	<i>Homestead</i>
<u>Etna Branch</u>	<i>Rankin</i>
<i>Millvale</i>	<i>Braddock</i>
<i>Etna (P+R)</i>	<i>McKeesport</i>

* - existing station, ** - North Shore Connector Project

Service Characteristics:

Travel Time:

36 minutes (Downtown – McKeesport)

14 minutes (Downtown – Etna)

Peak / Off-Peak Headway:

10 minutes / 20 minutes

Projected Daily Riders:

34,700

New Transit Riders:

10,700

Cost Estimates (2002 Dollars):

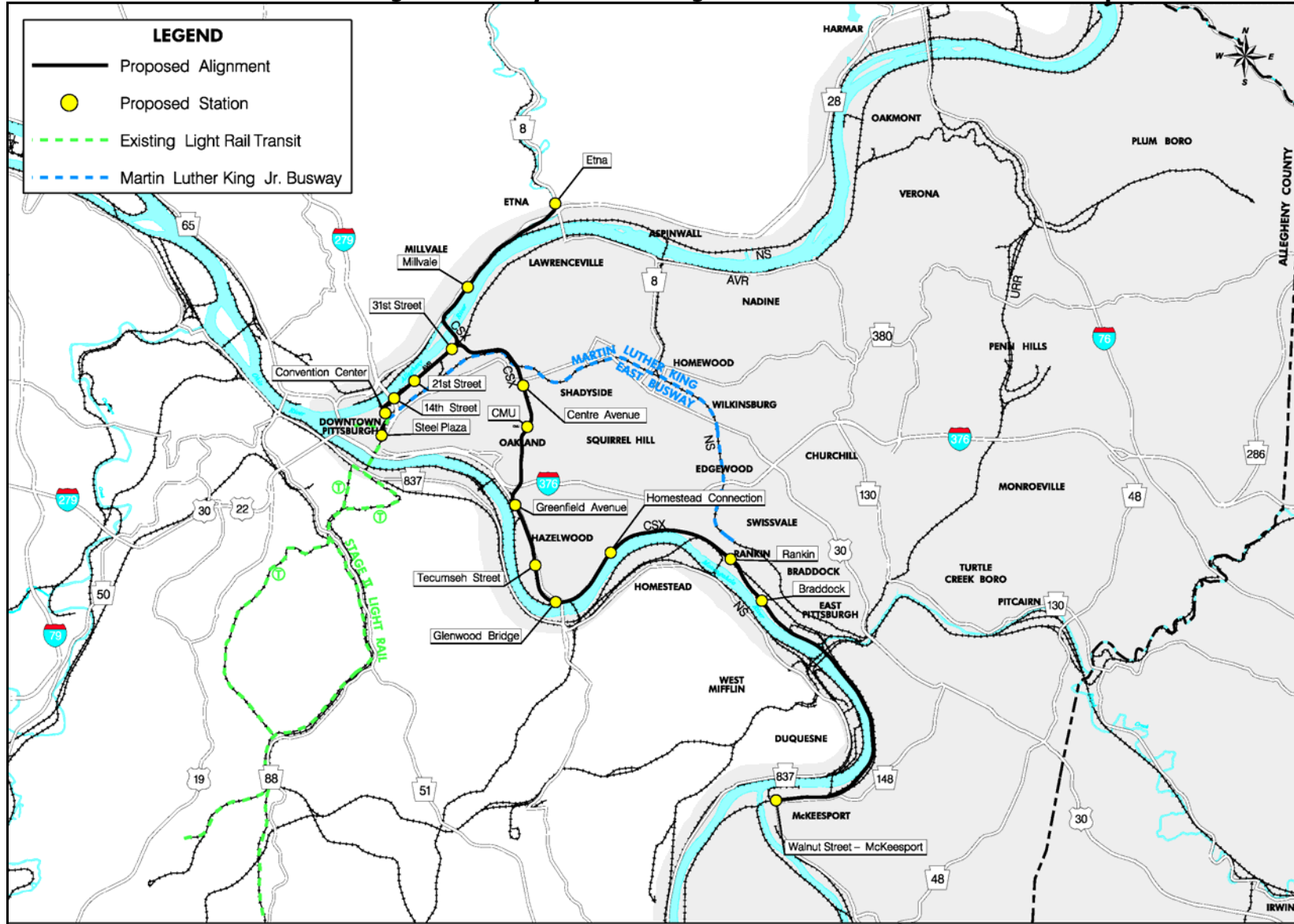
O&M Costs:

\$20.6 million / year

Capital Costs:

\$1.1 billion

Exhibit 6-27: Monongahela Valley Corridor - Light Rail Transit to Etna and McKeesport



Service changes, listed in **Exhibit 6-28** and **Exhibit 6-29**, would be made to existing bus routes to feed the light rail system and avoid duplications in service.

Travel on the Monongahela Valley light rail between McKeesport and Downtown would be 35 minutes faster than on the currently operating Route 61C, a transit travel time reduction of 49%. Similarly, travel between Downtown and Etna would be 12 minutes faster on the new light rail than on the currently operating Route 1A, a 50% reduction in transit travel time.

Exhibit 6-28: Changes to Existing Bus Service (MV-LRT McKeesport Branch)

Route	Change
51E	Cross Glenwood Bridge and Truncate at Glenwood Bridge light rail station
56B	Replace with Light Rail Service
56E	Truncate at Greenfield for Transfer to Light Rail Service
56U	Extend to Waterfront via Johnson Avenue
58C,58P,58V	Replace with Light Rail Service
60A,60P	Extend service hours.
63A	Extend service to new Braddock light rail station
63B	Extend to Rankin light rail station

* The above service changes were assumed as part of the ECTS analysis for this alternative. A more detailed assessment of service changes will be undertaken for this corridor should it be considered in future studies.

Exhibit 6-29: Changes to Existing Bus Service (MV-LRT Etna Branch)

Route	Change
1B,1C,3D,R,D,DB	Truncate at Etna for Transfer to Light Rail Service
1D	Extend service to Etna and reroute through Cherry City to Millvale, then via original route to downtown Pittsburgh
1F	Truncate at Millvale for Transfer to Light Rail Service

* The above service changes were assumed as part of the ECTS analysis for this alternative. A more detailed assessment of service changes will be undertaken for this corridor should it be considered in future studies.

Ridership

Daily boardings in 2025 were estimated at 34,700.

O&M Costs

As illustrated in **Exhibit 6-30**, O&M costs for MV-LRT were based on three variables including annual train hours, annual vehicle miles, and daily peak vehicles. Quantities were estimated for each branch as well as an additional, peak-period short-turn service with the following characteristics:

- Downtown to McKeesport: 36-minute run time, 17.5-mile length
- Downtown to Etna: 15-minute run time, 5.3-mile length
- Short-Turn (Downtown to Oakland/CMU): 13-minute run time, 4.3-mile length

The daily service period extended from 5:00 am to 12:00 am for 254 weekdays and 111 weekend days and holidays. Train lengths were based on the estimated ridership during the peak of the peak period, which required three cars on each of the main services, one car on the short-turn during peak periods and one car during off-peak periods (the short-turn does not operate off-peak). These quantities were then multiplied by their appropriate unit costs to arrive at incremental annual O&M costs for each

service level as provided under "Change in Annual Cost" in **Exhibit 6-30**. Approximately \$28.0 million would be required for operation and maintenance of the light rail service with a savings of about \$7.4 million from reductions in bus service that would otherwise be duplicative. The result is an overall system-wide increase in O&M costs of approximately \$20.6 million annually.

Exhibit 6-30: Net O&M Costs (MV-LRT)

	Rail			Port Authority Bus		
	Train Hours	Vehicle Miles	Peak Vehicles	Vehicle Hours	Vehicle Miles	Peak Vehicles
Change in Annual Quantities	65,060	2,110,971	43	-104,526	-1,018,642	-34
Unit Costs	\$69.53	\$6.09	\$246,059.83	\$39.70	\$1.53	\$49,507.16
Change in Annual Cost	\$4.5 m	\$12.9 m	\$10.6 m	-\$4.1 m	-\$1.6 m	-\$1.7 m
Total Change in Annual Cost	\$28.0 m			-\$7.4 m		
Grand Total	\$20.6 million					

Capital Costs

Construction costs for this alternative (guideway, trackwork, facilities, systems, stations, special conditions, mobilization, and contingency), shown in **Exhibit 6-31**, are estimated at \$595 million for 20.7 new miles of alignment. This includes an extension of the tunnel from the Convention Center Station toward the Strip District, widening of the Schenley Tunnel, and major rehabilitation of the 33rd Street CSX structure and bridge. These costs also include upgrades to the track, systems, facilities, and the construction of 14 new stations including one underground station under Centre Avenue, and a maintenance facility. Many of the stations would include significant park & ride facilities. The level of service for estimated ridership would require a fleet of 50 light rail vehicles (43 plus 7 spares), costing \$165 million. Soft costs for engineering, design, management, oversight, and insurance, are estimated at \$240 million. When combined with \$62 million in property for stations, parking, and railroad right-of-way, the overall implementation cost is estimated at approximately \$1,062 million.

Exhibit 6-31: Capital Costs (MV-LRT)

Category	Cost
<i>Guideway</i>	\$ 126.7 m
<i>Trackwork</i>	\$ 45.3 m
<i>Facilities</i>	\$ 34.7 m
<i>Systems</i>	\$ 70.0 m
<i>Stations</i>	\$ 123.4 m
<i>Special Conditions and Mobilization</i>	\$ 57.4 m
<i>Contingency</i>	\$ 137.2 m
<i>Vehicles</i>	\$ 165.0 m
<i>Soft Costs</i>	\$ 240.4 m
<i>Right-of-Way</i>	\$ 61.8 m
TOTAL COST	\$1,061.8 m
<i>ANNUALIZED COST</i>	\$ 84.9 m

Advantages and Disadvantages of MV-LRT

The following provides a general discussion of this alternative's advantages and disadvantages based on needs and technical/operational/institutional issues:

Advantages

- Utilizes existing railroad rights-of-way
- Provides a north-south transit line that connects Oakland to the Allegheny Valley and McKeesport
- Serves the large travel market on the north shore of the Allegheny River
- Serves the Carrie Furnace redevelopment area
- Provides improved transit between Pittsburgh, Etna, Oakland, and McKeesport
- Provides frequent, high quality service all day

Disadvantages

- Steep slopes near the alignment would decrease walk-up patronage in some areas
- Does not provide east-west access through Oakland
- Possible interference to construction and operation between Rankin and McKeesport due to heavy freight traffic on CSX right-of-way
- Requires a new maintenance facility
- Does not serve Hill District

Alternative Options

Both the Etna and McKeesport services could be implemented as separate and unique projects given their common alignments from Downtown to 33rd Street and reasonable ridership estimates along each branch. Attributes of both were developed as follows.

Option 1 (Etna Branch): Downtown to Etna with approximately 5.2 miles of new alignment and 5 new stations would have the following attributes:

- Service: 10-minute peak and 20-minute off-peak
- Capital Cost: \$369 million
- O&M Costs: \$4.0 million annually
- Daily Boardings: 14,900

Option 2 (McKeesport Branch): Downtown to McKeesport with approximately 17.3 miles of new alignment and 12 new stations would have the following attributes:

- Service: 10-minute peak and 20-minute off-peak
- Capital Cost: \$805 million
- O&M Costs: \$16.5 million annually
- Daily Boardings: 19,800

It is important to note that the combined capital cost for the two options (branches) is greater than for the total alternative. The difference results from the common section between Downtown and 33rd Street being included twice – once for each branch – assuming separate construction, and once in the full alternative.

6.4.9 NORFOLK SOUTHERN CORRIDOR – COMMUTER RAIL (NS-CR)

General Description

This alternative proposes a commuter rail line from the Amtrak Station in downtown Pittsburgh to Greensburg in Westmoreland County, as illustrated in **Exhibit 6-32**. The 30.9-mile alignment, which would be within existing NS right-of-way, would extend from Pittsburgh along the Strip District, around Polish Hill, through East Liberty and Wilksburg, to Swissvale, Braddock, East Pittsburgh, Wilmerding, and Trafford in Allegheny County, and Irwin, Jeannette and Greensburg in Westmoreland County.

Technology

Diesel locomotives capable of push-pull operation would be utilized to propel coach and cab cars to transport passengers. Push-pull capability simplifies operation and reduces the time required to prepare a train to reverse travel direction. The engineman can operate the train from either the locomotive, if it is in the front of the train, or from a small cab at the other end of the train, with controls that are linked to the locomotive in the rear of the train.

Service and Travel Time Characteristics

This alternative is intended to be primarily a commuter service, and as such would operate on 30-minute peak headways and 90-minute off-peak headways. One-way travel time from Pittsburgh to Greensburg would be 49 minutes. Changes to existing bus service, listed in **Exhibit 6-33**, would be made to reduce duplications in the study area's transit service.

Travel time between Greensburg and Downtown is 41 minutes faster than WCTA's Route 1F, the only existing service between those two locations. Transit travel time would be reduced 43% between Greensburg and downtown Pittsburgh.

Ridership

The SPC travel demand model projected 8,800 daily trips in the year 2025 attributable to NS-CR.

ATTRIBUTES AT-A-GLANCE

Commuter Rail from Downtown Pittsburgh (Amtrak Station) to Greensburg in Westmoreland County.



Greensburg Station

General Description:

Mode:

Commuter Rail – Locomotive & Coaches

Length:

30.9 miles (Downtown – Greensburg)

Stations Served:

*Pittsburgh Amtrak Station**

Wilksburg

East Pittsburgh

Trafford

Irwin

Jeannette

*Greensburg**

* existing Amtrak station

Service Characteristics:

Travel Time:

49 minutes (Downtown – Greensburg)

Peak / Off-Peak Headway:

30 minutes / 90 minutes

Projected Daily Riders:

8,800

New Transit Riders:

4,600

Cost Estimates (2002 Dollars):

O&M Costs:

\$16.5 million / year

Capital Costs:

\$233 million

Exhibit 6-32: Norfolk Southern Corridor - Commuter Rail to Greensburg

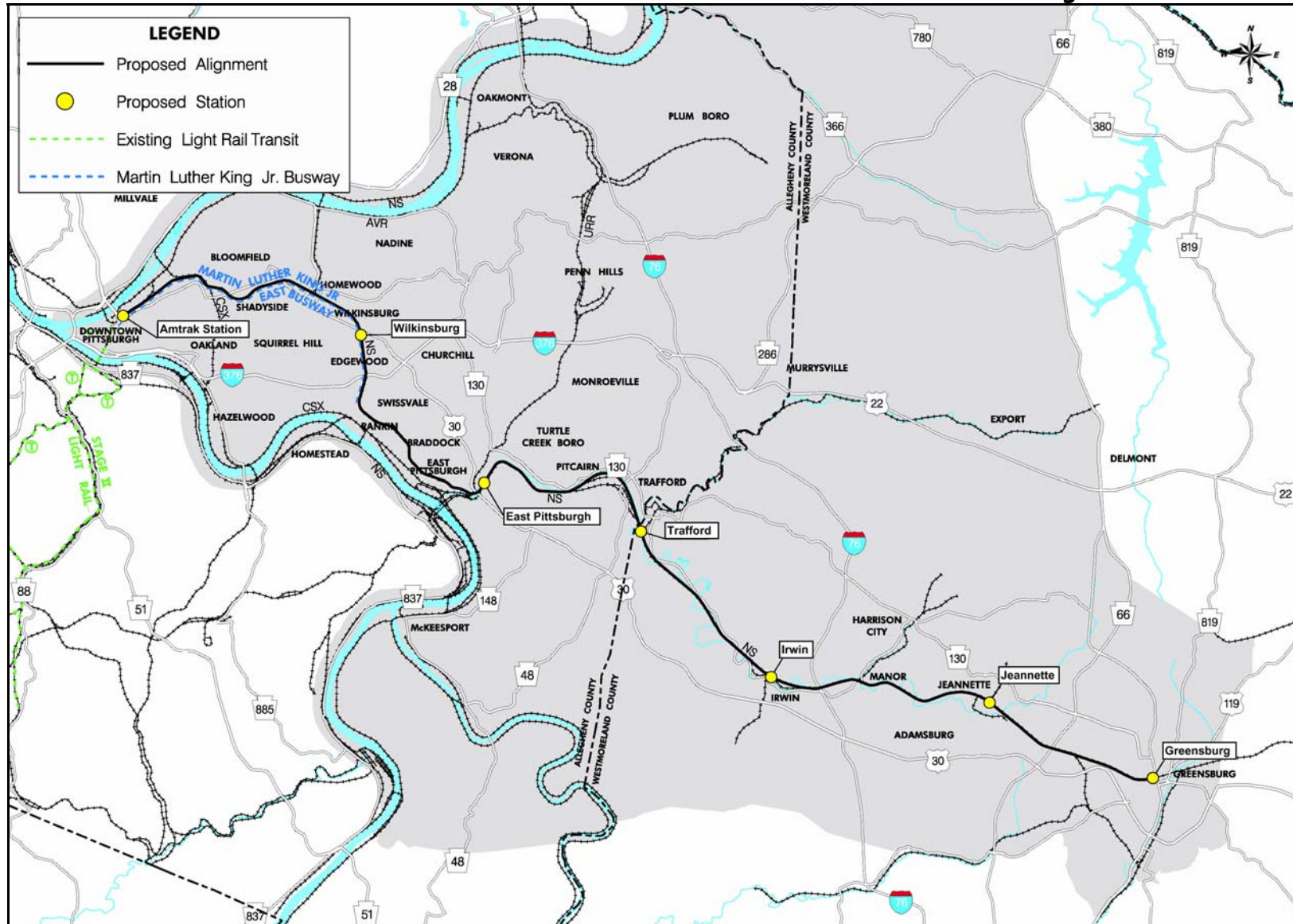


Exhibit 6-33: Changes to Existing Bus Service (NS-CR)

Route	Change
T	Replace with Commuter Rail Service
GR	Truncate at Trafford Station for Transfer to Commuter Rail Service

* The above service changes were assumed as part of the ECTS analysis for this alternative. A more detailed assessment of service changes will be undertaken for this corridor should it be considered in future studies.

O&M Costs

As illustrated in **Exhibit 6-34**, O&M costs for NS-CR were based on three variables, presented in Section 6.3, including annual vehicle hours, annual vehicle miles, and daily peak vehicles. Quantities were estimated based on a 49-minute run time, 30.9-mile length between Greensburg and Downtown, daily service period from 5:00 am to 12:00 am for 254 weekdays and 111 weekend days and holidays. Train lengths were based on the estimated ridership during the peak of the peak period, which required four coach cars during peak periods and two coach cars during off-peak periods. These quantities were then multiplied by their appropriate unit costs to arrive at incremental annual O&M costs for each service level as provided in **Exhibit 6-34** under "Change in Annual Cost". NS-CR also included a track access fee of \$10 per vehicle mile for use of the NS right-of-way. Combined, the changes in annual costs and the annual track access fee total approximately \$17.9 million for operation and maintenance of the commuter rail service. A savings of about \$1.4 million would be produced from reductions in bus service that would otherwise be duplicative. The result is an overall system-wide increase in O&M costs of approximately \$16.5 million annually for NS-CR.

Exhibit 6-34: Net O&M Costs (NS-CR)

	Commuter Rail			Port Authority Bus		
	Annual Vehicle Hours	Annual Vehicle Miles	Daily Peak Vehicles	Annual Vehicle Hours	Annual Vehicle Miles	Daily Peak Vehicles
Change in Annual Quantities	46,949	1,223,715	16 coach cars	-18,972	-156,831	-9
Unit Costs	\$131.73	\$2.25	\$300,307.70	\$39.70	\$1.53	\$49,507.16
Change in Annual Cost	\$6.2 m	\$2.7 m	\$4.8 m	\$0.75 m	\$0.24 m	\$0.45 m
Total Change in Annual Cost	\$13.7 m + \$4.2 m (track access fees)			-\$1.4 m		
Grand Total	\$16.5 million					

Capital Costs

Construction costs for a commuter rail service between Pittsburgh and Greensburg along the NS mainline are for the construction of stations and parking along the existing railroad, but also for key improvements to the existing railroad infrastructure. This will allow Norfolk Southern to better accommodate such an operation without jeopardizing current and future movements of freight and Amtrak passenger trains. Specifically, the estimated construction costs of \$127 million, shown in **Exhibit 6-35**, includes the construction of a third track between East Pittsburgh (the junction of the NS Mon River Line and Pittsburgh Main Line) and Greensburg, associated signal improvements and interlockings, additional interlockings and signal system improvements between East Pittsburgh and Downtown to enhance operational flexibility. Costs were included to upgrade the existing Amtrak Station in Pittsburgh, build the necessary platforms and other station components at the remaining six stations, and construct substantial park & ride facilities. Also included was a vehicle maintenance and

storage facility for a new commuter rail fleet. A commuter rail fleet of 5 locomotives and 19 cab/coach cars (16 plus 3 spares) is estimated to cost an additional \$46 million. Property costs are estimated at approximately \$8 million and are for station and park & ride property. Costs for railroad property are not included as Norfolk Southern would retain full ownership of the railroad and its infrastructure, however, a track access fee has been applied to the operating costs to compensate the Norfolk Southern for its increased costs associated with the NS-CR operations, a standard arrangement for commuter rail operations on Class I mainline railroads. Soft costs for engineering, design, management, oversight, and construction insurance are estimated to be \$52 million, bringing the total implementation cost of the 30.9-mile long commuter rail line to \$233 million.

Exhibit 6-35: Capital Costs (NS-CR)

Category	Cost
<i>Guideway</i>	\$ 4.5 m
<i>Trackwork</i>	\$ 15.1 m
<i>Facilities</i>	\$ 12.0 m
<i>Systems</i>	\$ 31.4 m
<i>Stations</i>	\$ 23.0 m
<i>Special Conditions and Mobilization</i>	\$ 11.4 m
<i>Contingency</i>	\$ 29.2 m
<i>Vehicles</i>	\$ 46.0 m
<i>Soft Costs</i>	\$ 51.8 m
<i>Right-of-Way</i>	\$ 8.4 m
TOTAL COST	\$ 232.8 m
<i>ANNUALIZED COST</i>	<i>\$ 19.1 m</i>

Advantages and Disadvantages of NS-CR

The following provides a general discussion of this alternative's advantages and disadvantages based on needs and technical/operational/institutional issues:

Advantages

- Utilizes existing railroad right-of-way
- Provides a high quality transit option that reduces travel times significantly between Greensburg and Pittsburgh with a fully grade separated alignment
- Has potential to reduce congestion on Parkway East, US 30 and US 22
- Provides convenient, high quality transportation between Greensburg and Pittsburgh
- Serves two counties with a major fixed guideway transit investment that operates in peak and off-peak periods

Disadvantages

- All movements on the line would likely be controlled by the owner--Norfolk Southern
- Both NS and Amtrak movements would presumably have priority over the commuter service
- Commuter rail is a labor intensive mode due to industry staffing requirements (e.g. engineers and conductors)
- Requires new vehicle maintenance and yard facilities because it differs from existing modes

Alternative Options

In an effort to test the potential for implementing an interim, lower cost commuter rail service in the Allegheny Valley Corridor, two additional estimates were prepared as follows:

Option 1 – Starter System: This option assumes a lower service level operating every 60 minutes during the peak period instead of every 30 minutes causing a reduction in overall rolling stock requirements. This option also assumes no purchase of right-of-way with a track usage fee applied to the operating costs. The full vehicle maintenance facility and yard would be replaced with a minimal facility and yard with certain heavy maintenance functions outsourced to another railroad maintenance facility in the region. Station investments would be significantly reduced to “barebones” platforms and shelters with reductions in park & ride provisions. The resulting alternative would have the following attributes:

- Service: 60-minute peak and 90-minute off-peak
- Capital Cost: \$142 million (39% less than NS-CR)
- O&M Costs: \$12.7 million annually (23% less than NS-CR)
- Daily Boardings: 4,400 (50% less than NS-CR)

Option 2 – Minimal Investment: This option would have drastically reduced service with only two inbound morning trains and two returning outbound trains in the afternoon. Capital investment reductions would be similar to Option 1 with other reductions including fewer park & ride spaces and used rolling stock. In addition, this alternative assumes a 50% reduction in soft costs and contingency costs which provide a significantly reduced capacity for project management, engineering, design and unforeseen construction impacts and costs that are impossible to assess at this level of planning. The attributes of this option are as follows:

- Service: two trains in am peak direction and pm peak direction
- Capital Cost: \$76 million (71 % less than NS-CR)
- O&M Costs: \$4.8 million annually (71% less than NS-CR)
- Daily Boardings: 2,500 (72% less than NS-CR)

It should be noted that for both options above, some foregone investments will likely reemerge in the form of upgrades and improvements that will be required after a short period of operation.

A summary of the eight Build Alternatives and their variations is provided in **Exhibit 6-36**. The exhibit presents each alternative’s alignment length and number of stations, service characteristics, travel time, year 2025 boardings, and capital and O&M costs.

Exhibit 6-36: Attributes of Short List Build Alternatives*

	Alternative	Total Length (miles)	Number of Stations	Service Peak/ Off-Peak (minutes)	Travel Time (minutes)	Daily Boardings (in year 2025)	Annual Incremental O&M Cost (2002 millions)	Capital Cost (2002 millions)
1	AV-CR	18.4	9	30 / 90	34 - Strip Dist. to Arnold	6,700	\$8.8	\$258.7
1a	AV-CR Starter System	18.4	9	60 / 90	34 - Strip Dist. to Arnold	1,900	\$5.3	\$131.0
1b	AV-CR Minimal Investment	18.4	9	Two AM trains Two PM trains	40 - Strip Dist. to Arnold	800	\$2.6	\$64.0
2	AV-LRT	19.3 (18.9 new)	14 (12 new)	10 / 20	37 - Steel Plaza to Arnold	18,200	\$16.3	\$803.6
3	EB-LRT (Monroeville)	17.4 (16.9 new)	19 (17 new)	10 / 15	39 - Steel Plaza to Monroeville 13 - Steel Plaza to CMU 32 - CMU to Monroeville	42,900	\$25.0	\$1,273.3 <i>(\$1,040 to Keystone Commons)</i>
3a	EB-LRT Extension to Murrysville	6.2 additional	4 additional	10 / 15	54 - Steel Plaza to Murrysville 13 - Steel Plaza to CMU 32 - CMU to Monroeville	3,800 additional	\$8.3 additional	\$741.6 additional
4	EB-BW (Monroeville)	15.6 (6.6 new)	15 (5 new)	10 / 15	42 - Penn Sta. to Monroeville 8 - Penn Sta. to Centre Ave. 38 - Center Ave. to Monroeville	41,500	\$10.9	\$367.6 <i>(\$230 to Keystone Commons)</i>
5	SL-LRT (Wilkinsburg)	8.8 (7.3 new)	15 (10 new)	5 / 7.5	23 - Steel Plaza to Wilkinsburg 12 - Steel Plaza to Oakland	39,400	\$12.3	\$2,496.7 <i>(Phase I: \$1,500, Phase II: \$1,000) (At-grade in Oakland and no extension to Wilkinsburg: \$1,200) (At-grade Downtown to Oakland \$600)</i>
6	SL-LRT (Homestead)	10.3 (8.8 new)	15 (10 new)	5 / 7.5	24 - Steel Plaza to Homestead 12 - Steel Plaza to Oakland	35,700	\$23.0	\$1,892.5 <i>(Phase I: \$1,430, Phase II: \$463) (At-grade in Oakland and no extension to Homestead: \$1,100) (At-grade Downtown to Oakland \$600)</i>
7	MV-LRT	21.0 (20.7 new)	16 (14 new)	10 / 20	14 - Steel Plaza to Etna 36 - Steel Plaza to McKeesport 13 - Steel Plaza to Oakland	34,700	\$20.6	\$1,061.8
7a	MV-LRT Etna Branch Only	5.6 (5.2 new)	7 (5 new)	10 / 20	14 - Steel Plaza to Etna 13 - Steel Plaza to Oakland	14,900	\$4.0	\$368.9
7b	MV-LRT McKeesport Branch Only	17.7 (17.3 new)	14 (12 new)	10 / 20	36 - Steel Plaza to McKeesport 13 - Steel Plaza to Oakland	19,800	\$16.5	\$804.7
8	NS-CR	30.9	7 (6 new)	30 / 90	49 - Penn Sta. to Greensburg	8,800	\$16.5	\$232.8
8a	NS-CR Starter System	30.9	7 (6 new)	60 / 90	64 - Penn Sta. to Greensburg	4,400	\$12.7	\$142.0
8b	NS-CR Minimal Investment	30.9	7 (6 new)	Two AM trains Two PM trains	64 - Penn Sta. to Greensburg	2,500	\$4.8	\$76.0

* Excludes TSM, which will be evaluated in future phases of study (e.g. AA, DEIS)

7 EVALUATION OF ATTRIBUTES, CONCLUSIONS AND NEXT STEPS

This chapter provides an analysis of the short-listed build alternatives presented in Section 6.4 based on attributes such as ridership, costs, and selected performance measures to inform regional decision-makers to advance transit improvement projects that effectively and efficiently satisfy the identified transportation and development needs in the study area. The alternatives under consideration are:

- **AV-CR:** Commuter Rail from downtown Pittsburgh to Arnold
- **AV-LRT:** Light Rail from downtown Pittsburgh to Arnold
- **EB-LRT (Monroeville/Murrysville):** Conversion of the East Busway to Light Rail from downtown Pittsburgh to Swissvale, Monroeville and eventually to Murrysville
- **EB-BW (Monroeville):** Extension of the East Busway from Swissvale to Monroeville
- **SL-LRT (Wilksburg):** Light Rail from downtown Pittsburgh to Oakland and Wilksburg
- **SL-LRT (Homestead):** Light Rail from downtown Pittsburgh to Oakland and Homestead
- **MV-LRT:** Light Rail from downtown Pittsburgh to Etna and McKeesport
- **NS-CR:** Commuter Rail from downtown Pittsburgh to Greensburg

7.1 EVALUATION MEASURES DEFINED

Seven measures were developed and applied to each alternative as follows:

- **Daily Transit Boardings (2025)** – The number of daily rides projected on each of the major transit investments described in Section 6.4. This measure represents the potential demand for the new investment based on the number of rides that it serves. Alternatives with higher boardings can reflect a system with sufficient service, competitive travel times, and travel within a densely populated service area. Lower boardings are indicative of a system with insufficient service, non-competitive travel times, and travel within a less populated service area. Lower boardings can also be attributed to the levels of service provided by the new investment and the markets served. For example, commuter rail alternatives typically have lower service frequencies than bus or light rail routes, where they seek to serve peak period commuters from long distances. In this case, lower ridership may be a result of lower service levels calibrated to the particular markets they serve and does not necessarily mean poor configuration of the alternative.
- **New Systemwide Daily Transit Passengers** – The increase in daily linked trips on the entire PAAC and WCTA transit systems due to the implementation of each alternative. This measure represents the alternative's ability to increase new riders on the entire regional transit system based on the implementation of the new investment. This measure captures new transit ridership resulting from the new investment's influence on the entire regional transit network through its enhancements to benefits such as regional transfers, total travel times, and overall convenience.
- **Capital Cost** – The cost to build each major transit investment, as described in Section 6.2. This measure represents the capital cost in 2002 dollars to implement the alternative and includes "hard" costs such as structures, trackwork, facilities, vehicles, and right-of-way, and "soft" costs such as environmental mitigation, project engineering, construction management, insurance, and contingency funds. Higher capital costs can be a function of the size of the alternative (i.e. length, number of vehicles) or complexity of the alternative (e.g. use of tunnel or elevated structures, right-of-way purchase, electrification). Lower capital costs would indicate a smaller alternative or one with less complexity (e.g. primarily at-grade, few stations). Note that this measure does not

indicate the performance of an alternative and is provided to represent the cost to implement an alternative in its entirety.

- **Annualized Capital Costs** – To facilitate the comparison of alternatives, which have annual operating and maintenance costs, plus lump sum capital costs, FTA requires that the capital costs be annualized. As noted in Section 6.2, this is done by multiplying the cost of each type of asset (such as vehicles, track, signaling, structures, etc.) by an annualization factor. This factor is based on the assumed life of the asset (25 years for rail vehicles, 12 years for buses, 30 years for structures, etc.) and a 7.0 percent discount rate as specified by the Federal Office of Management and Budget. When annualized costs are totaled for all of the assets in an alternative, the sum represents the equivalent uniform annualized capital cost for that alternative, and also represents the amount of money that would have to be invested annually to keep that alternative functioning in perpetuity. Conversion of the capital costs to annualized costs in this manner facilitates the comparison of alternatives' total costs on a normalized basis. The OMB specified methodology specifically excludes consideration of the impact of inflation.
- **Operating and Maintenance (O&M) Costs** – This measure, as described in Section 6.3, represents the additional annual costs in 2002 dollars for each alternative as compared to the No-Build, to operate and maintain the alternative on a daily basis and to keep the system in a state of good repair. O&M costs include labor, fuel or electricity, vehicle maintenance, non-vehicle maintenance (including guideway), fare collection, insurance, and administrative costs. Higher O&M costs are typical of alternatives with long service distances, frequent service, large vehicle fleets, and high ridership levels. Lower O&M costs can reflect alternatives with less frequent service, shorter alignments, and fewer riders. Note that this measure does not indicate the performance of an alternative and is provided to represent the cost to operate and maintain an alternative in its entirety.
- **Capital Cost per New Route Mile** – This measure represents the capital cost per new route mile constructed for the alternative enabling a comparison of the alternatives against costs. Total capital costs (2002 dollars) for the alternative were divided by the new route miles of the alternative. A higher capital cost per new route mile can be a function of the size of the alternative and/or complexity of the alternative as discussed above. Lower costs per new route mile could indicate a smaller alternative or one with less complexity.
- **Daily Transit Boardings per Route Mile** – This measure represents the alternative's ability to attract/generate transit trips in relation to the amount of new alignment constructed for its operation. While the distribution of passengers, especially the peak load, is not uniform across the entire alignment, this measure gives an overall view of how intensively the system is being utilized in relation to its length, an indication of its level of overall effectiveness. Daily transit boardings on the alternative are divided by route miles of the alignment. Higher daily transit boardings per new route mile can indicate a more efficient alternative.

The build alternatives and their attributes are discussed below. The TSM was not evaluated since its corridor components will automatically move forward should any of the build alternatives move to the next phases of project development.

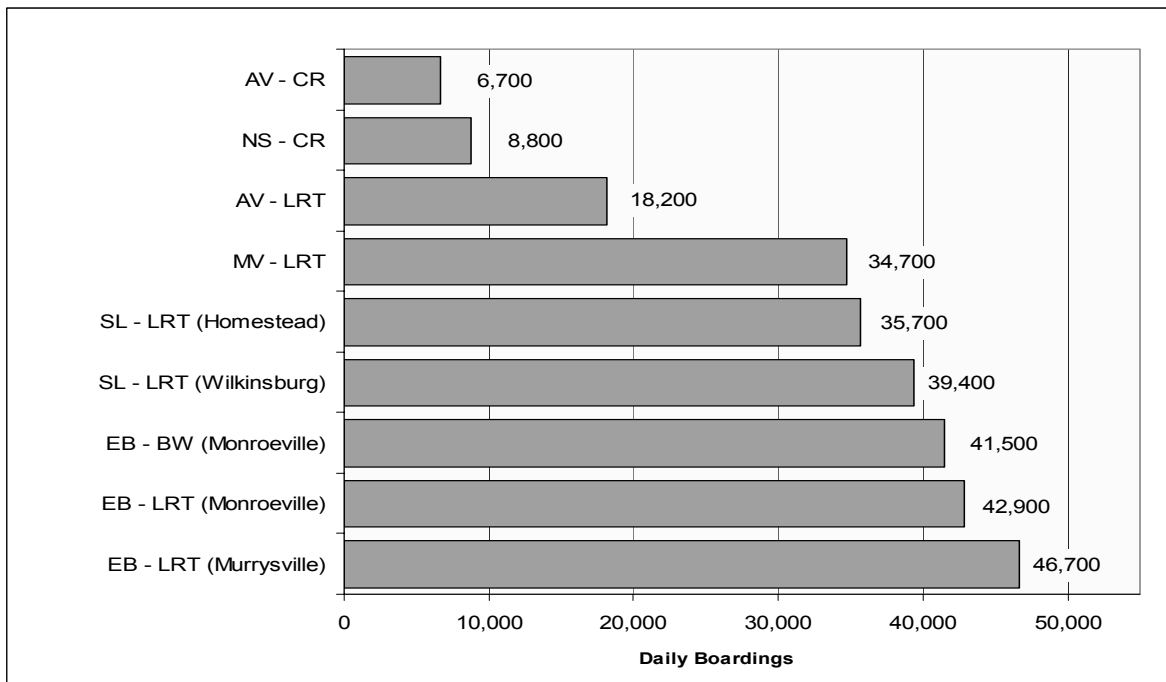
7.2 EVALUATION OF ALTERNATIVES

Values for the evaluation measures defined above are presented below for each of the build alternatives.

7.2.1 DAILY TRANSIT BOARDINGS (2025)

Exhibit 7-1 provides estimated daily transit boardings for each alternative that includes both existing transit riders attracted from currently operating transit services and new riders that did not previously use public transit.

Exhibit 7-1: Daily Transit Boardings (2025)



Daily transit boardings range from a low of 6,700 on the AV-CR alternative, to a high of 46,700 on the EB-LRT (Murrysville) alternative. Key highlights include:

- **AV-CR** is projected to attract 6,700 daily transit boardings, nearly two-thirds less than projected for light rail in the same corridor. However, this estimate is based on a lower frequency service and a reduced number of stations when compared to the light rail alternative. This alternative performs well as a commuter rail service tapping into an underserved market within the study area.
- **NS-CR** is estimated to attract 8,800 daily transit boardings, the second lowest among all alternatives but slightly higher than AV-CR, the only other commuter rail alternative. In general, the commuter rail alternatives have lower ridership levels than the light rail and busway alternatives due to their lower service frequencies and greater station spacings.

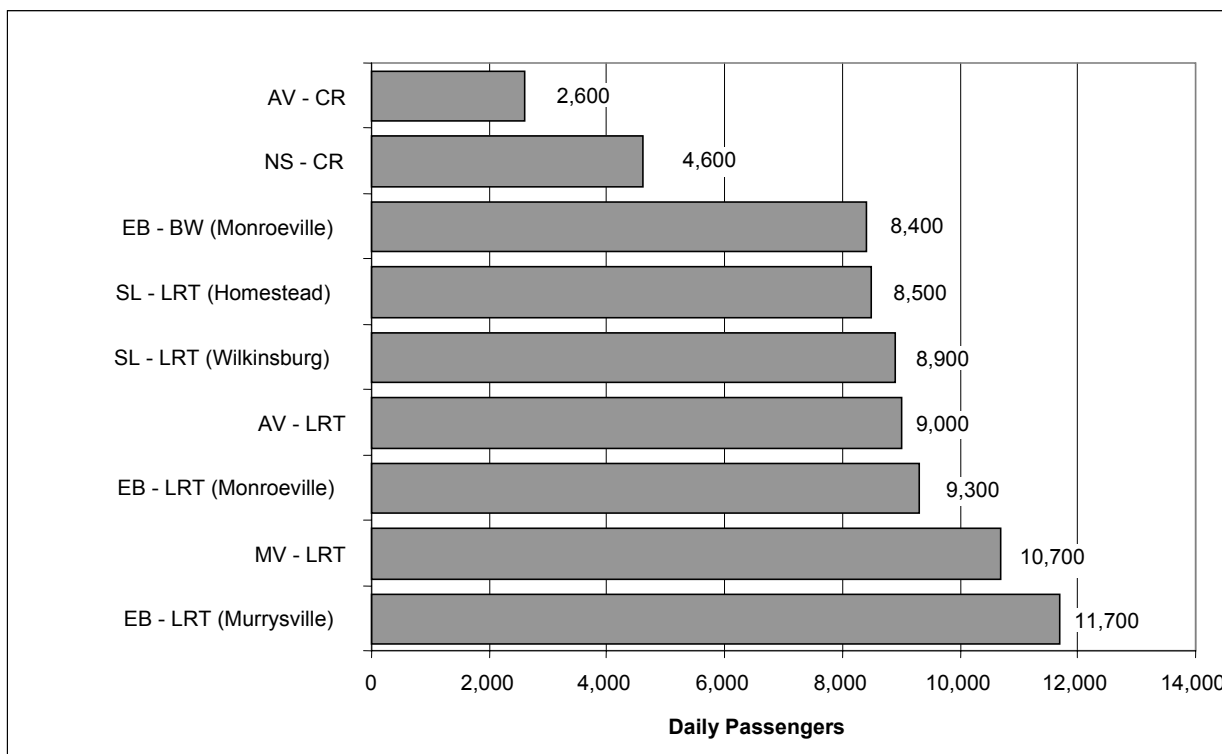
- **AV-LRT** is estimated to attract 18,200 daily transit boardings, which is significantly fewer than the Spine Line and East Busway corridor alternatives. Considering the low density of development in much of the area it serves, ridership projections for this alternative are relatively good.
- **MV-LRT** is estimated to attract 34,700 daily transit boardings, slightly less than the SL-LRT (Homestead) alternative discussed above. The MV-LRT alternative is composed of two separate branches, one to McKeesport and one to Etna that would produce 19,800 and 14,900 daily transit boardings, respectively. This alternative provides a high quality and attractive transit service to Etna and McKeesport, areas that are currently served by fixed route bus only.
- **SL-LRT (Wilkinsburg)** estimated at 39,400 daily transit boardings and **SL-LRT (Homestead)** at 35,700 daily transit boardings illustrate the next strongest potential for attracting total ridership among all alternatives. These alternatives serve the second and third largest activity centers in the state of Pennsylvania, downtown Pittsburgh and Oakland, where heavy traffic congestion and slow travel times are common, and transit usage is high based on existing bus service ridership levels in the corridor.
- **EB-LRT (Murrysville)** estimated at 46,700 daily transit boardings, **EB-LRT (Monroeville)** at 42,900 daily transit boardings and **EB-BW** at 41,500 daily transit boardings illustrate the alternatives showing the highest levels of ridership potential. The East Busway Corridor is well established from a development perspective with an existing high capacity, exclusive transit service that currently attracts high levels of ridership. Each of the proposed alternatives builds on these characteristics as evidenced by the significant ridership levels. It is important to note that the EB-LRT (Murrysville) has the highest ridership projections because it extends farther to the east than either of the other two East Busway alternatives.

7.2.2 SYSTEMWIDE NEW DAILY TRANSIT PASSENGERS (2025)

Exhibit 7-2 illustrates estimated systemwide new daily transit passengers attracted to the entire transit system that would result from implementation of each alternative. These figures include only new transit riders that would not have used transit without the implementation of the new alternative.

New systemwide daily transit passengers range from a low of 2,600 on the AV-CR to a high of 11,700 on the EB-LRT (Murrysville). Key highlights include:

- **AV-CR** with an estimated 2,600 new transit passengers is lowest among all alternatives and just slightly lower than the **NS-CR** at 4,600, the only other commuter rail alternative. However, the lower level of new passengers can partially be attributed to the low level of service configured for this commuter rail type operation.
- **EB – BW (Monroeville)** at 8,400, **SL – LRT (Homestead)** at 8,500, **SL – LRT (Wilkinsburg)** at 8,900, **AV – LRT** at 9,000 and **EB – LRT (Monroeville)** at 9,300 all fall within the same range for new systemwide daily transit passengers.

Exhibit 7-2: New Systemwide Daily Transit Passengers (2025)

- MV-LRT** is estimated to attract 10,700 new systemwide daily transit passengers, second highest among all alternatives. This alternative provides a significant improvement to existing transit service given the high quality connections from the Etna area to Downtown along Route 28, and from the Mon-Valley. Both areas are currently served by several bus routes, but daily traffic congestion degrades their level of service. It also serves two distinct areas of the study corridor, the northeast (Etna) and the southeast (McKeesport), compared to one corridor served by each of the other alternatives.
- EB-LRT (Murrysville)** is estimated to attract 11,700 new systemwide transit passengers, highest among all alternatives but just slightly higher than the MV-LRT. The extension to Murrysville adds 2,400 more riders than LRT to Monroeville by providing high quality LRT service in an elevated alignment over Route 22.

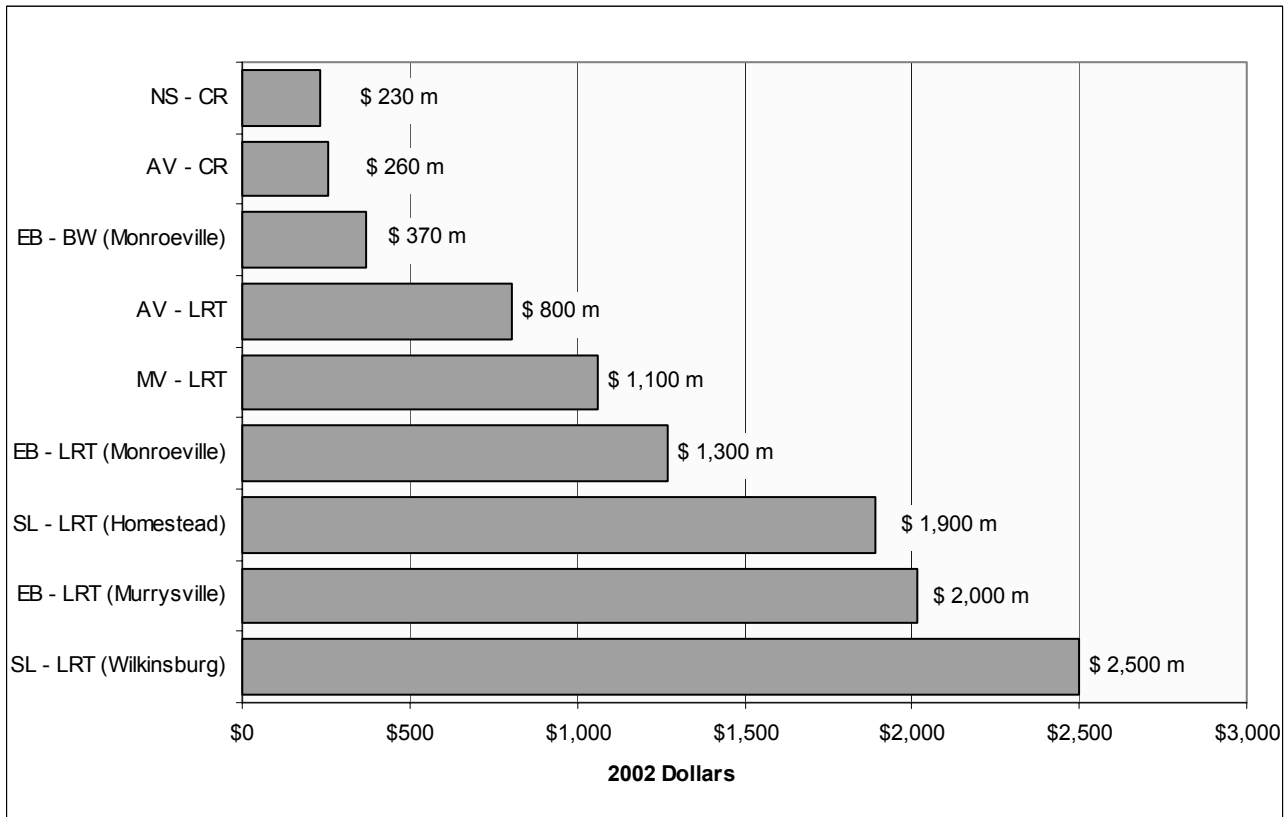
7.2.3 CAPITAL COST

The estimated capital cost for each alternative is presented in **Exhibit 7-3** and the annualized capital cost for each alternative is shown in **Exhibit 7-4** (annualized capital costs are shown for informational purposes only). These costs were calculated in accordance with the methodology detailed in Section 6.2 of this report.

Capital costs range from a low of \$230 million (\$19 million annualized) for the AV-CR to a high of \$2.5 billion (\$189 million annualized) for the EB-LRT (Murrysville). Key highlights include:

- NS-CR and AV-CR** are the least expensive among all alternatives at \$230 million (\$19 million annualized) and \$260 million (\$21 million annualized) respectively. Both of these alternatives assume the use of existing freight railroad rights-of-way for the operation of vehicles meeting the Federal Railroad Administration’s (FRA’s) vehicle requirements for simultaneous operation with freight vehicles. In the case of the NS-CR, given the excellent condition of the right-of-way and existing track, few upgrades would be required to implement a high quality commuter rail service with the exception of adding a third track from Greensburg to East Pittsburgh, park & ride and station facilities. Although the AV-CR is shorter than the NS-CR, the costs assume significant upgrades to track and systems given the poor quality of the existing infrastructure. Additionally, the AV-CR costs include allowances for park & ride facilities, new vehicles and ownership of the railroad property because of the large investment in the infrastructure.

Exhibit 7-3: Capital Costs (2002 Dollars)

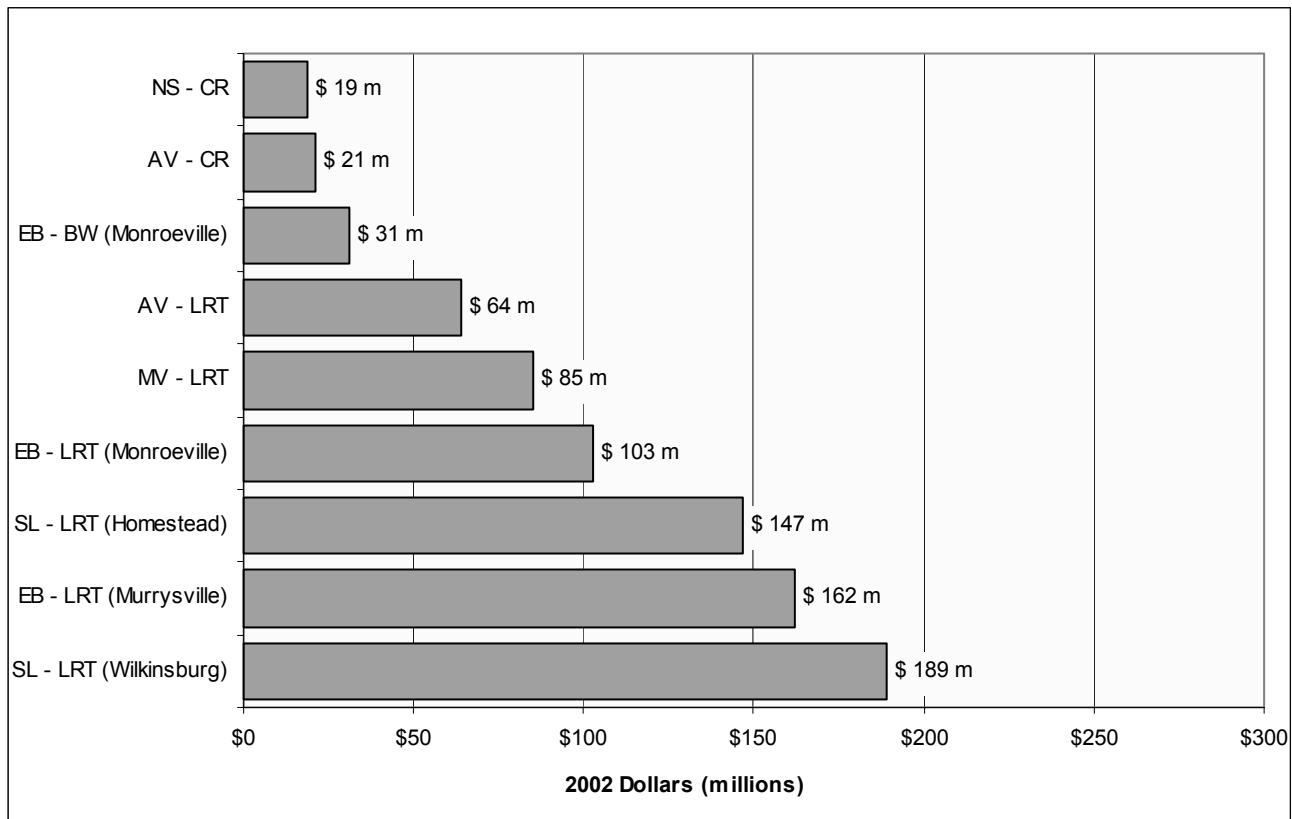


- EB-BW (Monroeville)** at \$370 million (\$31 million annualized) is among the least expensive of the alternatives to construct due to its relatively short route length (6.6 miles), extension of an existing facility (i.e. East Busway), compatibility with existing bus fleet, and slightly lower typical cost on a per mile basis when compared to light rail.
- AV-LRT and MV-LRT** are estimated at \$800 million (\$64 million annualized) and \$1.1 billion (\$85 million annualized) respectively. Both alternatives require a new short tunnel connection to the Convention Center station below 14th Street for access into the Downtown “T” system. The MV-LRT requires an elevated ramp structure to the CSX bridge at 33rd Street and a widening of Schenley Tunnel under Oakland for double tracking. Both alternatives require the purchase of railroad

rights-of-way, the AVR for AV-LRT and CSX railroad property for MV-LRT, and significant investments in vehicles and maintenance/storage facilities.

- **EB-LRT (Monroeville)** is estimated to cost approximately \$1.3 billion (\$103 million annualized) for a complete conversion of the existing East Busway to light rail and an extension to Monroeville Mall from East Pittsburgh along railroad right-of-way and on a retained cut on the high grade toward the mall.
- **SL-LRT (Homestead)** at \$1.9 billion (\$147 million annualized), is the third most expensive of the alternatives. Although the SL-LRT (Homestead) alternative travels at-grade from Oakland to Homestead in existing CSX right-of-way, it requires underground infrastructure from Steel Plaza to Oakland. SL-LRT (Homestead) costs could be reduced by using entirely at-grade guideway or could be spread over a larger time period by using phased construction.

Exhibit 7-4: Annualized Capital Costs (2002 Dollars)



- **EB-LRT (Murrysville)** at \$2.0 billion (\$162 million annualized) is the second most expensive alternative. This alternative requires a complete conversion of the existing East Busway to light rail, a partially-elevated extension to Monroeville Mall, and a fully-elevated extension to Murrysville to avoid large disruption impacts to development on Route 22.
- **SL-LRT (Wilkinsburg)** at \$2.5 billion (\$189 million annualized) is the most expensive of the alternatives due to its underground construction from Steel Plaza through the Hill District, Oakland and Squirrel Hill to Wilkinsburg. Costs for this alternative could be reduced with the use of at-grade guideway or spread over a longer period of time by phasing the construction.

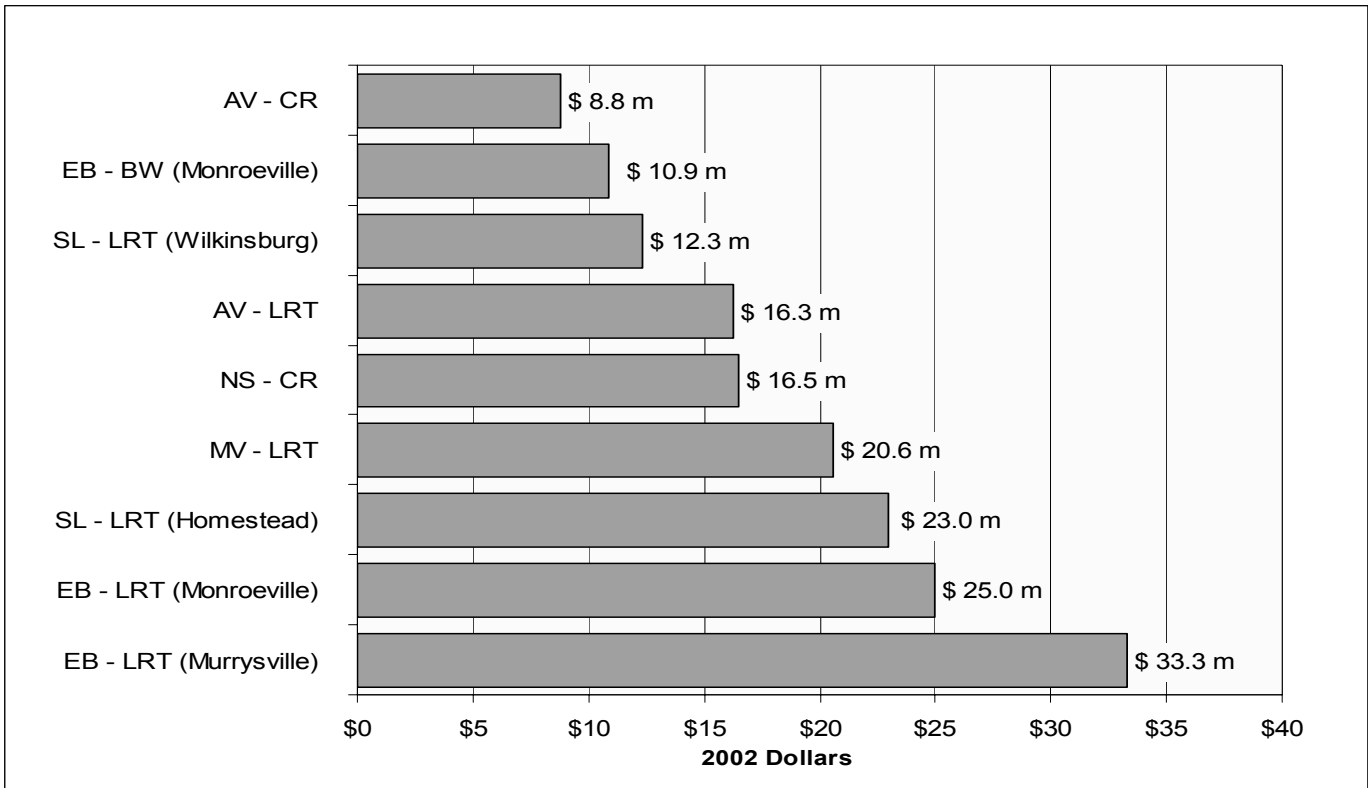
7.2.4 ANNUAL INCREMENTAL OPERATING AND MAINTENANCE COST

Exhibit 7-5 presents the operating and maintenance costs for each alternative.

Operating and maintenance costs range from a low of \$8.8 million for the AV-CR to a high of \$33.3 million on the EB-LRT (Murrysville). Key highlights include:

- **AV-CR** Incremental O&M costs are estimated at \$8.8 million annually, lowest among all alternatives. This estimate is based on 30-minute peak and 90-minute off-peak headways between Arnold and downtown Pittsburgh. Five-car trains are required to serve peak-hour passenger demand. The estimate does include the O&M costs to operate the frequent shuttle bus service between the 16th Street Station and downtown Pittsburgh.

Exhibit 7-5: Annual Incremental O&M Costs (2002 Dollars)



- **EB-BW (Monroeville)** Incremental O&M costs are estimated at \$10.9 million annually, second lowest among all alternatives. This estimate is based on three main service lines from Downtown to Oakland, Downtown to Monroeville Mall and Oakland to Monroeville Mall with each line providing 10-minute peak and 15-minute off-peak service.
- **SL-LRT (Wilkinsburg)** Incremental O&M costs are estimated at \$12.3 million annually based on a 5-minute peak and 7.5-minute off-peak service with two-car trains to serve peak hour passenger demand. This alternative is shorter than the SL-LRT (Homestead), has a lower peak load factor, and included more reductions in existing bus services in the corridor.

- **AV-LRT** Incremental O&M costs are estimated at \$16.3 million annually based on a 10-minute peak and 20-minute off-peak service with three-car trains to serve peak hour passenger demand.
- **NS-CR** Incremental O&M costs are estimated at \$16.5 million annually and are based on 30-minute peak and 90-minute off-peak headways between Greensburg and downtown Pittsburgh. Four-car trains are required to serve peak hour passenger demand. This estimate also includes a train-mile fee that would be paid to NS for the use of their railroad right-of-way based on the assumption that the alignment would not be available for purchase.
- **MV-LRT** and **SL-LRT (Homestead)** Incremental O&M costs are estimated at \$20.6 million and \$23.0 million annually. MV-LRT provides service on two lines, Downtown to McKeesport and Downtown to Etna on 10-minute peak and 20-minute off-peak headways with three-car trains for each service line. SL-LRT (Homestead) provides 5-minute peak and 7.5-minute off-peak service with three car trains to serve peak hour passenger demand.
- **EB-LRT (Monroeville)** and **EB-LRT (Murrysville)** Incremental O&M costs are estimated at \$33.3 million and \$25.0 million annually, both alternatives offer the same three main service lines as the busway alternative, but EB-LRT (Murrysville) provides those services over greater distances than any of these alternatives.

7.2.5 CAPITAL COST PER NEW ROUTE MILE

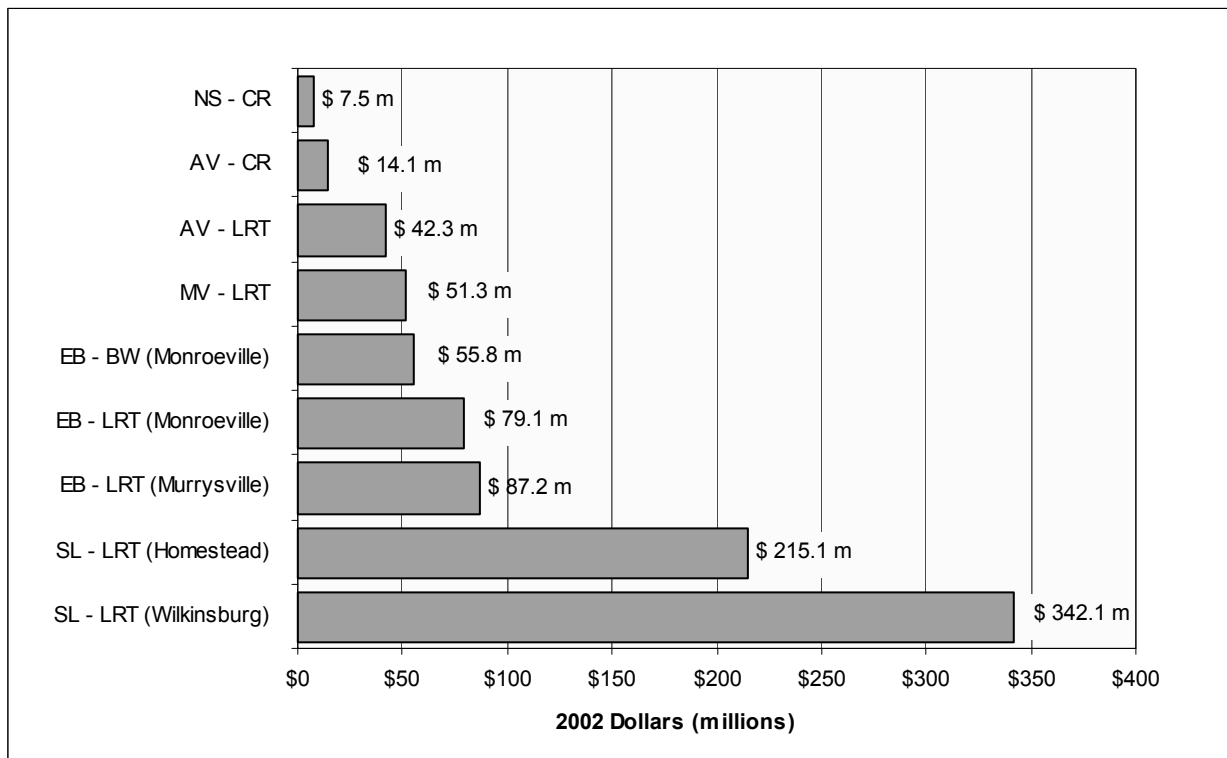
Capital cost per new route mile, which is the total capital costs normalized by the length of the alignment, is presented for each alternative in **Exhibit 7-6**. This measure allows a more level comparison of the capital costs for each alternative.

Capital cost per new route mile ranges from a low of \$7.5 million for the NS-CR to a high of \$342.1 million on the SL-LRT (Wilkinsburg). Key highlights include:

- **NS-CR** at \$7.5 million and **AV-CR** at \$14.1 million are the least expensive alternatives on a per new route mile basis given the use of existing right-of-way, lower number of stations on a per mile basis and lower service frequencies which directly affect the amount of rolling stock required for implementation of service.
- Three alternatives fall between \$42 million per mile and \$56 million per mile:
 - **AV-LRT** is estimated at \$42.3 million per mile based on the use of the AVR to provide light rail service from Downtown to Arnold.
 - **MV-LRT** is estimated at \$51.3 million per mile based on its two-branch service which is primarily at-grade except for the ramp to, and use of, the 33rd Street bridge, widening of Schenley Tunnel, and tunnel connection to the Convention Center Station.
 - **EB-BW (Monroeville)** is estimated at \$55.8 million per mile based on the use of the NS Railroad right-of-way from Swissvale to East Pittsburgh and elevated guideway up through the Union Railroad right-of-way prior to the approach to Monroeville Mall.
- **EB-LRT (Monroeville)** at \$79.1 million per new route mile is significantly higher than the EB-BW (Monroeville) due to the need to convert the existing busway to light rail and for the complex approach to Monroeville Mall combined with the need for substantial rolling stock for the three services between Downtown, Oakland, and Monroeville.

- **EB-LRT (Murrysville)** is third highest among the alternatives at \$87.2 million per mile due to the costly requirements for conversion of the existing busway and the need for elevated structure beyond Monroeville Mall along Route 22 and large fleet requirements.
- **SL-LRT (Homestead)** and **SL-LRT (Wilkinsburg)** are the most expensive alternatives per new route mile at \$342.1 and \$215.1 million respectively. It is important to note that both include long sections of underground alignment that significantly increase construction costs for both the guideway and stations. The SL-LRT (Wilkinsburg) alternative was estimated with its entire alignment underground, while the SL-LRT (Homestead) included both underground and at-grade alignment with the use of the CSX right-of-way for access to Hazelwood and Homestead. Costs for these alternatives could be reduced with the use of an at-grade alignment through Oakland, or financed over a longer time period by phasing construction.

Exhibit 7-6: Capital Cost per New Route Mile (2002 Dollars)

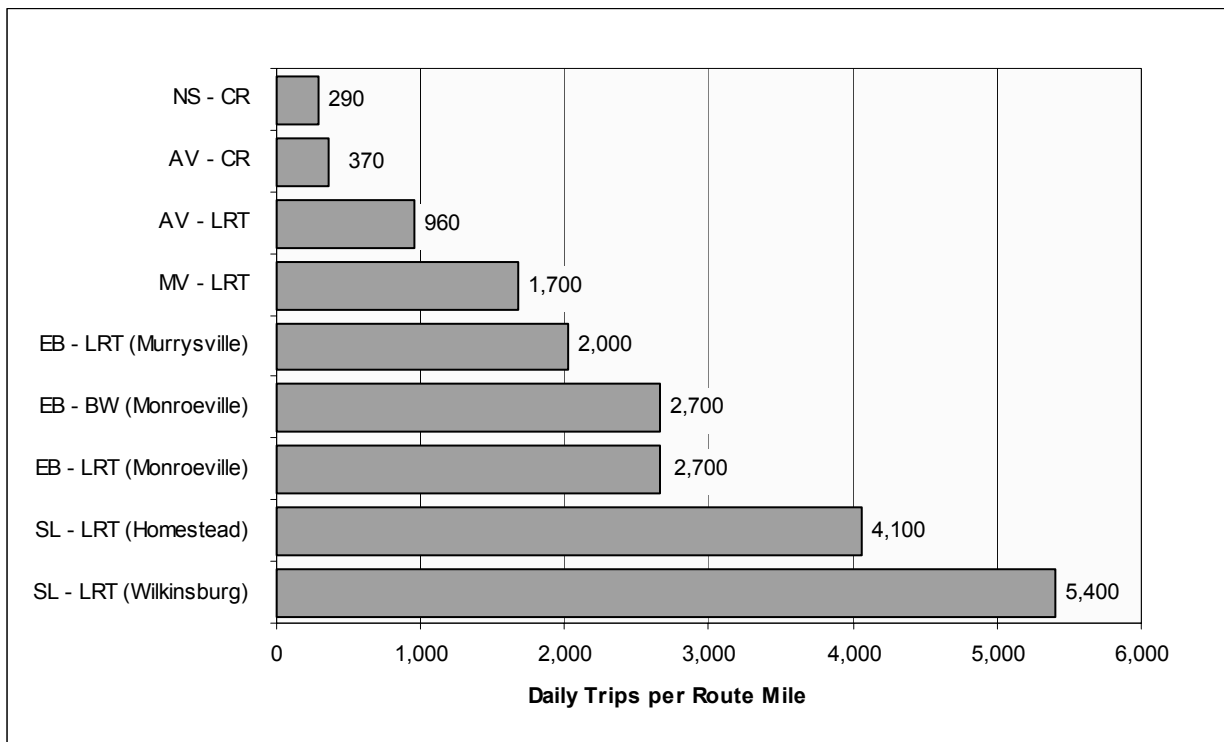


7.2.6 DAILY TRANSIT BOARDINGS PER ROUTE MILE

Exhibit 7-7 provides daily transit boardings on each transit investment per new route mile. This is a measure of the productivity of a transit investment normalized by its length.

Daily transit boardings on the transit investments per new route mile range from a low of 290 trips for the NS-CR to a high of 5,400 trips for the SL-LRT (Wilkinsburg). Key highlights include:

Exhibit 7-7: Daily Transit Boardings per Route Mile



- **NS-CR** and **AV-CR**, the two commuter rail alternatives, have the lowest number of daily transit boardings per new route mile at 290 and 370 trips respectively. The alignment for NS-CR is the longest of all alternatives at approximately 31 miles with the second lowest number of daily boardings causing its lowest ranking. AV-CR is approximately the same length as the light rail alternative in the same corridor, but attracts fewer riders than the light rail since it stops at fewer stations and operates significantly less frequently, giving it the second lowest ranking among the short-listed alternatives.
- **AV-LRT** would attract 960 daily transit boardings per route mile, significantly fewer than most of the other light rail alternatives. This is primarily due to the alignment’s location in less densely developed communities.
- **MV-LRT** as a whole alternative would attract approximately 1,700 passengers per route mile. When split into the two branches, it becomes apparent that the branch to Etna is more productive in terms of boardings per route mile with 2,900 as compared to 1,150 to McKeesport.
- **EB-LRT (Murrysville)** would attract approximately 2,000 daily transit boardings per route mile, slightly more than the AV-LRT and MV-LRT light rail alternatives but less than EB-LRT and EB-BW (Monroeville).
- **EB-BW (Monroeville)** and **EB-LRT (Monroeville)** would each attract 2,700 boardings per route mile. Both alternatives are among the highest in daily transit boardings and have similar alignment lengths causing them to be ranked second only to the Spine Line Corridor alternatives.
- **SL-LRT (Homestead)** and **SL-LRT (Wilkinsburg)** are ranked the two highest among the alternatives at 4,000 and 5,400 boarding per route mile respectively. As discussed in previous

sections, both of these two alternatives travel through some of the densest and most active areas in the study area, attracting significant numbers of riders on relatively short alignment lengths.

7.3 CONCLUSIONS AND IMPLEMENTATION STRATEGIES

The detailed analysis conducted in this study provides information on each of the short-listed alternatives with regard to specific attributes that allow for an evaluation and identification of those alternatives that provide the greatest opportunities to satisfy the identified transportation and development needs in the ECTS study area. Each alternative has advantages and disadvantages associated with its implementation as a major transportation investment in the study area. This section suggests advancing several of the alternatives into subsequent phases of planning and environmental analysis. The alternatives under consideration are:

- **AV-CR:** Commuter Rail from downtown Pittsburgh to Arnold
- **AV-LRT:** Light Rail from downtown Pittsburgh to Arnold
- **EB-LRT (Monroeville/Murrysville):** Conversion of the East Busway to Light Rail from downtown Pittsburgh to Swissvale, Monroeville and eventually to Murrysville
- **EB-BW (Monroeville):** Extension of the East Busway from Swissvale to Monroeville
- **SL-LRT (Wilkinsburg):** Light Rail from downtown Pittsburgh to Oakland and Wilkinsburg
- **SL-LRT (Homestead):** Light Rail from downtown Pittsburgh to Oakland and Homestead
- **MV-LRT:** Light Rail from downtown Pittsburgh to Etna and McKeesport
- **NS-CR:** Commuter Rail from downtown Pittsburgh to Greensburg

It is important to note the conclusions or implementation strategies herein for next steps are made in relation to the federal process, in order to be eligible to use federal funds. If federal funds are not to be used, a different process to advance alternatives might be pursued. Furthermore, even if federal funds are to be pursued, the decision on level of effort to be followed is a collaborative one, that is identified at the time the decision is at hand, and takes into account local and regional conditions.

7.3.1 AV-CR

This alternative has the potential to attract a reasonable level of ridership including new transit trips systemwide with a low capital investment and performed well based on total capital costs, incremental O&M costs and capital cost per new route mile. In addition, this alternative has wide public support to move forward including confirmed cooperation from the AVR. The following steps are suggested for this alternative:

- Move forward into a full Alternatives Analysis and Environmental Analysis (e.g. DEIS or EA) to more fully assess and define commuter rail in the corridor and to identify the environmental impacts that could be encountered during implementation.
- Investigate more thoroughly the three different levels of investment for commuter rail within this corridor including the Full Build Alternative, Starter System and Minimal Investment System. This effort should also include an evaluation of various rolling stock technologies that would be applicable in the corridor.
- Develop, as part of this investigation, an option to improve the connection into downtown Pittsburgh, as this alternative currently must utilize a shuttle bus from a terminus at 16th Street. A

possible modification could involve extending the "T" to meet the AV-CR in the Strip District for an improved connection to downtown Pittsburgh. This would provide better service to the pedestrian-oriented Strip District, allow for a possible future light rail extension, and provide single-transfer access to major Downtown destinations and stations along the "T".

- Continue coordination with the AVR to ensure a smooth transition to passenger service with regard to use or purchase of the right-of-way and co-existence with freight railroad service.

7.3.2 AV-LRT

This alternative also has the ability to attract a reasonable level of ridership, albeit at a more significant level of investment than for commuter rail and with a modest increase in patrons over AV-CR, given the additional cost. AV-LRT has the lowest ridership levels among the light rail alternatives and is slightly less expensive on a cost-per-mile basis. The following steps are suggested for this alternative:

- Consider light rail only on the segment from the Convention Center to one of the proposed commuter rail stations in the Strip District (as described under and as part of AV-CR). That would be the most logical use of this technology due to good pedestrian access in this area. Extension of the light rail through the Strip District would result in a core light rail system linking four major activity centers in the heart of Pittsburgh: Downtown, Station Square, North Shore, and the Strip District.
- Do not move the remainder of this alternative forward into the next phases of project development given the findings on the commuter rail alternative in this corridor.

7.3.3 EB-BW (MONROEVILLE)

The extension of the existing East Busway to Monroeville builds upon an existing and well-utilized transit service and facility that currently operates between Downtown and Swissvale. This alternative performed relatively well, especially in the categories of capital costs and incremental O&M costs. It is important to note that costly infrastructure would be needed at the east end of the alignment in order to traverse the topography of the Turtle Creek area and to access Monroeville Mall. The following steps are suggested for this alternative:

- Move this alternative forward into a full Alternatives Analysis and Environmental Analysis (e.g. DEIS) to detail the available busway options and environmental impacts of the project.
- Examine the options for reducing the alignment length to the area of East Pittsburgh as a first phase in an effort to manage construction costs and expedite implementation. Consider use of the future extension of the Mon-Fayette Expressway facility for a combined and more cost-effective facility to access Monroeville with the extension from East Pittsburgh traveling within the existing expressway lanes or on an exclusive lane. Coordinate future planning efforts with the Pennsylvania Turnpike Commission's efforts to implement the Mon-Fayette Expressway.

7.3.4 EB-LRT (MONROEVILLE & MURRYSVILLE)

Both of these alternatives require significant capital investments with the conversion of the existing East Busway to a light rail facility at \$1.3 billion, including the extension to Monroeville and an additional \$881 million for the further expansion to Murrysville. When compared to EB-BW (Monroeville), the EB-LRT (Monroeville) does not perform well. For example, the conversion and extension of the busway to light rail at \$1.3 billion only attracts 1,400 more boardings than the East Busway extension that would cost approximately \$368 million (nearly one-billion less). More importantly, the funding to convert the existing East Busway to light rail would likely not be available from the Federal Transit Administration since it funded a significant portion of the current busway and would be deemed as a redundancy of investment and funding for a transit service that achieves little to no incremental mobility benefits.

Although the segment from Monroeville to Murrysville shows some promise for attracting new ridership, it does not warrant the costly and disruptive infrastructure required to provide adequate service along Route 22 at a cost of approximately \$750 million. Bus rapid transit in the form of an express bus service along Route 22 would serve this area more efficiently. The following steps are suggested for these alternatives:

- Eliminate these two alternatives from further study based on their performance, high cost to implement, and redundancy with the existing and recently extended East Busway to Swissvale.
- Coordinate transit planning efforts with the communities and businesses along the Route 22 corridor to increase the effectiveness of the existing public transportation system through more improved and expanded bus service and increased park & ride facilities and access.
- Implement use of cleaner-fuel buses in the East Busway Corridor as per 2006 EPA regulations.

7.3.5 SL-LRT (WILKINSBURG/HOMESTEAD)

As defined in this study, these alternatives share a common alignment to reach and serve Oakland with SL-LRT (Wilkinsburg) continuing through Squirrel Hill to Wilkinsburg and SL-LRT (Homestead) continuing through Hazelwood on CSX right-of-way to Homestead. Both alternatives attract similar and reasonable levels of total ridership, new systemwide boardings, and boardings per route mile but at high capital costs. It is important to note however, that total incremental O&M costs for both alternatives appear reasonable due to the substitution of light rail service for the existing bus services that traverse the corridor. As discussed in the previous chapter, at-grade options through Oakland can significantly reduce the overall capital costs for these projects and phasing of project construction could spread those costs over a longer time period to allow for more incremental funding. In addition, both of these alternatives received strong public support based on the high quality connection between Oakland and downtown Pittsburgh. The following steps are suggested for these alternatives:

- Move the SL-LRT (Homestead) forward into a full Alternatives Analysis and Environmental Analysis (e.g. DEIS) to detail the available alignment and structural options for providing access to the Hill District, 5th/Forbes corridor, Oakland, and Homestead. SL-LRT (Homestead) received strong public support, particularly due to its east/west accessibility through Oakland in combination with service to Hazelwood and Homestead, two areas not currently served by a major high-quality transit investment. The possibility of extending service from Oakland to Wilkinsburg or from Oakland to

McKeesport as in MV-LRT should also be examined in this effort to fully understand the benefits and trade-offs of each option.

- At-grade scenarios should be examined in detail and the effort coordinated with the City of Pittsburgh Engineering and Construction, and Planning departments as well as stakeholders in Oakland such as community organizations, businesses, hospitals (e.g. University of Pittsburgh Medical Center), and institutions (e.g. The Carnegie, Carnegie Mellon University, University of Pittsburgh).
- Coordinate and/or combine effort with results of the AMM-MIS to test needs and opportunities from Oakland and Downtown to the Airport. This would connect three major destinations in the region (Downtown, the Airport, and Oakland) that have been identified in the major transportation studies that were initiated in 2001.
- Examine phased construction scenarios such as Downtown to Oakland, Oakland to Hazelwood, and Hazelwood to Homestead to offset capital expenditures in an effort to stage implementation of the project and work within funding constraints.
- Perform a core capacity analysis of impacts of this alternative on the existing Downtown "T" operation given the service levels from the South Hills and additional constraints that will be realized with the onset of the North Shore Connector. This analysis should include a careful engineering review of the connection options available at Steel Plaza for a new service line from the East.
- Perform a detailed operational analysis of the potential benefits that can be achieved by replacing the extensive bus service between Downtown and Oakland with a trunkline light rail system as per this alternative.
- Continue communications with CSX Railroad and begin discussions on possible usage scenarios of existing track alignment including the outright purchase of the right-of-way from Etna to Glenwood yard and beyond to Homestead.

7.3.6 MV-LRT

This alternative illustrates the potential to attract a high level of ridership and new systemwide boardings with a moderate capital cost and incremental O&M costs. However, a review of the two service lines, Etna on the north shore of the Allegheny River and McKeesport along the Monongahela River, have independent merit and can be considered as separate components combined with other alternatives already recommended for further consideration in the Allegheny Valley and Spine Line corridors. The following steps are suggested for these alternatives:

- Examine, as part of an Alternatives Analysis, light rail service to Etna from Downtown. This analysis can be completed independently or in tandem with the AV-CR alternatives analysis and environmental analysis.
- Evaluate the service line to McKeesport as part of the analysis of the SL-LRT (Homestead) alternative that is similar in service levels and accessibility. MV-LRT offers an alternative alignment between Downtown and Oakland, and a third possible destination for a further extension beyond

Oakland to McKeesport. The evaluation should include a close review and analysis of an appropriate feeder bus network to supplement the investment.

7.3.7 NS-CR

This alternative demonstrates the ability to attract a reasonable level of total ridership and new systemwide boardings at a moderate level of capital investment and incremental O&M costs. The implementation of this alternative assumes the use of the NS right-of-way from Greensburg to downtown Pittsburgh with minimal enhancements to existing infrastructure. This alternative appears to provide increased access and mobility to the corridor between Greensburg and downtown Pittsburgh. The following steps are suggested for these alternatives:

- Move this alternative forward into a full Alternatives Analysis and Environmental Analysis (e.g. DEIS or EA) to provide additional detail on service levels, operational issues, and costs associated with the use of the NS right-of-way. This analysis can be combined with the effort discussed above for the AV-CR as part of a two-pronged study that would maximize the use of resources for these two similar transportation investments in different corridors between Allegheny and Westmoreland Counties.
- Establish communications with NS Railroad and begin discussions on providing commuter rail service in this corridor including any necessary infrastructure improvements (e.g. installation of a third track from Greensburg to East Pittsburgh) that may be needed to accommodate both freight and passenger service with the greatest flexibility.

7.3.8 TRANSPORTATION SYSTEM MANAGEMENT

Several key opportunities were developed for the TSM Alternative including:

- BRT application between Downtown and Oakland
 - Potential for sizeable ridership increases with travel time improvement
 - Operational issues require further analysis in next phase
- New Routes and Service Increases
 - Identified underserved markets in Allegheny County
 - Identified unmet demand in Westmoreland County (e.g. Sony Plant to Greensburg)
- Incline between Strip and Hill Districts identified unmet travel need
- Park & rides in Westmoreland County exhibited high potential for increased usage, especially locations at Greensburg, I-76/Irwin, and Delmont

The next steps for the TSM include further refinement and evaluation as part of any AA/DEIS phases for the build alternatives. In addition, given the level of interest and ridership potential, WCTA should pursue the planning and further development of park & ride facilities at the locations discussed above.

A summary of the conclusions for moving projects forward is presented in

Exhibit 7-8. It should be noted that funding for future planning and environmental phases will be a prerequisite along with stakeholder and consensus from the general public.

Exhibit 7-8: Summary of Conclusions and Potential Implementation Schedule

Alternative	Next Steps	Approach & Opportunities	Priority	Schedule Planning/ Construction
AV-CR Allegheny Valley Commuter Rail	Advance to AA/DEIS or EA	<ul style="list-style-type: none"> Investigate lower cost options Evaluate "T" extension to Strip District station Coordinate and partner with AVR from the outset 	High	2004/2007
AV-LRT Allegheny Valley Light Rail	No Advancement			
EB-BW (Monroeville) East Busway to Monroeville	Advance to AA/DEIS	<ul style="list-style-type: none"> Evaluate project phasing including extension to Braddock and East Pittsburgh Coordinate with the Turnpike Commission (i.e. Mon-Fayette Expressway) for transit accommodations 	High	2004/2010
EB-LRT (Monroeville) East Busway Light Rail to Monroeville	No Advancement			
EB-LRT (Murrysville) East Busway Light Rail to Murrysville	No Advancement			
SL-LRT (Wilkinsburg) Spine Line Light Rail to Wilkinsburg	Advance as Part of SL-LRT (Homestead)	<ul style="list-style-type: none"> Evaluate as part of SL-LRT to Homestead AA/DEIS Analysis of trade-offs for extensions from Oakland to Wilkinsburg, Homestead or McKeesport 		
SL-LRT (Homestead) Spine Line Light Rail to Homestead	Advance to AA/DEIS	<ul style="list-style-type: none"> Investigate lower cost options Coordinate and partner with City Planning Develop phasing scenarios and core capacity analysis Coordinate with CSX for use/acquisition of railroad right-of-way Analysis of trade-offs for extension from Oakland to Wilkinsburg, Homestead or McKeesport 	Medium	2006/2015
MV-LRT Mon-Valley Light Rail to Etna & McKeesport	Advance Downtown to Etna line to AA/DEIS and examine service to McKeesport	<ul style="list-style-type: none"> Evaluate LRT to Etna in separate study from LRT to McKeesport. Evaluate LRT to McKeesport as part of SL-LRT (Homestead) analysis Coordinate with CSX for use/acquisition of railroad rights-of-way 	Medium (LRT to Etna)	2005/2012
NS-CR Norfolk Southern Commuter Rail to Greensburg	Advance to AA/DEIS or EA	<ul style="list-style-type: none"> Investigate lower cost options Coordinate with NS for use of railroad right-of-way Coordinate or combine with AV-CR next steps 	High	2004/2007
TSM	Advance simultaneously with above recommendations	<ul style="list-style-type: none"> Refinement parallel to the advancement of build alternatives Move forward with park & rides in Westmoreland County 	Medium To High	2004/2015

7.4 GENERAL GUIDANCE FOR NEXT STEPS

The following section provides guidance on the next steps in the project development process that would be applicable for any of the proposed alternatives recommended for future phases of implementation.

7.4.1 PROJECT DEVELOPMENT PHASES

The Eastern Corridor Transit Study is intended to provide an evaluation of needs and transit solutions for major transportation investments in the area from downtown Pittsburgh east to Westmoreland County (see **Exhibit 2-1** for a map of the study area). The following steps would be undertaken to move any of the recommended projects forward in the project development process.

- **Long Range Plan (LRP) Adoption** – The first step in advancing a major transit investment forward to the next stage of project development is adoption in the SPC's LRP project listing. Additionally, the financial requirements for the next phase of study (e.g. AA, DEIS) should be included in the financially constrained portion of the LRP to indicate that funding exists to complete the next phase of development.
- **Alternatives Analysis (AA)** – For any identified long term and capital intensive transit initiatives, the AA phase will be initiated. This represents the highest level of transportation planning for major investments and includes a detailed purpose and need for the project, full definition of alternatives, travel demand modeling, financial analysis, and detailed capital and operating costs in an effort to select a Locally Preferred Alternative (LPA). AA is required for any investments that seek Federal New Starts Funding. This phase includes development of the Transportation System Management alternative, as a lower cost comparison to justify the major investments. The final step in this level of planning would be the development of an FTA New Starts Application to Request Entry into Preliminary Engineering.
- **Draft Environmental Impact Statement (DEIS)** – The analysis of environmental impacts and mitigations for major transportation investments and the no-build alternative as required by NEPA. Categorical examples of environmental impacts include noise and vibration, natural resources, traffic impacts, cultural resources, air quality, wetlands, and land use. An Environmental Assessment (EA) would be a lower level of environmental analysis that could be warranted depending on the expected impacts of any given alternative.
- **Final Environmental Impact Statement (FEIS)** – The documentation of mitigations and responses addressing comments and concerns raised during the DEIS as required by NEPA. Refinement of the transportation investment and additional analysis of select potential environmental impacts are also documented in the FEIS with the goal of receiving the Record of Decision (ROD) required from the supporting agency in order to proceed with construction of the investment.
- **Preliminary Engineering (PE)** – The first level of engineering that advances a project to the 30% design level and includes full development of a plan and profile for the major investment, refined capital and operating costs and ridership estimates, and identification of stable and reliable revenue sources.

- **Final Design (FD)** - The final level of engineering that takes a project to the 90-100% design level and includes final development of a plan and profile for the major investment, absolute capital and operating costs and ridership estimates, and fully committed revenue sources.
- **Construction** – The actual construction of the major investment including purchase of right-of-way, construction of infrastructure, installation of systems, manufacture and delivery of rolling stock, start-up and testing.

7.4.2 MENU OF FUNDING SOURCES

One of the most important aspects of implementing a major transportation investment is the identification of stable and reliable capital and operating funds for an extended period of time to ensure the completion of construction and continued operation and maintenance of the new system for decades to come. Building infrastructure, procuring transit vehicles and equipment, operating services, and maintaining the investment require continual funding throughout the lifetime of the transit project. Sound financial planning is necessary to ensure that funds are available when needed, in order to keep construction on schedule and provide uninterrupted service to the public.

The following discussion provides a menu of funding options that could be available for the future implementation of any of the ECTS alternatives. The discussion highlights traditional federal, state, and local sources as well as incremental transit-dedicated sources and finally, innovative funding techniques to supplement these primary sources.

Capital Sources (Existing):

- **Section 5307** - Section 5307 is a formula grant program for urbanized areas providing capital, operating (for small systems only), and planning assistance for mass transportation. This program was initiated by the Surface Transportation Act of 1982 and became FTA's primary transit assistance program in FY 1984. Funds are apportioned to urbanized areas utilizing a formula based on population, population density, and other factors associated with transit service and ridership. Section 5307 is funded from both General Revenues and Trust Funds. Section 5307 urbanized area formula funds are available for transit improvements for 34 urbanized areas over 1 million population, 91 urbanized areas with populations between 200,000 and 1 million, and 283 urbanized areas between 50,000 and 200,000 population. For urbanized areas over 200,000 in population, funds flow directly to the designated recipient. For areas under 200,000, the funds are apportioned to the Governor of each state for distribution.

Several changes became effective to this program in fiscal year 1998 with the passage of TEA-21. One percent of appropriated Section 5307 funds are set-aside to be used for transit enhancement projects that physically or functionally enhance transit service or use. Preventive maintenance, defined as all maintenance costs, became eligible for FTA capital assistance at an 80 percent Federal share. FY 2000 operating assistance is available only to urbanized areas with populations under 200,000. An exception is made for urbanized areas over 200,000 in population if the number of total bus revenue vehicle miles operated is under 900,000 and the number of buses operated does not exceed 15. Up to 10% of an area's apportionment may be used for complementary ADA paratransit service costs.

- **Section 5309** - The Federal Section 5309 program provides funding for the establishment of new rail or busway projects (New Starts – 40% of all 5309 appropriations), the improvement and maintenance of existing rail and other fixed guideway systems (40%), and the upgrading of bus systems (20%). Funding for fixed guideway modernization is based on a formula that considers route miles and revenue vehicle miles in systems at least seven years old. Typically, these funds are used for infrastructure improvements such as track and right-of-way rehabilitation, station modernization, rolling stock renewal, safety-related improvements, and signal and power modernization. Section 5309 also funds bus and bus-related assets including acquisition of bus and rolling stock and ancillary equipment, and the construction of bus facilities (i.e., maintenance facilities, garages, storage areas, bus terminals, and the like). Under the Transportation Equity Act for the 21st Century (TEA-21), funding for New Starts projects can provide up to 80% federal funds, and a 20% local match must cover the project's remaining capital cost. However, the FTA's policies seek a maximum of 60% federal and a 40% local match. It should be noted that the next transportation bill (SAFETEA) could reduce the federal contribution further to a maximum of 50%.
- **Federal Highway Flexible Funding** – These are Surface Transportation Program highway funds that can be transferred to transit capital projects through the State and the Metropolitan Planning Organization with the permission of both the Federal Highway Administration (FHWA) and FTA. TEA-21 provides considerable flexibility in the use of FHWA and FTA funds for either highway or transit investments. The flexibility provisions of these transportation acts allow:
 - Broad highway, transit, and bicycle/pedestrian eligibility under major funding programs;
 - Transfer from one category of FHWA funds to another to capitalize on the new eligibility; and
 - Transfer of funds from FHWA to FTA and vice versa.

It is important to remember that the metropolitan and statewide transportation planning processes are the contexts for reconciling State and regional transportation needs with proposed transportation projects and activities. All projects must be included in the regional LRP, the short-term transportation improvement program (TIP), and the approved Statewide Transportation Improvement Program (STIP). The following procedures generally describe the process for flexing transportation revenues from FHWA to FTA:

- Funds that are transferred from FHWA to FTA are to be administered under the requirements of the Chapter 53 of Title 49, U.S.C. Funds transferred to or from FHWA or FTA can only be used for purposes eligible under the original program that the funds are transferred from.
- Some categories of FHWA funds that do not have transit eligible activities may be used for transit purposes if transferred to a FHWA funding category that has transit eligibilities (e.g., Interstate Maintenance transferred to the Surface Transportation Program).
- For a formal transfer from FHWA to FTA, the State Transportation Department requests the transfer of funds, with the concurrence of the MPO, in a letter to the FHWA Division Office.
- Funding transfers are permitted only for projects contained in the approved TIP/STIP.

Potential Highway Sources that can be flexed to transit projects include:

- **Surface Transportation Program (STP)** – Eligible for transit capital projects, vehicles, and facilities publicly or privately held, and for transit safety improvements.
- **Congestion Mitigation and Air Quality (CMAQ)** – Eligible for transit capital and operating expenses for new services in non-attainment areas only. Projects must demonstrate that benefits to air quality and operating uses are limited to three years.

- **National Highway System (NHS)** – Eligible for transit improvements within a National Highway System Corridor (may apply depending on interpretation).
 - **Interstate Maintenance** – Eligible for transit purposes identical to NHS or STP funds, after transfer to these funds then to transit.
 - **Highway Bridge Replacement and Rehabilitation** – Eligible for transit purposes identical to NHS or STP funds, after transfer to these funds and then to transit.
 - **National Corridor Planning and Development Program** – Eligible for transit planning, coordination, design and locations studies, environmental review, and construction.
- **State Bond Funds** – Derived from state bond proceeds where the Commonwealth matches the FTA’s allocation of Section 5307 and Section 5309 formula funds. Specifically, to match FTA funds, the Commonwealth would provide 5/6 of the non-federal amount with the remaining 1/6 provided by Allegheny County or other local sources.
 - **Act 3 Dedicated Sales Tax** – These are state funds derived from the Supplemental Public Transportation Assistance Account (Act 3 of 1997), which allocates revenues at a rate of 1.22% of the state sales tax (and is capped at \$75 million statewide). Beginning in 1998, the state also committed additional funding to the account in the form of additional state bond funds (\$50 million per year) and Federal Flexible Highway funding of \$25 million.
 - **Act 26 Capital** – These are state funds from the Public Transportation Assistance Fund (Act 26 of 1991). Act 26 generates revenue from several sources including: a flat fee of \$1.00 per new highway motor vehicle tire sold, a 3.0 percent tax imposed on the total lease price of a motor vehicle in addition to the current tax imposed, a \$2.00 fee per day imposed on the rental of a motor vehicle, an additional 7.6 mills per dollar to the Utility Realty Tax levied against public utility companies, 0.18 percent of the current utilities gross receipts tax, and 0.53 percent of the current sales tax.

Operating Sources (Existing)

- **Act 26 Operating** – The fund is comprised of revenues derived from several different sources and is referred to as the Public Transportation Assistance Fund (PTAF). PTAF revenues are derived from: a \$1.00 fee per tire sold; a 3% tax on motor vehicle leases; a \$2.00 per day fee on car rental transactions; 0.53% of the Commonwealth’s sales and use tax and hotel tax revenue; an additional tax assessment on public utility realty; and a 0.18% gross receipts tax on electricity sales in the Commonwealth. Impacts, such as the Commonwealth’s deregulation of the electrical utility industry have affected the growth rate of some of these sources. While the overall outlook is positive for these funds to grow, PAAC and WCTA have been forced at times to constrain their operating budget to adjust for a shortfall in anticipated PTAF revenues. These revenues are matched on a 1:29 basis by Allegheny and Westmoreland Counties for their respective transit authorities.
- **Pennsylvania Mass Transit Assistance** – State operating assistance is subject to annual appropriation by the Legislature and concurrence by the Governor. Historically, this revenue source has escalated about 3 percent every three years. This assistance has a local match requirement of 1:3 for each dollar received.
- **State Bond Funds, Vehicle Overhaul (VOH) and Infrastructure Renewal Program (ISRP)** – These programs are funded as part of a \$30 million per year allocation from an annual, \$125-million statewide pool for capital investment and depreciation-related rehabilitation. A maximum of

\$18.5 million can be applied to these two programs from the \$30 million allocation. The ISRP and VOH funds are 100 percent state dollars and require no local match.

Potential New Sources

- **Local Sales Tax** – Earmarking a portion of the existing sales tax revenue for transit or proposing an additional levy would provide a revenue stream dedicated to transit.
- **Local Income Tax** – A potential source for transit funds would be the local income tax, currently generating \$1.2 billion in the nine-county southwestern Pennsylvania region through a 1% earned income tax and 2% school tax for resident employees and a \$10 per year occupation tax for those employed in the City of Pittsburgh, regardless of residency.
- **Vehicle Registration Fees** – Current vehicle registration surcharge is \$40 per vehicle, with 1.9 million vehicles registered in the nine-county region. An additional surcharge for dedicated transit funding could provide revenue for transit operations.
- **Gas Tax** - Pennsylvania motorists currently pay 18.4 cents in federal tax and 26 cents in state tax for each gallon of fuel used for automobiles. These revenues are used to fund highway improvements only. Recent state budget concerns have prompted consideration of increasing the state gas tax further. However, use of these proceeds for public transit would require an amendment to the Pennsylvania Constitution. As an example, the state of New Jersey's Transportation Trust Fund draws upon a state-wide gas tax to fund highway, bridge and public transit projects (e.g. Southern New Jersey Light Rail - River Line).

Innovative Funding Sources:

- **Benefits Assessment District** – Creation of a special district that taxes commercial property owners in partial compensation for the benefits from improved accessibility resulting from the project. Such a district could be considered for dense, commercialized areas surrounding station locations to help defray localized costs for maintenance and upkeep of facilities.
- **Joint Development** – Joint development involves a partnership or joint venture between a transit agency and a private developer to develop certain assets. Joint development is seen as a method by which private funds are used to develop transit property resulting in a profit for the private developer and a developed asset for the transit agency. Risks related to the development are either shared or borne by the transit agency or the private developer.
- **Certificates of Participation** – Certificates of Participation (COPs) are securities that represent interest in a stream of payments, typically a lease or installment sales agreement. A purpose-formed State entity issues tax-exempt bonds with maturities that match the lease term of assets (typically transit vehicles) that are purchased by the State entity with the proceeds from the bond issue. Assets are then leased back to transit agencies and the use of this financing mechanism versus up front payments, allows transit agencies to make larger purchases of vehicle assets sooner, thereby enhancing service.
- **Cross Border Lease** – Cross border leasing transactions are designed to enable a foreign entity to receive in its county the tax benefits associated with ownership of an item of equipment. These transactions are attractive to many transit agencies because the foreign entity, the "lessor" of the

equipment, will pay the "lessee" (the transit agency) between approximately 3 percent and 7 percent of the cost of the equipment for entering into the transaction. These revenues are then available to the transit agency for any purpose.

- **Delayed Local Match** – The ability to delay the local contribution to a transportation project may allow better utilization of local funds that may be currently encumbered. While other local funding mechanisms are secured, the uneven expenditure of Federal and local funds (i.e. 100% Federal funding for design, engineering) may help assure smooth progression of the project.
- **State Infrastructure Bank** – Also referred to as State Revolving Loan Funds, this mechanism allows the State to use the initial capital, provided by federal transit allocations, to make loans, provide credit enhancement, serve as a capital reserve for bond or debt financing, subsidize interest rates, issue letters of credit, finance purchase and lease agreements, provide debt financing security, or provide other forms of financial assistance for construction of qualifying projects. Among other benefits, this provides an ongoing source of local capital in support of the State's transit operators.
- **TIFIA** – The Transportation Infrastructure Finance and Innovation Act (TIFIA) provides for a loan guarantee program through the USDOT. It enables the FTA to provide loans and loan guarantees for up to 33 percent of a major project's construction costs. Loans are made at U.S. Treasury rates, and may be repaid over as long as 40 years. Special eligibility requirements, selection criteria, and a favorable credit rating are used to determine projects to receive TIFIA funding.

More detailed financial plans will be developed for each alternative that advances into AA/DEIS resulting from this study.