TASK 2 TECHNICAL MEMORANDUM: FEASIBILITY ANALYSIS

DRAFT

Regional Monorail Exploratory Study

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TASK 2 TECHNICAL MEMORANDUM
WILMAPCO Regional Monorail Exploratory Study

List of Selected Figures and Tables

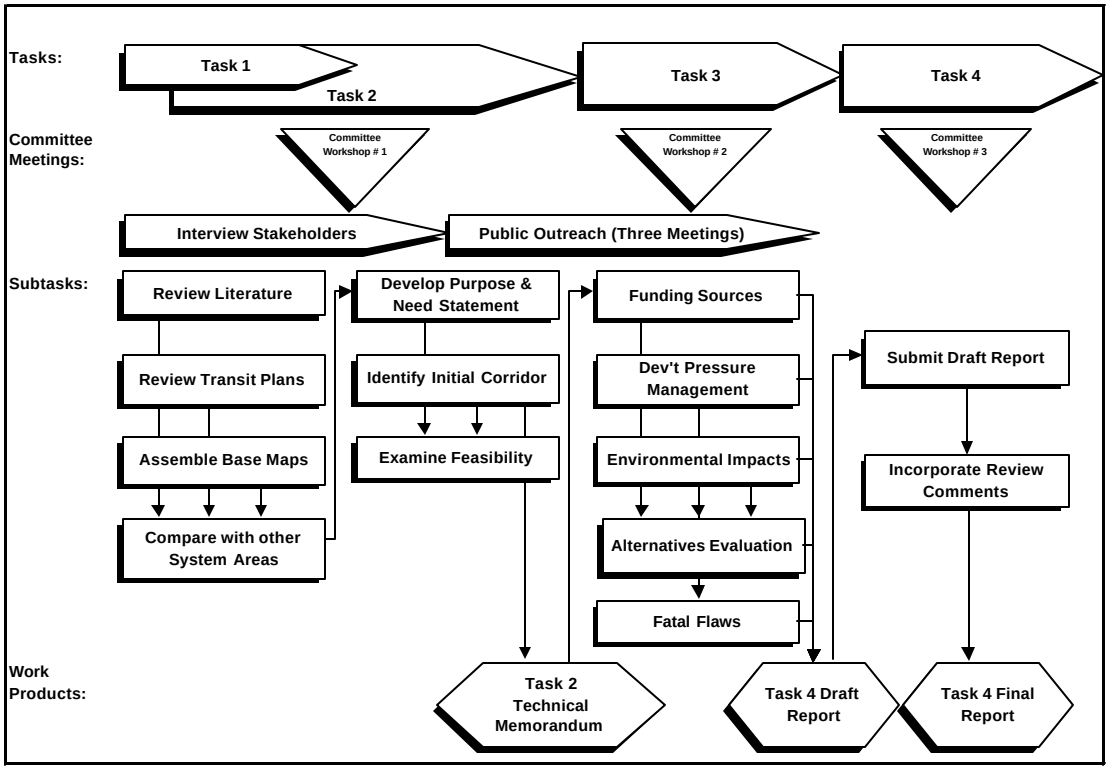
1.0 INTRODUCTION AND PURPOSE

This Technical Memorandum analyzes the feasibility of monorail transit in northern New Castle County and is summarized in the accompanying report. We have done this Regional Monorail Exploratory Study is to determine if driverless fixed guideway technology, referred to herein as "Monorail" but also referred to in the industry as "Automated Guideway Transit (AGT)", should be incorporated in a comprehensive analysis along with other high capacity transit options for the Wilmington metropolitan area. This Technical Memorandum incorporates the Purpose and Need Statement, describes criteria used in selecting the initial corridor, analyzes the initial corridor, and assesses the feasibility of implementing this corridor.

1.1 DESCRIPTION OF STUDY PROCESS

Figure 1-1 outlines the process we used. Through this process, valuable information was gained from prior studies, meetings with the management and steering committees, and discussions with stakeholders from the community at-large. Public outreach was essential for identifying the goals to address, finding a desired alignment, and assessing community support for further study. The technical analysis directly relates to the goals and objectives defined by the committees and contained in the Purpose and Need Statement.

Figure 1-1: Work Schedule



1.2 STUDY ORIGIN AND BACKGROUND

In the early 1980s, state officials began discussions about connecting a train station north of Wilmington with a monorail-type service to various transit, recreational, cultural, and business centers in the region. When SEPTA terminated all commuter service to Delaware during this period, Senator Harris McDowell and Representative David Ennis lead the establishment of a Task Force that recommended opening at least two suburban stations north of Wilmington--Claymont and Edgemoor--as well as others. The Claymont station was reopened and has been expanded three times. New stations opened in Newark and Churchman's Crossing during the 1990s. The Task Force also called for the reestablishment of train service to Dover.

In the mid 1990s, the Delaware Department of Transportation (DelDOT) performed a rail study that found that Amtrak might be willing to stop some of their regular trains at station(s) north of Wilmington if the station was part of an intermodal system.

In the late 1990s, DelDOT determined that the Tyler McConnell Bridge would have to be replaced or expanded. Since the monorail discussions considered a proposed routing that crossed this bridge, Representative Ennis and others suggested that the new bridge be built to accommodate some form of fixed guideway transit.

In recognition that public transportation is crucial for addressing future travel needs and meeting federal air quality requirements, as described in the 2025 Metropolitan Transportation Plan (MTP), WILMAPCO led this exploratory study to determine if monorails should be incorporated in a comprehensive study of high capacity transit options. This study was done partnership with DelDOT, Delaware Transit Corporation (DTC), the City of Wilmington, New Castle County, and elected officials in the region.

The study answered the following questions:

- Where and how have Monorail/AGTs been implemented, and with what results? How do these locations compare with the WILMAPCO region?

- Would a Monorail/AGT or other elevated fixed guideway system be effective in the WILMAPCO region? Effectiveness should be based on public acceptance, demographics, and technical feasibility.

- If deemed effective, what would be the preferred alignment and technology? Also, what issues need to be addressed through further study to advance Monorail/AGT planning, i.e., what changes in land use, innovative sources of funding, and overcoming of major obstacles would be needed to make a Monorail/AGT system a success?

Many of the questions related to technical feasibility are addressed in this memorandum while all of these issues are considered in the final report for the study.

1.3 COMMITTEES AND PUBLIC PROCESS

1.3.1 Management Committee – Purpose and Role

The Management Committee consisted of nine (9) representatives from the implementing agencies of DelDOT, WILMPACO, New Castle County, City of Wilmington, TMA Delaware, Delaware Transit Corporation, and the Delaware General Assembly. They directed the study process and worked with the Consultant Team to determine the optimal alignment that will allow for future expansion as population and employment centers shift within county boundaries. Once the exploratory study is complete, the Management Committee make recommendations on whether subsequent studies are desired and a course of action toward implementation if a future transit system is proposed.

1.3.2 Steering Committee – Purpose and Role

More than ninety individuals were invited to join the Steering Committee, which represented a cross-section of stakeholders including transit advocates, environmental, community and civic organizations, business leaders and elected officials. Membership was open to anyone wishing to participate.

The Steering Committee's purpose and role was to gather information and make recommendations to the Management Committee based on the analysis and recommendations made by the Consultant Team. The Steering Committee also assisted in public outreach programs to assess community feedback.

Working in concert with the Consultant Team, the Steering Committee helped to develop a "Purpose and Need Statement" that identifies the mobility needs in northern New Castle County that a monorail would need to satisfy to be successful. This Purpose and Need Statement is presented in Section 3.0.

1.3.3 Public Participation

Public outreach was a critical component of our process. The public had many opportunities to provide comments, questions or concerns including:

- Public Workshop
- Public Comments on the WILMAPCO Website
- Stakeholder Interviews
- Concerns Relayed Through Elected Officials, Business and Civic Leaders
- Informal Surveys Distributed at Public Workshop and Steering Committee Meetings

All information received was evaluated and presented to the Management and Steering Committees to assist them in making a decision about future study and actions.

1.4 STUDY METHODOLOGY

We used both sketch planning and consensus-building techniques to identify and assess a corridor, and decide on the feasibility of monorails in northern New Castle County. To assess demand, we used GIS-based sketch planning techniques to find areas in the region that are transit supportive. This type of analysis uses data such as land use, population and employment indices, and the locations of major trip generators. To assess system characteristics, we used information such as vehicle capacity, maximum and average speed, vehicle costs, civil (station, guideway, etc.) costs, and operations and maintenance costs to identify the most appropriate transit technology for the demand and topographic/geographic characteristics.

Consensus-building involved working with three distinct groups. The first group was comprised of the study team, the Steering Committee and the Management Committee. The second group was comprised of the major stakeholders such as major employers and institutions. Many in this group were also on the Steering Committee. The third group was the public. We provided opportunities throughout the project for the community to comment, helping us to achieve a public consensus, using public meetings, a project web site, newsletters and comment sheets.

2.0 EXISTING CONDITIONS AND CURRENT PLANS

2.1 DESCRIPTION OF THE STUDY AREA

The study area included New Castle County, north of the Chesapeake and Delaware Canal and adjacent areas of Cecil County, Maryland, focusing on a corridor approximately 3 to 5 miles north and south of I-95 (Figure 2-1). Because the influence of any future transit connection would extend beyond this area, we coordinated our planning with neighboring areas of Pennsylvania as well.

2.1.1 Major Roads

In northern New Castle County, major highways connect Delaware to regional, national, and even international destinations. Nationally, I-95 is one of the most traveled interstates, linking Miami to Maine and the Atlantic Provinces of Canada.

Regionally, New Castle County is part of the Philadelphia tri-state area (Pennsylvania, New Jersey, and Delaware). Interstates and limited-access highways provide links within this metropolitan area. I-95 goes to Philadelphia via Downtown Wilmington, while I-295 goes to Southern New Jersey and the New Jersey suburbs of Philadelphia. I- 295 also serves as a Philadelphia by-pass to the New Jersey Turnpike and New York City. I-495 is a Wilmington by-pass allowing a short travel time between Pennsylvania and I-95. I-95 from the Delaware state line to the South College Avenue (Delaware 896) exit, is the Delaware Turnpike. This small portion of Interstate generated $59.9 million in 2000--almost 75 percent of the Delaware's toll revenues and 17 percent of the state's transportation user fees revenues.

Delaware Route 1 is a limited-access highway that travels south from I-95 through Delaware. This freeway is a fast alternative to US Route 13 for access to Dover and the Delaware beaches. Delaware Route 141 is another such highway, albeit a shorter one, connecting New Castle County Airport to Kirkwood Highway and continues as a circumferential highway around Wilmington to US 202. Major arterials include US 13, US 40 (connecting Maryland and New Jersey), and US 202. The latter of the three routes is a vital regional corridor housing the biggest employers and retail facilities in the region. Within Delaware, Route 202 links downtown Wilmington to a commercial and business corridor all the way to the Pennsylvania border. This corridor continues through Pennsylvania, where it travels through the heavily traveled technology, commercial, and suburban corridor from West Chester to King of Prussia.

A smaller network of key highways connects the cities of Newark, New Castle, and Wilmington. Delaware Route 4 connects Newark, Churchman's Crossing, Newport and Wilmington. Delaware Route 2 (Kirkwood Highway) connects Wilmington and Newark before continuing to Maryland. The cities of New Castle and Wilmington have the traditional grid street pattern, with Wilmington having the denser and more widespread network. Newark carries a more suburban street pattern.

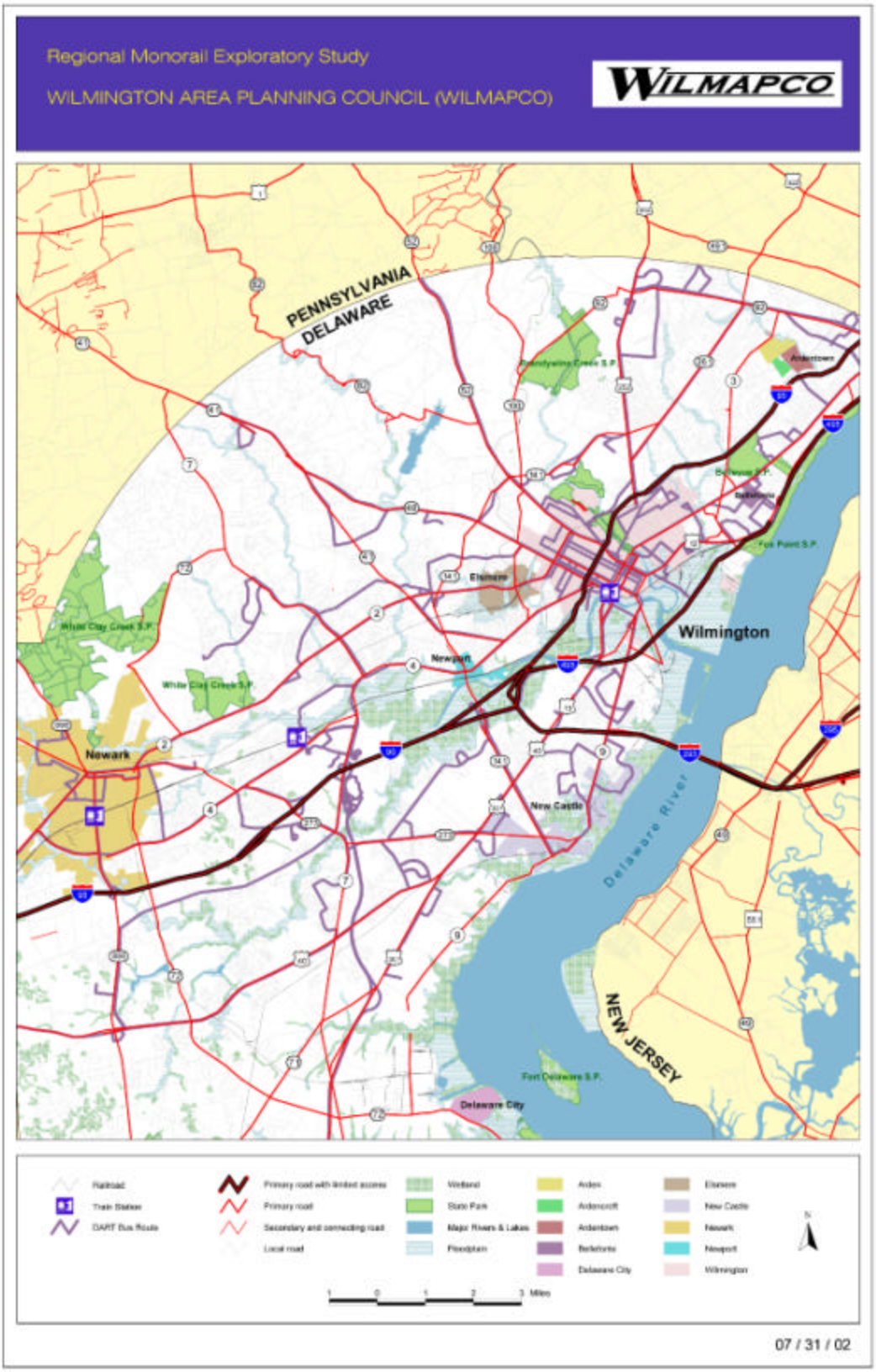


Figure 2-1: Area Map and Environmental Features

2.1.2 Major Rail Lines

More than 21 million tons of freight was carried by rail along the Northeast Corridor across Delaware. Norfolk Southern and CSX are two of the six freight railroads operating on the state's 218 miles of track. Two smaller railroads, the Maryland & Delaware Railroad and the Wilmington & Western Railway, also operate in the state[1].

Passenger rail service is available at four stations: Wilmington, Newark, Churchman's Crossing, and Claymont. Amtrak serves the Wilmington station with Metroliner, and Acela Regional and Express Service. The Southeastern Pennsylvania Transit Authority (SEPTA) serves all four stations with connections to Philadelphia, suburban Pennsylvania, and New Jersey.

2.1.3 Demographic and Housing Characteristics

Because of the study area's prime location along the Northeast Corridor, most of Delaware's population lives within it. New Castle County's population accounts for 64 percent of the state's population with approximately 500,000 residents[2]. The population is projected to increase by approximately 54,000 by the year 2025[3]. The 2000 Census showed that New Castle County is the most densely populated of Delaware's three counties. Outside of New Castle County, no area has a density below 450 persons per square mile while densities inside the county start at 733, with most between 2,000 and 3,000. In downtown Wilmington, densities reach over 6,000 persons per square mile. Population expected to increase the fastest along the Route 202 corridor, the Delaware Route 1 corridor, and south of the City of New Castle. Employment is expected to grow by a factor of at least two in most of this area.

2.1.4 Major Environmental Features

Northern Delaware, with its woodlands and water bodies, is home to several environmental features (Figure 2-1). If monorail planning continues, then a future Environmental Impact Statement with a detailed environmental analysis would be completed. Our parks and wetlands are potential environmental obstacles, as the monorail system should not harm these valued resources. State Parks represent protected land in the region, while flood regions represent regional protected wetlands and waterfronts. Finally, air quality affects our natural resources and the health of our population. The corridor evaluation considers the level of impact a particular alignment would have on each of these environmental features.

[1] Association of American Railroads, Jan. 2002.
[2] WILMAPCO indicates a population of around 487,000, while the US Census Bureau (2000) calculates 500,265.
[3] From WILMAPCO. The Delaware Population Consortium predicts the population of New Castle County to be over 94,000 by 2030.

2.1.4.1 Parks and Greenways

Nine Delaware State Parks are in New Castle County. White Clay Creek Park, north of Newark, is the largest with approximately 3,200 acres. Brandywine Creek Park is near busy Route 202, with approximately 900 acres. Fox Point Park, with about 500 acres, is along the Delaware River adjacent to the SEPTA/Amtrak line just south of the Claymont Station. Bellevue Park is immediately west of Fox Point. Wilmington State Parks include the Brandywine Zoo, Alapocas Woods, Rockford Park and others. Spanning 10 miles, the Northern Delaware Greenway connects Fox Point State Park on the Delaware River to the Brandywine Creek and the City of Wilmington. This urban trail connects with Wilmington's Walkway System and links together residential communities, schools, businesses, parks and cultural sites. The East Coast Greenway is a route planned from Maine to Florida, that will connect Claymont, Fox Point, Wilmington, New Castle, Churchman's Crossing and Newark in Delaware.

2.1.4.2 Wetlands and Flood Region

Small, fragmented wetlands encompass areas south of the Northeast Corridor Rail line. One large cluster is located in the City of New Castle and between New Castle and Delaware City along the Delaware River. Another is along I-95 near the I-95/I-295 interchange. The flood region takes up much space along the Christina River, reaching its widest point at the Port of Wilmington (2.8 miles). From there inland, the flood region gradually narrows, but grows again and encompasses the entire I-95/I-295 interchange. After this point, the flood region breaks into two paths in tandem with the Christina River and White Clay Creek, and reaches a width of about 1,300 feet.

2.1.4.3 Air Quality

New Castle County and Cecil County, Maryland are located in a severe non-attainment area due to unhealthy levels of ozone. This designation is issued by the Environmental Protection Agency (EPA) for not reaching the desirable levels of air quality as outlined in the National Ambient Air Quality Standards (NAAQS). WILMAPCO must work to reduce the amount of air pollution through the long-range transportation plan and the transportation expenditures programmed in the 3-year Transportation Improvement Program.

2.2 REGIONAL GOALS AND PLANS

As the Metropolitan Planning Organization for the Wilmington Urbanized Area, WILMAPCO is required under federal regulations to develop a long-range transportation plan for the region. The 2025 Metropolitan Transportation Plan reflects the transportation goals, policies and investment planned for the region in the next 20 years and is updated every three years. The 2025 MTP has five basic elements: (1) Goals, (2) Growth assumptions, (3) Strategies and policies, (4) Actions, and (5) Major project investments.

The MTP identifies transportation investment areas (TIAs) and specifies appropriate types of investments in them. Community TIAs and Centers have dense populations and well-established land uses, making them more likely to support transit than other areas in the region. Public transportation is proposed for these TIAs to provide more transportation choices and mitigate congestion Transit improvements include rail service expansion and/or extensions, enhancements to multi-modal stations, new and upgraded bus facilities, and new express busses.

The MTP outlines six goals for the region:

1. **Better and more predictable planning**, with land-use and transportation linked.

2. **Sustain a healthy and growing economy** that is built on our geographic advantage and the skills of the population.

3. **Improved quality of life,** emphasizing a sound environment, less congestion, better and more appropriate use of land, instilling a sense of security, and providing opportunities for employment and better education.

4. **Enhancement and re-emergence of traditional communities and municipalities** as the location of commerce, culture and mixed-use housing for the area.

5. **Improved mobility, accessibility, and transportation alternatives** to provide efficient movement of people and goods.

6. **Achieve more effective intergovernmental coordination,** at the federal, state, regional, and local levels, and better public/private communication and understanding on issues of development and transportation.

The MTP includes strategies to that consist of projects and policies to:

- link transportation and land use
- protect natural and historic resources
- improve mobility
- manage the transportation system
- improve commerce

Federal regulations require that the MTP be financially constrained, meaning we anticipate having enough funds to pay for all projects included. The MTP also is required to work toward achieving better air quality and be a product of public and local government input.

An Annual Effectiveness Review measures accomplishments for each of the strategies and analyzes trends to gauge progress since the last MTP. Currently, WILMAPCO preparing an updated MTP, called the 2025 Regional Transportation Plan (RTP). This update will be adopted in the spring of 2003 and will reflect new demographic information and updated transit plans.

2.3 DESCRIPTION OF RECENT PLANDS AND STUDIES

A review of existing transportation and land use plans and studies was conducted better understand the long-range transportation planning issues facing the region. The key interrelated challenges are traffic congestion and its impact on ambient air quality along with the variety of socioeconomic impacts that result from suburban sprawl.

The studies described below propose an intermodal approach to these growth challenges. These approaches involve significant enhancements to the regional transit network.

Regional Parking and Land Use Study for WILMAPCO prepared by Edwards & Kelcey, Inc., July 1996.

This study developed parking strategies for the region that were consistent with and supportive of the 2020 Metropolitan Transportation Plan (MTP). Through a comprehensive analysis of parking supply and demand, a series of strategies for on-street and off-street parking were recommended for implementation at the county and municipal levels. Short-term recommendations included changes to existing zoning ordinances to provide incentives such as density bonuses for developers prepared to include mixed use or new site design standards that reduce the need for exclusive on-site parking. Specific recommendation were made for Wilmington, Newark, and Elkton involving changes to zoning codes, new parking policies, and actions to be undertaken by departments of public works and local business associations.

Churchman's Crossing Study, prepared by WILMAPCO, DelDOT, and New Castle County, April 1997.

The Churchman's Crossing Study defined a vision for this area and developed a transportation and land use plan to support the vision. The study made specific recommendations regarding land use, transit, regional rail, travel demand management (TDM), and roadways. The transit analysis involved the testing of two packages of future public transit services for Churchman's Crossing. The first package contained the new and expanded services recommended in the WILMAPCO MTP. The second package was a set of new bus routes developed to service the specific travel needs of Churchman's Crossing. The study recommended many elements of both packages with the caveat that a number of related elements must also be in place. Some of these elements are higher population and employment densities in transit corridors, employer support of transit use, improve off-street parking, improve bus stop access, and continuing transit service development with a comprehensive marketing program. Since the completion of the study, many of the recommendations have been implemented, including two circulator bus routes, a new park & ride, bus stop enhancements, new sidewalks, and commuter rail service.

Wilmington Area Planning Council Transit Service Needs Study, Final Report prepared by SG Associates, Inc., and Michael Baker Jr., Inc., December 1997.

This study identified a series of actions that would build on existing programs and begin a process leading to the transit system required to meet the 2020 MTP goals. The regional plan called for reducing the share of travel by driving from 67 percent of all trips to 57 percent of all

trips. Public transportation played a key role in achieving this objective requiring a four-fold increase in the number of daily trips carried by transit.

The recommendations included improved customer services such as better public information and enhanced bus stop facilities, the recognition of Newark as a growing employment destination, the implementation of non-tradition transit services such as route and point deviation utilizing automated support technologies, improved capital facilities, and providing better service connections between New Castle and Cecil counties. Recommendations that have been carried out include bus service between Newark and Elkton, Maryland, commuter rail service in Newark, and improvements at bus stops.

Application for New Starts – Wilmington Trolley, prepared by Delaware Transit Corporation, July 1999.

The Wilmington Trolley project grew out of previous transportation and economic development studies that focused on the redevelopment of downtown Wilmington. These studies showed the need for improved connections among the major activity centers of the Downtown and the Riverfront. For example, the I-95 viaduct and the Christina River constrict the rapidly developing entertainment, cultural, and retail centers on the Riverfront. This constraint restricts Wilmington Train Station patrons' access to this area, as well as to attractions such as the Exhibition Center. Wilmington's corporate, retail, educational, cultural and entertainment centers are dispersed with distances between major activity centers that are too far to walk.

A 2.1-mile route for the Wilmington Trolley was proposed to provide downtown connections that would vastly improve mobility to the City's residents, employees, and visitors. The trolley route was to originate at 12th Street and Market, operate along Market Street, and terminate at the Riverfront. The trolley would improve mobility for automobile users who work downtown and wish to go to other areas such as the Riverfront without taking their cars. The trolley would also improve mobility to pedestrians and Amtrak and SEPTA passengers who use the train station every day and need a convenient way to travel around the downtown area.

The proposed steel wheel trolley was projected to cost $37 million with an annual operating cost subsidy of almost $1.5 million. Annual ridership was estimated at slightly over one million passengers. Since the completion of the study, a rubber-tire version of the trolley has been implemented as an alternative to the trolley originally proposed.

Route 40 Corridor 20-Year Transportation Plan prepared by DelDOT and New Castle County and WILMAPCO, July 2000.

This plan identified transportation improvements that address current and planned development with alternatives to the automobile such as bus transit, bicycle, and pedestrian improvements. Specific projects are recommended over the next twenty years with time frames and projected costs. A program of bus transit service, facilities, and management improvements were recommended having an estimated capital cost of $5.5 million and an estimated 20-year operating cost of $30 million.

DTC 2025 Long Range Plan prepared by Parsons Brinckerhoff, December 2000.

The Long Range Plan (LRP) provided DTC with a broad policy direction and a detailed description of transit services, programs and projects to be undertaken through 2025. It was developed concurrently with the agency's Five-Year Business Plan, which serves as the first phase of actions set forth in the LRP. The plan methodology included a background assessment, defining goals and objectives, a public outreach program, and the determination of transit needs. An initial base service concept was established for the horizon year that included improved bus services, a state-wide express bus system, expanded parking at existing rail and new bus facilities, improved passenger amenities, more extensive marketing, increased paratransit productivity, and improved SEPTA R2 rail service.

An "augmented" service concept was also developed that could supplement the base concept. The initiatives that make up the augmented concept include a MARC extension to Wilmington, a ferry service with ports in Lewes and Wilmington, rail service to Philadelphia International Airport, *cross-town rapid transit service from Fox Point*, and various interstate bus linkages. The augmented services are recommended as "studies". This *Regional Monorail Exploratory Study* is addressing the feasibility of the cross-town rapid transit concept.

DTC Five-Year Business Plan 2002-2006 prepared by Parsons Brinckerhoff, December 2000.

This business plan describes the program of projects for the first five years of the LRP. The program includes several bus service expansions and improvements, the development of performance standards, and a number of facility and technology improvements such as upgrades to bus stops, park-and-ride lots, real-time travel information, automatic vehicle locations systems, on-board bus surveillance equipment, and a new bus maintenance facility.

Blue Ball Properties Master Plan prepared by Wallace Roberts & Todd, LCC, January 2001.

The Blue Ball Plan seeks to maximize public benefit from approximately 225 acres of land acquired by the State of Delaware at the intersection of U.S. Route 202, Foulk and Rockland Roads. This land acquisition has allowed the State to address several local and regional issues such as Delaware's economic competitiveness and the creation of high quality jobs, the provision of recreational opportunities and open space, the safe and convenient movement of people and goods, and the protection and repair of the natural environment.

The Master Plan integrates transportation and recreation planning with economic development activities. The park features are the result of a synthesis of site constraints/opportunities weighed against park needs. Park uses are designed to fit with the existing natural and cultural characteristics of the land. The park is designed with sections west and east of Route 202. The transportation plan includes features to enhance the road network, intersections, the construction of greenway and pedestrian bicycle paths, and a series of transit improvements. Some of the transit improvements include increasing the frequency and directness of bus Route 28, extend bus Routes 20 and 21 to AstraZeneca and DuPont, a bus route in the Foulk Road Corridor and the U.S. Routes 41, 48 and 141 corridors, and bus priorities on Route 202 (possible queue jumper egress). The plan also includes a comprehensive stormwater management program.

Update to Innovative Transportation Opportunities for Delaware In the 21st Century prepared by Representative David Ennis, November 2001.

This "talking points document" provided the basis for the *Regional Monorail Exploratory Study*. The purpose of the document was to raise the level of discussion about transportation alternatives that might place Delaware in the competitive business market for economic growth in the 21st Century while protecting the current quality of life to attract the right kinds of businesses in the future. The document discussed the use of high-speed ferry services between Wilmington and Kent and Sussex, as well as to New Jersey and Philadelphia. It described expanded SEPTA services and the establishment of a regional Monorail/AGT people mover system connecting high-speed ferry stops with light rail transit centers and SEPTA commuter stations.

DTC Passenger Rail Engineering Study prepared by DMJM + Harris, January 2002.

This study examined the engineering feasibility of passenger railroad service between Wilmington and Dover. The study did not find any "fatal flaws" that would prevent operating passenger trains in a weekday commuter service between Dover and Wilmington. The service would be primarily based on existing railroad lines and former railroad rights of way. Significant property acquisition is not anticipated with the exceptions for stations, parking lots, yards and other ancillary facilities.

Three routes between Dover and Wilmington were proposed for further study. Each route uses the same rail corridor between Porter and Dover and each has similar alignment options in Wilmington. The service is expected to have an initial capital cost between approximately $303 and $477 million depending on the route and option. The annual operations and maintenance costs will be between $12.3 and 13.8 million depending on route and option.

3.0 PROJECT PURPOSE AND NEED

3.1 PURPOSE AND NEED DEFINITION AND DEVELOPMENT PROCESS

The Purpose and Need Statement outlines the issues that need to be addressed and the reasons for we completed the study.

Early in the process, WILMAPCO convened the project's Steering Committee. This committee was made up of the Wilmington Area Planning Council (WILMAPCO), the consultant team, and a group of concerned Delaware citizens. The first Steering Committee meeting took place on June 24, 2002 and was open to the general public. The background issues of the project were presented and the importance of a Purpose and Need Statement discussed. The criteria required from the Federal Transit Administration for their New Starts Evaluations, the process by which federal funds are granted to transit projects, was also presented. At this stage in a project's development, the FTA guidelines were offered as information but are not required. Bearing the FTA criteria in mind early in the process could make meeting such requirements down the road easier. The FTA measures include measurements of:

- mobility
- environmental quality
- operating efficiencies
- cost effectiveness
- land use

The Steering Committee then generated a list of the motivations for considering AGT in the Wilmington region. The responses fell into these categories:

- Transportation improvements (more connectivity, mobility, multi-modalism)
- Use of this system as an impetus for improved Quality of Life
- Destinations (work, home, retail, tourist)
- Insure that the end product is a logically and realistically sound one

With these comments, the project team performed background research on previous Delaware transportation studies. The study team, in an effort to be consistent with the goals of previous studies, adopted the mantra of these studies. The information from those studies, combined with the Steering Committee meeting discussion, was used to create this Purpose and Need Statement.

3.2 PURPOSE AND NEED STATEMENT

The purpose of exploring a Monorail/AGT system in the Wilmington Region is to assess if Monorails have the technical feasibility and public support to meet future transportation needs in a way that is cost effective and has minimal adverse impacts on the environment. The Wilmington Region has a growing population and employment base, a strategic location on the Northeast Corridor, a full mix of recreational and retail opportunities, and strong transportation

connections to other urban centers. Our Region offers a variety of lifestyles: urban downtowns, suburban residential communities and office parks, and rural lands. Tourists visit from points throughout the eastern seaboard and beyond. The transportation system supporting all of this is truly multi-modal and includes roadways, rail, and fixed route and demand-responsive bus transit. As our Region moves into the future however, it will need a more extensive and better transportation system.

Continued economic growth, an established goal for the region, depends upon a strong, multimodal transportation network. The Region's transportation and planning agencies thoroughly understand this, and have initiated planning to expand all aspects of the system to serve future needs. Expanding the existing bus and rail transit routes, capitalizing on railroad property for passenger service, providing options for walking and cycling, and improving the efficiency of our roads are all parts of the same overall plan for supplying the transportation network needed for the future.

The Region's current and future employment is located in downtown Wilmington and in the various suburban centers. Access to these employment centers varies, with some areas well served by highways, transit, or both; other areas are not so fortunate. Consequently, travel around the Region is not always direct and is frequently congested.

Central to the Region's concerns for the future is growing traffic congestion and poor air quality. Both the major highways and local arterials are experiencing increased traffic forcing motorists to deal with increasing delay. This is one factor that has resulted in the Region falling into an air quality status of "non-attainment." Unless our transportation plans work to improve our air quality, we risk losing Federal transportation funding for any roadway expansion; should this occur, only transit and HOV projects may be constructed with federal funds.

The transportation system supports a lifestyle but does not create it. Land use is an important element in creating a high quality environment in which to live. Growth has given rise to concerns over "suburban sprawl." Increasingly, communities are being built that are entirely dependent on the automobile. Transit is limited or non-existent and walking and bicycling opportunities are infrequent. An inconvenience to many, lack of transportation choices can limit mobility for the elderly and transit-dependent in our community, who have limited access to a car.

Livable Delaware seeks to reverse this trend by encouraging development in areas where adequate infrastructure can support it. Transit can work cooperatively with this notion by encouraging and supporting development in densities sufficient to make transit operations viable. In turn, transit-oriented development can offer some measure of independence from the automobile.

Automated guideway transit (AGT), including Monorails, might play a role in the overall transportation system for the Wilmington Region. Its unique operating characteristics and physical features make it ideal in certain settings and for specific uses. AGT would be responsive to the principal transportation needs of the Region by:

- Effectively serving central city and suburban employment centers

- Offering an alternative to single occupancy vehicles
- Mitigating growing highway congestion
- Mitigating deteriorating air quality conditions
- Integrating with other modes of travel and transit services
- Supporting regional economic development
- Improving connectivity between the Region and Wilmington, Philadelphia and other urban centers

A future AGT system should be carefully considered to ensure it:

- Can be constructed and operated in a cost-effective manner
- Meets with general acceptance by the traveling public and the communities through which it passes
- Minimizes adverse impacts on the natural and manmade environment.

4.0 MONORAIL/AGT IMPLEMENTATION AND ASSOCIATED ISSUES

Monorail/AGT has characteristics that are attractive to Delaware leaders given the concern of meeting federal air quality standards. Monorails run on a dedicated guideway separate from the road and do not add to traffic congestion. Since monorails run on electricity, they produce no harmful emissions and little noise. Because the trains are lighter than traditional rail and generally operate on rubber tires, there is less vibration, especially on the ground. For systems installed to date, there has been no significant electromagnetic interference.

In recent years, a growing number of Monorail/AGT technologies have been built in urban areas as circulators and distributors. Table 4.0-1 compares various urban AGT systems to aid the decision making process locally. More details on these systems are in the Appendix.

4.1 MONORAIL AND OTHER AGT TECHNOLOGIES

Monorails (as a specific class of fixed guideway transit technology) are self-propelled vehicles or trains that are supported on or suspended from a single rail or guideway beam. Monorails are considered a subset of the AGT technology class. Whether monorails are straddle-beam or suspended, the nature of their design does not allow for the derailments suffered by conventional rail. Monorails operate on concrete or steel guideways using electric self-propelled, rubber-tired, driverless vehicles. Monorails rely on computer-based control systems that are capable of rapidly responding to fluctuations in demand. The two general groups of monorails, large capacity and small capacity, are defined by both cabin/vehicle size and speed. Large capacity monorails are relatively fast, with speeds up to 60 mph. System line capacities for large monorails range from 3,000 to 10,000 passengers per hour per direction (pphpd). System line capacities for small monorails range from 500 to 3,000 pphpd, with speeds of 15 to 30 mph.

The wider class of AGTs are fully automated, driverless systems that run on fixed guideways along exclusive right-of-ways. Cruise speeds vary from about 20 to 55 mph. These systems operate on guideways using electric self-propelled, driverless vehicles. Their computer-based control systems are capable of rapidly responding to fluctuations in demand. System line capacity ranges from 5,000 to 20,000 pphpd.

When AGTs function like horizontal elevators, moving people in activity centers like downtowns, airports, and entertainment areas, they are called Automated People Movers (APM). APMs have potential in office parks, shopping centers, and resorts and can provide interesting architectural opportunities. While driverless systems were readily accepted for airports, downtowns and circulation within other defined activity centers beginning in the 1970s, the concept of no driver or attendant sitting in the cab of a high speed, high capacity metro or rapid transit vehicle was not quickly adopted due to passenger perception concerns and labor union reaction.[4] The number of driverless rapid transit systems has steadily increased in Europe and Asia; however, in North American this growth has not yet occurred,

[4] Hal Lindsey and David Little, Lea+Elliott, Inc., Driverless Rapid Transit Systems Take Hold, APTA Commuter Rail/Rail Transit Conference Proceedings, Boston, MA, June 2001.

URBAN AGT SYSTEMS								
		Existing				Planned		
System Characteristics	Units	Las Vegas	Jacksonville	Seattle	Vancouver	Las Vegas	Seattle	Vancouver
- Length	dual-lane/miles	0.7	2.5	0.9	18.0	6.8	14.0	13.0
- Number of stations	Each	2	8	2	15	13	16-18	14
- Fleet size	vehicles	12	18	8	150	19	Large Capacity	60
Ridership	Million/year	5.0	0.72	2.5	43.4	20.1	19.7-24.5	24.1
Cost/mile – direct Cost/mile – adjusted***	Million $/mile	$36 NA	$74 $111	$4 NA	$48 -	$91 $83	$64 $62	$48 $52
Capital Cost	Dollars	$25 million	$184 million	$3.5 million	Ph 1 $615 million* Ext1 $145 million Ext2 $97 million	$618 million	$900 million	$800 million
Operating Cost	Million/year	-	$3.5	-	$43 ($Can)	$19.8 - $23.2 (initial)	$18-$25 (Green Line)	$43** ($Can)
Population 2000 - City - County	Persons	478,434 -	735,600 -	563,374 -	514,008 (1996) -	- 1.6 million (2006)	732,400 (2030) -	514,008 (1996) -
Land Use Impacts	N.A.	Tourist commercial use.	No significant impact on land use.	Provides a link between downtown Seattle and the Seattle Center.	Provides no harmful emissions.	Commercial & retail growth, Conversion of residential to commercial, Higher density tourist commercial use.	Land use will not vary much once the monorail is built.	Encourages urban development of commercial and residential areas.
Economic Impacts	N.A.	Joint venture between MGM and Bally's Hotel/ Casino. Proposed extension to include the RTC.	Growth and development did not happen as anticipated.	Only fully self-sufficient public transportation system. Proposed extension of the system.	High ridership and route length have encouraged development.	Increase in employment during construction. Links strip with downtown.	Improve mobility and transit access along the corridor.	Increase in development. Increase in jobs with the vehicle being built in Vancouver.

* Cost in year built. Phase 1 and extensions 1 and 2 in US dollars.
** Current operating costs of existing system in 2001.
*** Adjusted to account for differences in location, level of supplier competition and inflation in comparison to a system in the Wilmington/Newark region.

TABLE 4.0-1: EXISTING AND PLANNED URBAN AGT SYSTEMS

except in Vancouver, the only non-monorail system discussed in this Section. The existing monorail systems in Las Vegas and Seattle have drivers while it is anticipated that each expanded system will be driverless. The Jacksonville Skyway monorail system is driverless.

4.2 LAS VEGAS MONORAIL SYSTEM

The Las Vegas Monorail is considered an effective means of positively influencing land values and redevelopment efforts. With the monorail, commercial and retail growth is expected, with a conversion of residential to commercial and a higher density of development for tourist use. The system is expected to be a tourist-oriented system and its station locations should attract ridership. The monorail is also expected to increase employment during the construction of the system. The expanded Las Vegas system is similar to what is being considered in Wilmington with regard to being a line-haul service connecting several employment and recreational generators with limited direct access to residential areas. The markets each system is expected to serve, however, are quite different. The Las Vegas system is tourist oriented with the vast majority of its riders accessing the system by walking. The Wilmington system will serve the work trip with most riders accessing the system via car, bus, or rail.

4.3 SEATTLE MONORAIL SYSTEM

According to the Draft Seattle Popular Transit Plan, the Green Line was chosen for the first regional monorail line because the 14-mile alignment would connect neighborhoods with each other and with the downtown and met the City of Seattle's goals for intermediate capacity transit. In addition, it was selected in coordination with other transportation agencies and after considering suggestions from hundreds of people at community meetings. This process is similar to what is now being undertaken in the Wilmington metropolitan area. The Seattle monorail plan calls for good linkages between bus, train, and ferry services, which is identical to the objectives described in Innovative Transportation Opportunities for Delaware in the 21st Century.

4.4 JACKSONVILLE MONORAIL SYSTEM

The Jacksonville Monorail system (Skyway) currently has two intermodal stations that serve as transfer facilities for bus and park-n-ride patrons. With free transfers from bus to Skyway, this can potentially shift vehicular trips to transit. Ridership on this downtown circulator/distributor system has not met the projected levels. The transit authority attributes the lack of riders to economic recessions in downtown Jacksonville in the early 1990s that led to a decrease in development in the area.

The Skyway system also includes a river crossing over the St. Johns River. The Acosta Bridge was replaced with a new bridge to accommodate the Skyway. Having a bridge, which combined automobile traffic and the skyway on a single structure, was a significant cost savings to the taxpayers. The lessons learned can be used when considering the option for Wilmington's Tyler McConnell Bridge project.

4.5 VANCOUVER RAPID TRANSIT SYSTEM

The Vancouver SkyTrain also includes a river crossing over the Fraser River. The high ridership and route length of SkyTrain have several economic benefits, such as an increase in development. The Bombardier MKII vehicles for the extension are being built in Vancouver, creating jobs and an investment of $175 million in local goods and services.

4.6 SUMMARY OF PLANNING AND IMPLEMENTATION ISSUES

In urban areas, Monorail/AGTs will only be operationally successful in comparison to traditional transit modes when used within a well-defined system application. The significant issues that impact the planning and implementation of Monorail/AGT systems are related to aesthetics, construction, cost, efficiency, and safety.

5.0 INITIAL FEASIBILITY CRITERIA/INITIAL CORRIDOR EVALUATION CRITERIA

In identifying a potential initial corridor, the Team examined person trips and major generators. The Team researched where urban monorails and AGTs were implemented and how they compared to the WILMAPCO region. The proposed alignments take into consideration downtown service to Newark and Wilmington, a link to rail service at Amtrak and SEPTA with intermodal stations, and station locations at major activity centers. The alignments also connect with the commuter rail service between Wilmington and Dover that is currently being studied.

The development of potential alignment segments was based on the review of:

- Transportation data
- Alignments proposed in the document "Innovative Transportation Opportunities for Delaware In the 21st Century"
- Input from the WILMAPCO staff and Steering Committee

A major transportation data input was the Person-Trip Tables developed by DelDOT. The Team developed a desire line map of the Home-Based Work Person-Trips using districts developed for this study from the existing New Castle County traffic analysis zones (TAZs). Figure 5-1 shows the inter-district work trip volumes. Additional data considered included transit usage, major trip generators, and the potential for the Monorail/AGT to interface with the proposed Wilmington-Dover passenger rail service.

The innovative transportation opportunities "talking points document" developed by Representative David Ennis suggests Monorail/AGT routing alternatives that provide good coverage given the person-trip movements and the location of major generators in the service area. In addition, the route suggestions are attentive to intermodal connections such as commuter rail services and possible high-speed ferry services.

All of the alignment options are shown in Figure 5-2 and are defined as "segments" that would be fashioned into an initial alignment.

5.1 CORRIDOR EVALUATION CRITERIA

The Management and Steering Committees, working with the Study Team, evaluated the proposed alternative alignments to select a preferred corridor for analysis. The Study Team conducted a comprehensive evaluation of the proposed alignment segments based on the seven criteria contained in the Purpose and Need Statement. These criteria are:

- Effectively serving central city and suburban employment centers

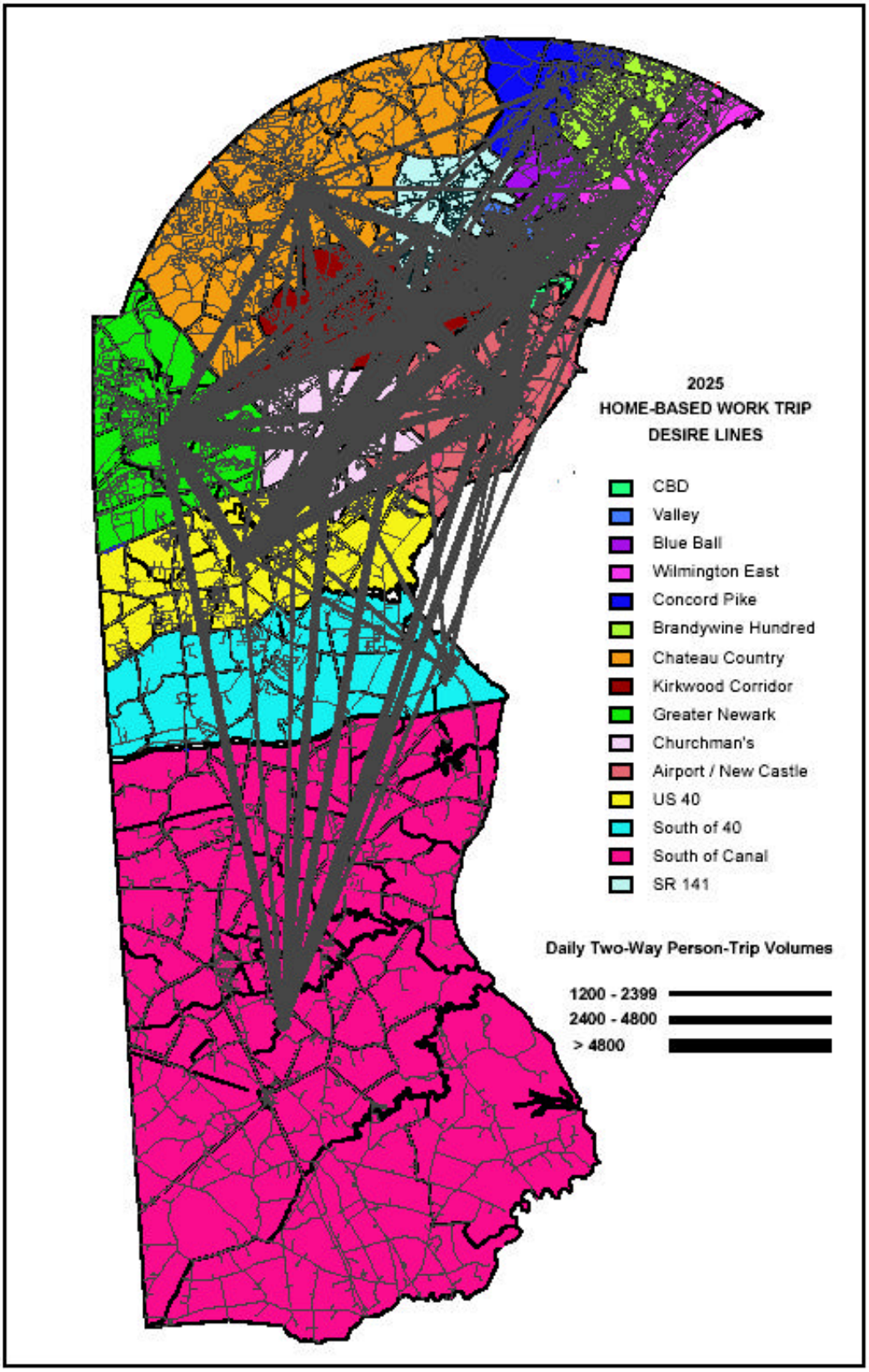


Figure 5-1: Inter-District Work Trip Volumes

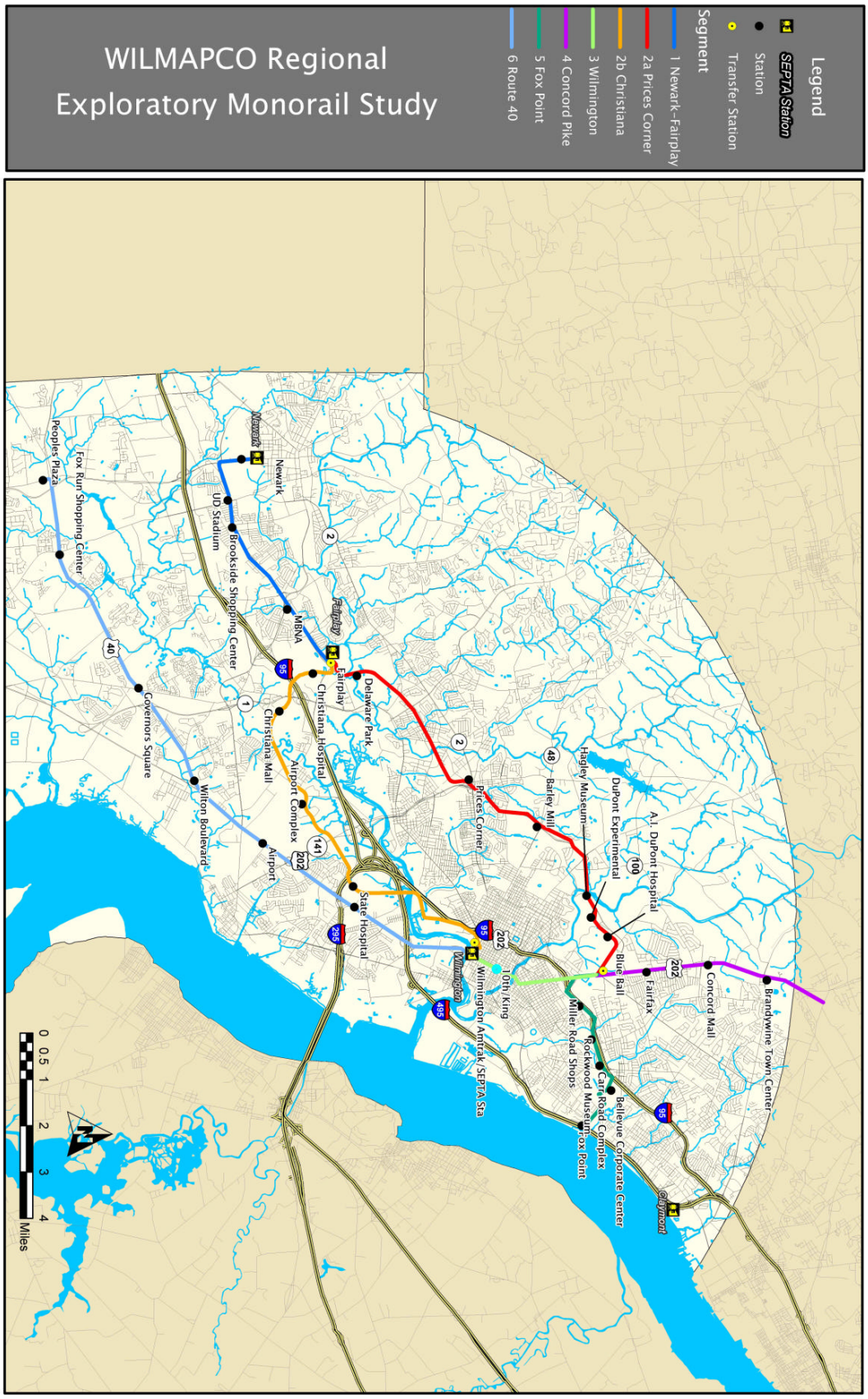


Figure 5-2: Segment Identifier Map

- Offering alternatives to the automobile
- Mitigating growing highway congestion
- Mitigating deteriorating air quality conditions
- Integrating with other modes of travel
- Supporting regional growth
- Improving connectivity between the Region and Wilmington, Philadelphia and other urban centers

A matrix was used to effectively evaluate these parameters against each alignment segment. The matrix was created using a qualitative evaluation system to determine which segments are preferred. This approach recognized that there are some segments that could never function alone. A matrix assessment is used to create a combination of segments, so an entire alignment can be further evaluated. This approach used initial evaluation by the study Team with further refinements by the Management and Steering Committees.

The following matrix evaluation was used as a basis for discussion with the Management and Steering Committees:

Segment Name/ Criteria	**1 Newark-Fairplay**	**2a Prices Corner**	**2b Christiana**	**3 Downtown**	**4 Concord**	**5 Fox Point**	**6 Route 40**
Effectively serving central city and suburban employ-ment centers	M	Y	Y	Y	Y	N	Y
Offering alternatives to the automobile	M	M	Y	Y	M	M	Y
Mitigating growing highway congestion	M	Y	M	M	M	M	Y
Mitigating deteriorating air quality conditions	M	Y	M	M	M	M	Y
Integrating with other modes of travel	Y	Y	Y	Y	M	Y	Y
Supporting regional growth	N	N	Y	M	M	N	Y
Improving connectivity between the Region and other urban centers	Y	Y	Y	M	M	M	Y

Y=yes N=no M=Maybe

6.0 ANALYSIS OF INITIAL CORRIDOR

6.1 ASSESSMENT OF TRANSIT USE AND KEY TRIP GENERATORS

Sound transportation system design begins with a thorough review of the existing travel characteristics and patterns. Such reviews provide the base for projecting future trip generation and distribution characteristics. In addition to the traditional surface transit system design concerns regarding connectivity and the ability to meet the needs of the various ridership market segments, the implementation of a major fixed guideway system requires the careful review of issues such as environmental and construction obstacles, visual aesthetics, and alignment flexibility.

6.1.1 Transit Usage

The 2025 Metropolitan Transportation Plan[5] developed by WILMAPCO in 2000 confirmed the need for significant increases in the use of modes other than the single occupant automobile. The plan called for a doubling of bus service but noted that, in spite of the actions taken by DART and the general growth in transit ridership, the share of travel by single occupant automobiles had continued to increase. Changes in travel behavior are necessary not only to assist in meeting the air quality goals for the region but also to maintain desirable levels of personal mobility with limited disruptive and costly roadway construction. Transit, ridesharing and non-motorized travel (walking and bicycling) need to increase in both the absolute number of trips and the regional share of trips if these goals are to be met. The absolute number of daily transit trips need to increase almost fourfold from roughly 20,000 to over 80,000. The plan recognized that such major changes require not only enhancement and expansion of transit services but also changes in the patterns of land development in New Castle County. Transit oriented development is required in order that citizens of the region can make use of the expanded transit services to meet their travel needs.

The Delaware Transit Corporation (DTC) has undertaken a series of activities designed to position the agency to play the role anticipated for it in the MTP. These activities have included not only new public services but also innovative fare policies, enhanced scheduling and dispatching systems and a renewed internal emphasis on customer service. As a result, DTC reports that transit ridership increased by 30 percent between 1995 and 2000[6], an astounding achievement. This achieved growth demonstrates that the residents of New Castle County will respond to the provision of new services that meet their travel needs. Maintaining ridership growth at these levels, however, will be difficult. To do so would require an aggressive effort by DTC to provide service that is not limited by ever increasing roadway congestion. It also requires involvement by all levels of government to promote development patterns that bring jobs and residences into close proximity to transit.

[5] WILMAPCO, 2025 Metropolitan Transportation Plan, February 2000.
[6] Delaware Transit Corporation, 2025 Long Range Plan, December 2000.

DTC's Long Range Plan sets out a menu of possible initiatives that can be undertaken to continue attracting additional transit riders. These relate to such basic actions as improved services frequencies and longer service hours to modified fare policies and new rail services. All of these actions are intended to make transit even more attractive to an increasing proportion of the population. A monorail or other AGT would, in the locations implemented, provide fast, frequent and easily visible transit service. Depending on the route, it could also bring transit within easy reach of home and/or workplace for many area residents.

The DART bus routes with the greatest ridership are Route 1 – Philadelphia Pike and Route 6 – Kirkwood Highway. A Monorail/AGT route that served all or part of these corridors would tap an existing market that has demonstrated a desire for transit service. As can be seen in Section 6.2, none of the alignment proposals covers the Philadelphia Pike bus route, and Segment 2a only covers the portion of the Kirkwood Highway bus route between Delaware Avenue and Prices Corner. The analysis in Section 6.2 of the Technical Memorandum examines transit usage and trip generation characteristics in the context of developing route alignment alternatives that try to link major employers and activity locations while tapping developing travel markets. In addition, there is significant right-of-way alignment challenges associated with the development in the high bus ridership corridors.

6.1.2 Trip Generators

The majority of travel in New Castle County is by residents traveling between their home and activities such as work, shopping, or school. Providing attractive connections that will entice travelers to use the Monorail/AGT requires that the system serve both residential areas and the concentrated trip generators. Residential activity is dispersed throughout New Castle County. Other than portions of the City of Wilmington and the City of Newark, major concentrations of high density have not yet developed in residential areas that are obvious points to be served by a Monorail/AGT. Some type of collection/distribution system will be required for most residents to access/egress the Monorail/AGT service. This can be achieved through attractive bus services and conveniently located in park-n-ride facilities.

Workplaces, shopping areas, educational institutions and other attractors are easily defined. Figure 6-1 illustrates many of these locations. The major single workplace with a high concentration of employees is downtown Wilmington. Other significant generators of work related travel are the Blue Ball area, Churchman's Crossing, the DuPont Experimental Station, MBNA sites, office parks, hospitals and shopping centers.

It can be difficult to attract shoppers to use transit, especially if they cannot walk from their residence to the Monorail/AGT. Shopping areas, by design, provide more parking than is needed 365 days of the year. Shoppers who require cars to access the Monorail/AGT, will likely drive all the way to the shopping area. The largest shopping areas, however, such as Christiana Mall, Concord Mall and Brandywine Town Center are also employment centers and

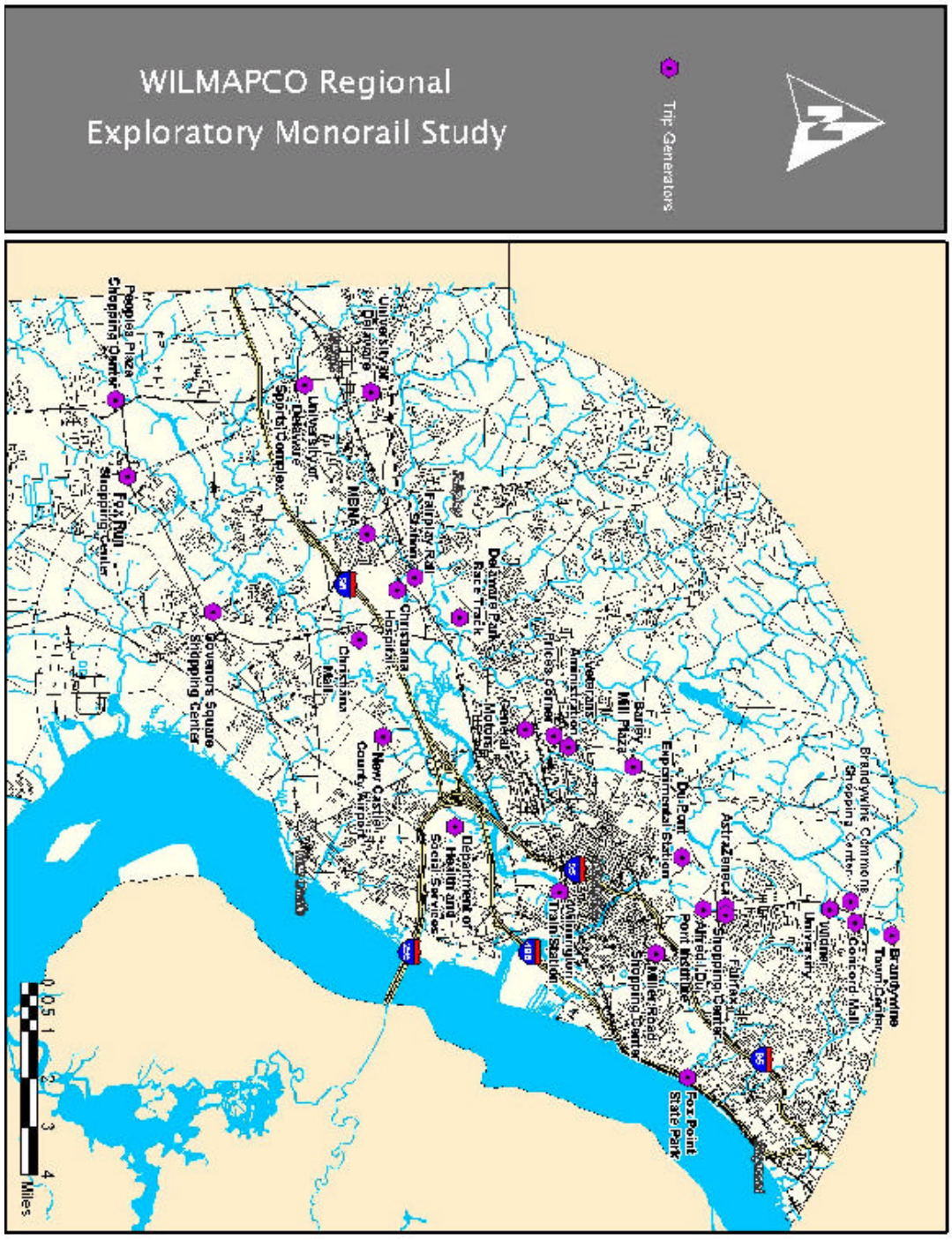


Figure 6-1: Selected Trip Generators

as such might generate some use of transit. These key shopping areas are also illustrated in Figure 6-2. Intercity Transportation terminals provide connections between New Castle County and external locations. In many metropolitan areas this function is provided by an airport; in New Castle County the Amtrak Station in Wilmington plays a similar role. With its excellent Northeast Corridor connections, the Amtrak Station is a trip generator for those entering and leaving the area. Parking at the station is limited but is presently expanding. Bus connections, especially to the core of downtown, are excellent. Visitors, however, may have difficulty determining the ways to use transit to travel from the station to the other parts of the County. A Monorail/AGT would serve as one component of the collection-distribution system for Amtrak and provide obvious and efficient links to the station.

6.1.3 Other Travel Potential Indicators

In addition to looking at travel usage and trip generators in the region, travel potential was also assessed by determining the typical trip generation for residential and commercial land uses. This assessment offers an overview of future travel in advance of more sophisticated and detailed forecasting methods. The primary input to this analysis is the WILMAPCO traffic analysis zones (TAZ) database containing:

- Population for the year 2025
- Households for the year 2025
- Employment for the year 2025

Trip generation was determined by applying the trip generation rates shown in the ITE Trip Generation Manual[7] for various residential and office land uses. The Trip Generation Manual is a compilation of studies showing the number of vehicle trips produced by various land use types. The number of trips generated is normalized against a variety of independent variables. In the case of residential properties, the rate is usually computed as the number of trips per dwelling unit although some studies examined the number of occupied dwelling units. For offices, the trip generation rate is computed based on the number of employees, square footage of office space, and other means.

For purposes of this analysis, each household identified within the TAZ database was assumed to occupy a separate dwelling unit. An average rate for the various types of housing that might be found within the study area was calculated. That rate was then applied, zone-by-zone, to the number of households in the study area. The table below shows the various trip generation rates and the average rate applied.

[7] Institute of Transportation Engineers, Trip Generation 6th ed., 1997.

Residential Trip Generation		
Housing Type	**Trip Rate**	**Units**
Single-Family Detached	9.57	Trips/Dwelling unit
Apartment	6.63	Trips/Dwelling unit
Low-rise Apartment	6.59	Trips/occupied dwelling unit
High-rise Apartment	4.20	Trips/Dwelling unit
Residential Condominiums/ Townhouse	5.86	Trips/Dwelling unit
High-Rise Residential Condominium/Townhouse	4.18	Trips/Dwelling unit
Mobile Home Park	4.81	Trips/occupied dwelling unit
Typical	5.98	Trips/Dwelling unit

A similar calculation was performed for commercial space. Various types of office space were tabulated and an average rate calculated. This rate was applied, again zone-by-zone, to the total number of employees in the study area. The table below indicates the various rates and average applied to this analysis.

Employee Trip Generation		
Development Type	**Trip Rate**	**Units**
General Office Building	3.32	Trips/employee
Corporate Headquarters Building	2.27	Trips/employee
Single-Tenant Office Building	3.62	Trips/employee
Office Park	3.50	Trips/employee
Research and Development Center	2.77	Trips/employee
Business Park	4.04	Trips/employee
Typical	3.25	Trips/employee

The study area contains a variety of land uses not represented in the tabulations above. Industrial and retail land uses for example would likely have appreciably lower and higher rates respectively than those for office uses. While this limits the accuracy of the analysis, it does not dramatically affect the guidance offered by this assessment.

6.2 ALIGNMENT PROPOSALS AND THE IDENTIFICATION OF KEY SEGMENTS

The Team developed a set of segments that could potentially make up the initial alignment for the Monorail/AGT. Segments were based on estimated trip generation rates, transit use in the region, the location of major trip generators, and the finding of previous studies including the alignments originally proposed by Delaware Representative David Ennis. Segments were further developed based on community input at the Steering Committee meeting held on June 24, 2002. These segments are shown in Figure 6-2 with a thematic mapping of trip generation rates. Each segment can be described as follows:

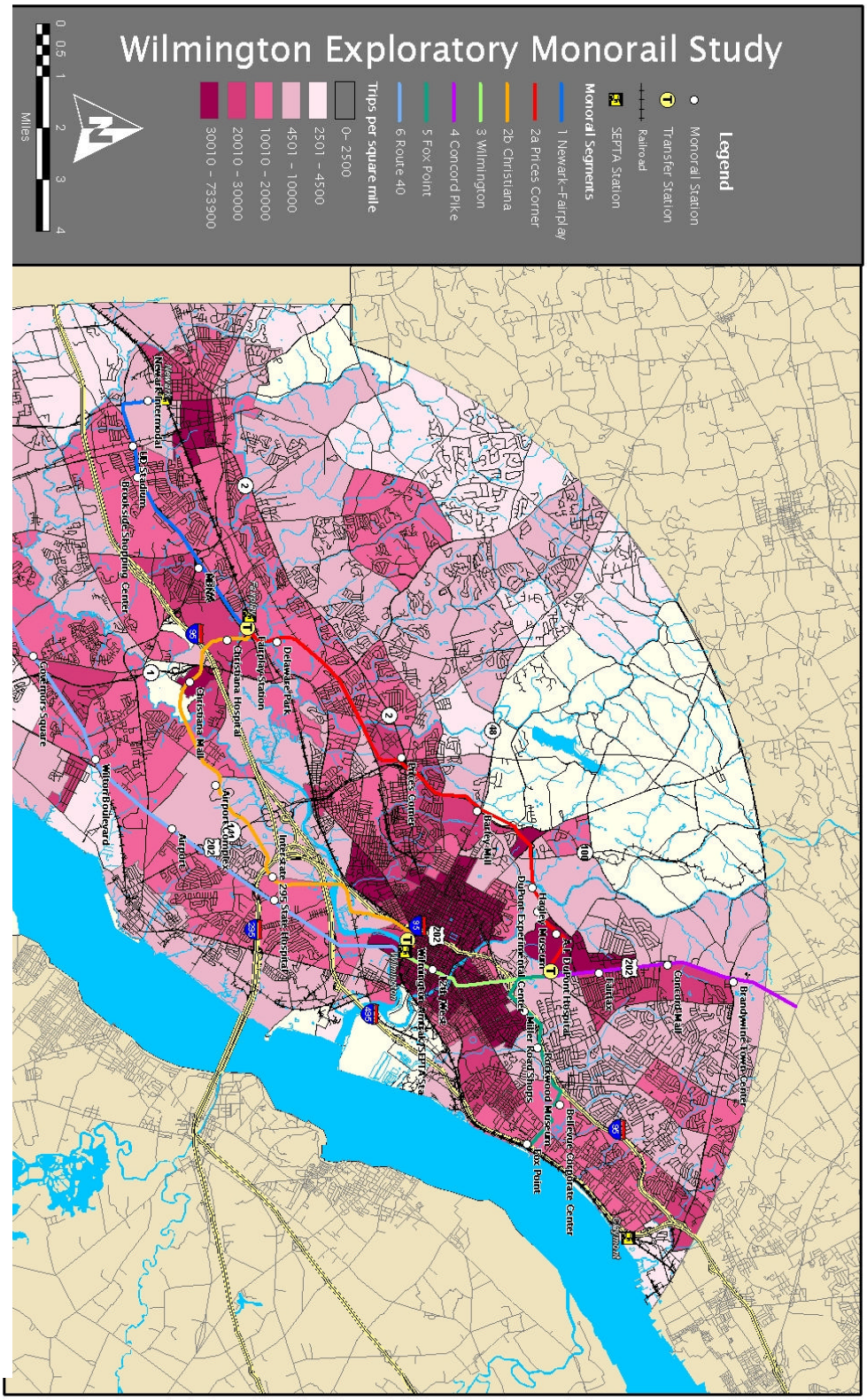


Figure 6-2: Key Segments Overlayed on Trip Generation Rates

Segment 1 – Newark to Fairplay Station (Newark-Fairplay)

This route starts at the Newark Regional Rail station served by the Southeastern Pennsylvania Transit Authority (SEPTA). The route moves southeast toward the University of Delaware Stadium. It then turns northeast and stops at the Brookside Shopping Center, the MBNA America corporate campus, Christiana Hospital, and the Fairplay SEPTA station.

Segment 2a – Fairplay Station to Blue Ball (Prices Corner)

The alignment turns north, stops at the Delaware Park Raceway and Casino, and crosses the Northeast Corridor rail line. It then continues northeast, stopping at Prices Corner, Barley Mill (both local retail centers), and Hagley Museum. After crossing the Brandywine River, the stops are located at DuPont Experimental Station. The alignment continues southeast and stops at the AstraZeneca campus (Blue Ball station).

Segment 2b – Fairplay Station to Wilmington (Christiana)

From the Fairplay Station, this segment goes south across Interstate 95, and proceeds through the Christiana Mall. Currently, the Mall is a large transfer station for the DART First State bus service. A station here would not only serve shoppers going to the mall, but would serve as a transfer between the Monorail/AGT and buses. From here, the alignment continues northeast to the Airport business center and across Interstate 295 to the State Hospital. Using an abandoned rail right of way, the alignment moves north into downtown Wilmington. The final leg travels north to the Riverfront. South of the Northeast Corridor rail line, the residents have relatively lower incomes than those that live north of it. In addition, the southern area tends to have a lower automobile-to-household ratio. These two factors lead to a higher percentage of the population that relies on bus transportation.

Segment 3 – Wilmington Riverfront to Blue Ball (Wilmington)

This segment connects the Riverfront, the Wilmington Train Station and downtown Wilmington. Wilmington is an urban area that has relatively high congestion and difficult parking ability (scarcity and/or high pricing). Such factors drive many commuters, regardless of automobile ownership, to seek alternative modes of travel. Downtown Wilmington is the densest area in New Castle County. From the downtown, this segment turns north on Baynard Boulevard to reach Concord Pike and Blue Ball.

Segment 4 – Blue Ball to Brandywine Town Center (Concord Pike)

The Concord Pike extension starts at Blue Ball and continues north along Concord Pike to the Brandywine Town Center near the Pennsylvania border, with stops at Fairfax and the Concord Mall. Although the retail and other businesses located in the area would benefit, the layout of these establishments would present a challenge. The suburban style layout, automobile-oriented development with large parking areas between the highway and the buildings, creates accessibility problems for pedestrians en route to final destinations. If stations were built in present day, pedestrians would have to walk several minutes from the station to any building.

Since transit ridership is highest within a five-minute walk of a transit stop, high ridership would not be likely. Either a change in land use and/or innovative station planning would be required to achieve maximum ridership.

Segment 5 – Blue Ball to Fox Point (Fox Point)

The logic of the Fox Point extension is to connect to the Northeast Corridor railroad line via a future intermodal station. This station is in the conceptual stage—its outcome is uncertain. If this station were not created, the Fox Point extension would lose considerable ridership. The stations on the line, in absence of Fox Point, serve some local tourist, shopping, and business riders. None of these areas has as much projected ridership as does the Fox Point station, where the transfers from SEPTA regional rail could enhance ridership.

Segment 6 – Wilmington to Glasgow (Route 40)

This segment would travel along the Route 40/13 corridor, with stops at the Delaware State Hospital, New Castle County Airport, Wilton, Governors Square Shopping Center, Fox Run Shopping Center, and Peoples Plaza. As with the Concord Pike segment, this route's current land use includes high-density residential and commercial development. However, the design of some developments is auto-oriented and difficult to serve with transit. A supplemental collector/ distributor system would be desirable.

The proposed segments are on the simple base map previously referenced as Figure 5-2.

6.3 IDENTIFICATION OF THE INITIAL CORRIDOR

The selection of the most appropriate alignment for feasibility assessment was the result of a consensus building process among the members of the project management and steering committees. The process was based on the evaluation criteria emanating from the Purpose and Need Statement discussed in Section 5 of this Technical Memorandum.

The results of the evaluation process were presented to the Management Committee. A detailed discussion among the committee members followed. The discussion assessed the evaluation process and built a group consensus on the most desirable alignment. A proposed initial corridor alignment was agreed upon for recommendation to the Steering Committee. The key segments were reduced to the most viable corridor that began at "Peoples Plaza" on Route 40 through "Governors Square" to the "Christiana Hospital" via Route 1 and then moving east to the "New Castle County Airport" complex and "State Hospital" into "Downtown Wilmington" and proceeded north via Route 202 to the "Blue Ball Properties". Figure 6-3 is a base map showing the initial alignment corridor.

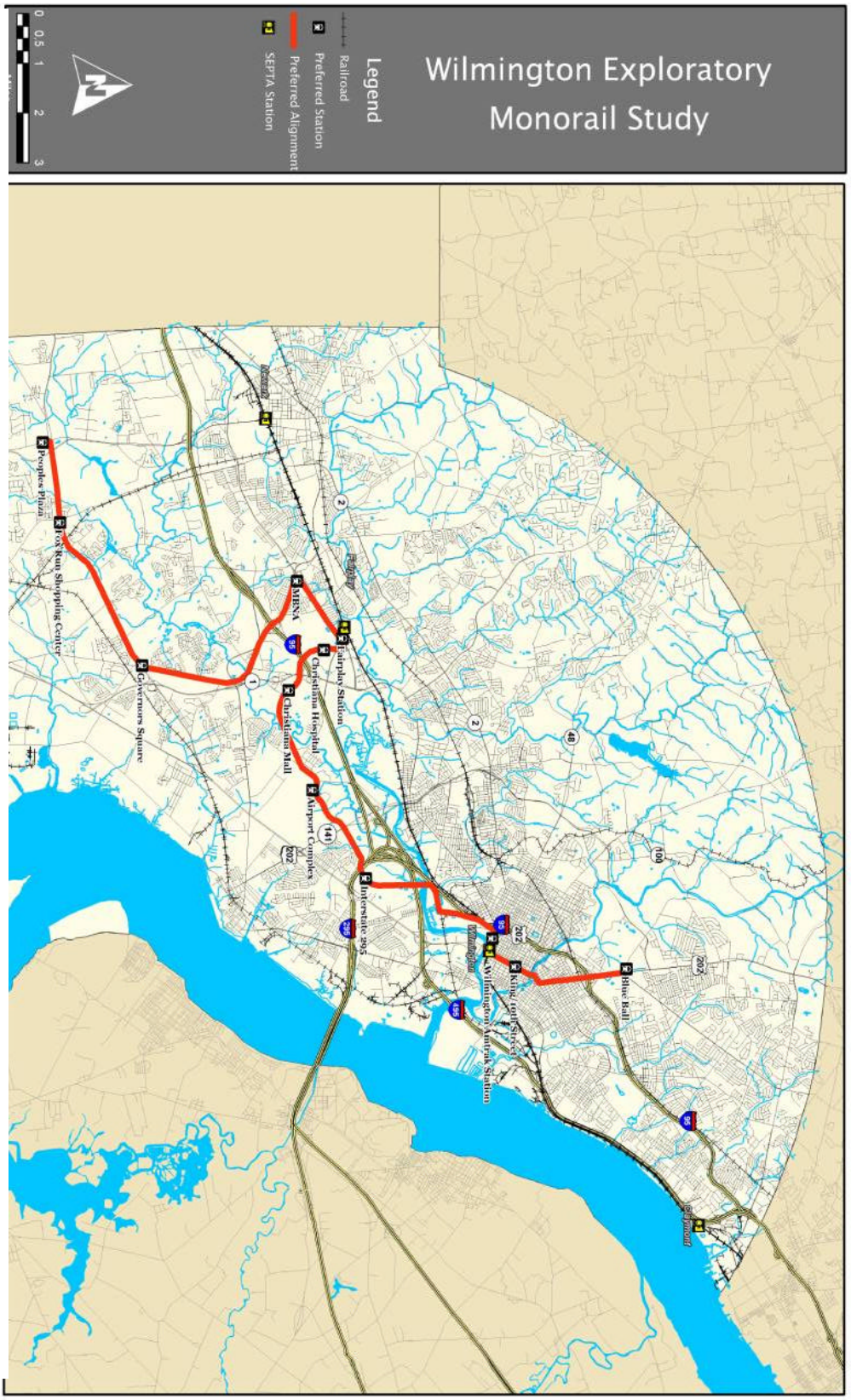


Figure 6-3: Initial Alignment Corridor

6.4 ASSESSMENT OF INTERFACE POTENTIAL BETWEEN MONORAIL/AGT SYSTEM AND PROPOSED WILMINGTON-DOVER PASSENGER RAIL SERVICE

Dover and Wilmington were once connected by passenger rail service that permitted residents of areas south of the Canal to make day trips to Wilmington or even Philadelphia. Restoration of passenger rail operations using existing tracks or rights-of-way is now under study by DTC. Several alternative alignments have been proposed. One would connect the rail from Dover to the Northeast Corridor in Newark For passengers traveling beyond Newark, a change of trains might be needed or there could be through service to Wilmington. Other alignments under study would follow a more southerly route closer to New Castle with the line from Dover connecting at the Amtrak Station in Wilmington.

If the rail service from Dover serves the Wilmington Amtrak Station then connections with a Monorail/AGT, and many other transportation services, could be made there. As discussed above, the Monorail/AGT would be a key part of the collection-distribution system to and from the Amtrak station. If the Dover service terminates in Newark requiring a transfer for travel to Wilmington, then the Monorail/AGT could provide an additional transfer opportunity as well as providing connecting service to intermediate points such as MBNA or Christiana Mall.

7.0 FEASIBILITY ASSESSMENT AND RECOMMENDATIONS

Monorail/AGT feasibility is assessed based on how the monorail would achieve the goals and objectives in the Purpose and Needs Statement based on both the land use scenario in the WILMAPCO 2025 Regional Transportation Plan and other transit oriented land use scenarios.

7.1 DEVELOPMENT OF EVALUATION CRITERIA TO MEET PURPOSE AND NEED

The following evaluation criteria were developed based on the Federal Transit Administration (FTA) criteria for New Starts Evaluations, taking into consideration the motivations of the Steering Committee for considering AGT in the Wilmington region, specifically:

- Mobility – particularly to provide connectivity and increased mobility through a multi-mode system of public transportation;
- Environmental quality – as an impetus for less air pollution and improved quality of life;
- Operating efficiencies – that are better than existing bus operations;
- Cost effectiveness – in terms of the Capital Costs and Operation and Maintenance (O&M) costs per annual ridership;
- Land use – in terms of the need for any additional land and the use of public rights-of-way; and
- Technical feasibility – to insure that the product is technically capable of being built. Technical thresholds include alignment grades, curves and spans, as well as station sizing, compatible with projected station locations.

7.2 ASSESSMENT OF GENERAL FEASIBILITY

The following assesses the general feasibility of the two Monorail/AGT system concepts (large monorail versus small monorail). The large, higher-speed system operating characteristics are those of the Bombardier M-VI system being proposed for Las Vegas and the small, slower speed system characteristics are those of the Bombardier M-III, which is installed in Jacksonville, Florida The assessment is based on the evaluation criteria described above and then refined in consideration of alternative land use scenarios.

7.2.1 Basis for Assessment of Feasibility

The feasibility assessment is based on the results of Monorail/AGT ridership forecasts developed by the Project Team. These forecasts are derived from trip tables provided by DelDOT. These trip tables are also used for WILMAPCO's 2025 Metropolitan Transportation Plan. The procedure developed to provide the forecasts is based on a 1997 model previously developed for the DelDOT transit service area. The model uses mode choice as a parameter including walking to transit, driving to transit, driving alone, and carpooling. Specific district-to-district movements were defined along the Monorail/AGT alignment and, with available network data, travel times were computed for bus, Monorail/AGT, and automobile. Table 7.2-1 shows the station-to-station travel distances and times for both small and large Monorail/AGT systems.

This Mode Choice Procedure was applied only to Home-Based Work Trips. Expansion to all trip purposes is based on Home-Based Work Trips representing 40 percent of all transit trips in accordance with the 1997 model. The procedure estimates 12,800 total daily boardings on the Monorail/AGT. Many of these riders would be diverted from existing DART bus or SEPTA commuter rail services. The analysis of the Home-Based Work Trips indicates that the Monorail/AGT ridership represents approximately 16 percent of the total transit market.

7.2.2 Monorail/AGT System Descriptions

The initial Monorail/AGT alignment described in Section 6.3 underwent an operations analysis for both small and large systems to determine the appropriate fleet size. The fleet size is based on an operating fleet that meets the peak hour demand plus spare vehicles to account for vehicle maintenance. The Mode Choice Procedure shows that the peak volume between the Airport Complex and downtown Wilmington is 800 Home-Based Work passengers (traveling towards downtown). Assuming 50 percent of peak period travel is in the peak hour and Home-Based trips are 40 percent of total trips, then the peak hour, peak direction, peak load point volume is approximately 1,000 passengers. A surge factor of 1.5 is applied to account for the surging characteristics that could occur during the peak hour. In this case, the surge factor represents 25 percent of the peak volume occurring during the first twenty minutes, 50 percent occurring during the second twenty minutes, and 25 percent occurring during the last twenty minutes. The surged peak hour demand is 1,500 passengers in the peak direction.

Tabular data describing the fleet sizing operations along with cost data follows. A summary discussion is presented after the tabular data.

			Large Monorail: Bombardier M-VI			Small Monorail: Bombardier M-III		
	Distance			Trip Time			Trip Time	
Station	Incremental (ft)	Cumulative (ft)	Depart Time (min)	Incremental (min)	Cumulative (min)	Depart Time (min)	Incremental (min)	Cumulative (min)
Peoples Plaza	0	0	0	0	0	0	0	0
Fox Run Shopping Center	8,368.3	8,368.3	2.4	2.4	2.4	3.6	3.6	3.6
Governors Square	19,586.0	27,954.3	7.2	4.8	7.2	11.4	7.9	11.4
MBNA	23,202.0	51,156.2	13.1	6.0	13.1	20.8	9.4	20.8
Fairplay Station	8,028.1	59,184.3	15.5	2.3	15.5	24.2	3.4	24.2
Christiana Hospital	1,172.8	60,357.1	16.3	0.8	16.3	25.1	0.8	25.1
Christiana Mall	8,959.8	69,316.9	18.9	2.6	18.9	28.8	3.8	28.8
Airport Complex	11,244.0	80,561.0	21.9	3.1	21.9	33.5	4.7	33.5
Interstate 270	10,840.0	91,401.0	25.3	3.3	25.3	38.1	4.6	38.1
Wilmington/Amtrak Station	18,507.2	109,908.2	30.7	5.5	30.7	45.6	7.6	45.6
King/10th Street	4,567.6	114,475.7	32.7	2.0	32.7	47.9	2.3	47.9
Blue Ball	12,593.6	127,069.3	0	3.7	36.4	0	5.3	53.1
Trip Time*				36.4			53.1	

* Trip Time does not include dwell time.

Table 7.2-1: Station-to-Station Travel Times

Bombardier AGT System	Round Trip Time	Headway	Cars per Train	Number of Trains	Fleet w/ 15% Spares	Peak Hour Capacity	Load Factor	Consist Length (ft.)	Station Length (ft.)
M-III (Min Consist)	115.4	2	3	57	66	1,511	99%	70	93.2
M-III (Max Consist)	115.4	4	6	29	34	1,538	98%	140	163.1
M-VI (Min Consist)	82	4.3	2	19	22	1,558	96%	67	100.5
M-VI (Max Consist)	82	16.4	8	5	6	1,640	91%	268	301.5

Table 7.2-2: WILMAPCO Preliminary Technology Operations Summary

7.2.3 Costs

Capital Costs and Annual O&M Costs have been estimated for the two Monorail/AGT system applications described in Section 7.2.1 above. The Capital Costs were estimated using a Lea+Elliott proprietary model that estimates unit costs based on trends of past bids for AGT systems, adjusted specifically for monorail type AGT technologies. The O&M costs were developed using the detailed Lea+Elliott proprietary O&M cost model that estimates operating and maintenance, labor and material requirements based on the assumed schedule of operations.

The assumed hours of operations are as follows:

Monday – Friday	5:30 a.m. – 11:30 p.m.
Saturday and Sunday	7:30 a.m. – 8:30 p.m.

The following tables present the Schedules of Operations for the two Monorail applications.

	LARGE MONORAIL SCHEDULE OF OPERATIONS						
1	One round trip distance (mi) =	48.1					
2	Round trip time (sec) =	4920					
3	Round trips / Hour per Train =	0.731707317					
4	Average Operating Speed (Miles/Hr) =	35.19512195					
5	Vehicle energy consumption (kWh/veh-mi) =	4.8					
6	Number of operating weekdays per year =	261					
7	Number of operating Saturdays per year =	52					
8	Number of operating Sundays/holidays per year =	52					
9	Total number of route operating days per year =	365					
10	**Weekdays**	**Hours/Day**	**Trains (2)**	**Headway (sec)**	**Train Size**	**Vehicles**	**Veh-miles**
11	*Peak Operating Fleet* =	5	19	258.9	2	38	1,745,326
12	*Normal Operating Fleet* =	7	8	615.0	2	16	1,028,824
13	*Off Peak Operating Fleet* =	6	5	984.0	2	10	551,156
14	*Night Period Operating Fleet* =	0	0	NA	2	0	0
15	Totals =	18					3,325,306
16	**Saturdays**	**Hours/Day**	**Trains (2)**	**Headway (sec)**	**Train Size**	**Vehicles**	**Veh-miles**
17	*Peak Operating Fleet* =	0	19	258.9	2	38	0
18	*Normal Operating Fleet* =	7	8	615.0	2	16	204,976
19	*Off Peak Operating Fleet* =	6	5	984.0	2	10	109,809
20	*Night Period Operating Fleet* =	0	0	NA	2	0	0
21	Totals =	13					314,785
22	**Sundays and Holidays**	**Hours/Day**	**Trains (2)**	**Headway (sec)**	**Train Size**	**Vehicles**	**Veh-miles**
23	*Peak Operating Fleet* =	0	19	258.9	2	38	0
24	*Normal Operating Fleet* =	7	8	615.0	2	16	204,976
25	*Off Peak Operating Fleet* =	6	5	984.0	2	10	109,809
26	*Night Period Operating Fleet* =	0	0	NA	2	0	0
27	Totals =	13	Peak Trains	Standby Trains	Oper. Trains	Train Size	314,785
28	**TOTALS**	**6,050**	**19**	**1**	**20**	**2**	**3,954,876**

	SMALL MONORAIL SCHEDULE OF OPERATIONS						
1	One round trip distance (mi) =	48.1					
2	Round trip time (sec) =	6924					
3	Round trips / Hour per Train =	0.519930676					
4	Average Operating Speed (Miles/Hr) =	25.00866551					
5	Vehicle energy consumption (kWh/veh-mi) =	0.8					
6	Number of operating weekdays per year =	261					
7	Number of operating Saturdays per year =	52					
8	Number of operating Sundays/holidays per year =	52					
9	Total number of route operating days per year =	365					
10	**Weekdays**	**Hours/Day**	**Trains (2)**	**Headway (sec)**	**Train Size**	**Vehicles**	**Veh-miles**
11	*Peak Operating Fleet* =	5	29	238.8	6	174	5,678,718
12	*Normal Operating Fleet* =	7	12	577.0	6	72	3,289,740
13	*Off Peak Operating Fleet* =	6	7	989.1	6	42	1,644,870
14	*Night Period Operating Fleet* =	0	0	NA	6	0	0
15	Totals =	18					10,613,328
16	**Saturdays**	**Hours/Day**	**Trains (2)**	**Headway (sec)**	**Train Size**	**Vehicles**	**Veh-miles**
17	*Peak Operating Fleet* =	0	29	238.8	6	174	0
18	*Normal Operating Fleet* =	7	12	577.0	6	72	655,427
19	*Off Peak Operating Fleet* =	6	7	989.1	6	42	327,714
20	*Night Period Operating Fleet* =	0	0	NA	6	0	0
21	Totals =	13					983,141
22	**Sundays and Holidays**	**Hours/Day**	**Trains (2)**	**Headway (sec)**	**Train Size**	**Vehicles**	**Veh-miles**
23	*Peak Operating Fleet* =	0	29	238.8	6	174	0
24	*Normal Operating Fleet* =	7	12	577.0	6	72	655,427
25	*Off Peak Operating Fleet* =	6	7	989.1	6	42	327,714
26	*Night Period Operating Fleet* =	0	0	NA	6	0	0
27	Totals =	13	Peak Trains	Standby Trains	Oper. Trains	Train Size	983,141
28	**TOTALS**	**6,050**	**29**	**1**	**30**	**6**	**12,579,609**

The Capital Costs were estimated as follows:

LARGE MONORAIL SYSTEM CAPITAL COST ESTIMATE

(Excluding any land acquistion)

ITEM DESCRIPTION	QUANTITY	UNITS	UNIT COST	ITEM TOTAL (US 2003 Dollars)
Stations Facilities	12	Each	$ 7,550,000	$ 90,600,000
PDS Substation Facilities	21	Each	$ 65,000	$ 1,365,000
Maintenance and Storage Facility	36,000	Sq. Ft.	$ 75	$ 2,700,000
Guideway Structure and Guideway Equipment	254,138	Single Lane Ft.	$ 2,500	$ 635,345,000
Station Equipment	24	Platform Edges	$ 460,000	$ 11,040,000
Maintenance and Storage Facility Equipment and Spare Parts & Equipment	22	2-Car Trains	$ 105,000	$ 2,310,000
Power Distribution System Equipment	254,138	Single Lane Ft.	$ 275	$ 69,887,950
Command, Control and Communications Equipment	254,138	Single Lane Ft.	$ 220	$ 55,910,360
Vehicles	22	2-Car Trains	$ 3,000,000	$ 66,000,000
Other Operating System Equipment	254,138	Single Lane Ft.	$ 50	$ 12,706,900
Subtotal 1				**$ 947,865,210**
Project Management and Administration	35.0%	% of Subtotal 1		$ 331,752,824
Subtotal 2				**$ 1,279,618,034**
CONTINGENCY	10.0%	% of Subtotal 2		$ 127,961,803
GRAND TOTAL				**$ 1,407,579,837**

SMALL MONORAIL SYSTEM CAPITAL COST ESTIMATE

(Excluding any land acquistion)

ITEM DESCRIPTION	QUANTITY	UNITS	UNIT COST	ITEM TOTAL (US 2003 Dollars)
Stations Facilities	12	Each	$ 12,250,000	$ 147,000,000
PDS Substation Facilities	21	Each	$ 65,000	$ 1,365,000
Maintenance and Storage Facility	47,000	Sq. Ft.	$ 75	$ 3,525,000
Guideway Structure and Guideway Equipment	254,138	Single Lane Ft.	$ 2,100	$ 533,689,800
Station Equipment	24	Platform Edges	$ 460,000	$ 11,040,000
Maintenance and Storage Facility Equipment and Spare Parts & Equipment	34	6-Car Trains	$ 105,000	$ 3,570,000
Power Distribution System Equipment	254,138	Single Lane Ft.	$ 275	$ 69,887,950
Command, Control and Communications Equipment	254,138	Single Lane Ft.	$ 220	$ 55,910,360
Vehicles	34	6-Car Trains	$ 1,600,000	$ 54,400,000
Other Operating System Equipment	254,138	Single Lane Ft.	$ 50	$ 12,706,900
Subtotal 1				**$ 893,095,010**
Contractor's Project Management and Administration	35.0%	% of Subtotal 1		$ 312,583,254
Subtotal 2				**$ 1,205,678,264**
CONTINGENCY	10.0%	% of Subtotal 2		$ 120,567,826
GRAND TOTAL				**$ 1,326,246,090**

The Capital Cost for a Monorail was found to be in the range of $1.3 to $1.4 billion. The large Monorail is estimated to be about $81 million more than the small Monorail application. This additional 6 percent Capital Cost is due mainly to the higher cost for the guideway and the fleet, in spite of the higher station costs for the small Monorail.

The following tables present the estimates for the Annual O&M Costs.

LARGE MONORAIL ANNUAL O&M COST

ITEM		AMOUNT (US $ 2003)
Labor		$ 5,975,000
Materials		$ 2,193,000
Subtotal 1		**$ 8,168,000**
Profit and G&A	10%	$ 817,000
ANNUAL O&M CONTRACT		**$ 8,985,000**
Utilities		$ 7,153,000
Technical Assistance		$ 100,000
Other APM Administrative Requirements		$ 100,000
Subtotal 2		**$ 16,338,000**
Contingency	10%	$ 1,634,000
TOTAL ANNUAL O&M COST		**$ 17,972,000**

SMALL MONORAIL ANNUAL O&M COST

ITEM		AMOUNT (US $ 2003)
Labor		$ 12,356,000
Materials		$ 4,816,000
Subtotal 1		**$ 17,172,000**
Profit and G&A	10%	$ 1,718,000
ANNUAL O&M CONTRACT		**$ 18,890,000**
Utilities		$ 7,199,000
Technical Assistance		$ 100,000
Other APM Administrative Requirements		$ 100,000
Subtotal 2		**$ 26,289,000**
Contingency	10%	$ 2,629,000
TOTAL ANNUAL O&M COST		**$ 28,918,000**

The Annual O&M Costs for the small Monorail/AGT were estimated to be about $11 million more than for the large Monorail/AGT. This 6 percent higher annual operating cost is due mainly to the maintenance of the required larger fleet size.

The following tabulates and compares the Present Value of 30 Years Life Cycle Costs based on a 5 percent discount rate for the large and small Monorail/AGT systems and a hypothetical express type bus service that could operate in the alignment corridor.

30-Year Life Cycle Costs

Based on a Discount Rate = 5.0%

Cost	Large Monorail	Small Monrail	Bus
Annual O&M Cost	$ 17,972,000	$ 28,918,000	$ 21,072,000
Capital Cost	$ 1,407,579,837	$ 1,326,246,090	$ 172,078,830
Present Value of 30 Years O&M Costs	$ 276,273,690	$ 444,540,539	$ 323,928,288
Present Value of Life Cycle Costs	$ 1,683,853,527	$ 1,770,786,629	$ 496,007,118
Ridership (30 years)*	110,714,250	110,714,250	36.9M - 74.2 M
Life Cycle Cost per Rider	$ 15.21	$ 15.99	$ 13.44 - 6.68

* Based on 12,800 boardings per weekday (250 days/year) and 4,265 boardings per Sat., Sun. and holiday (115 days/year)

While the large Monorail/AGT is found to be only slightly less costly (about 5 percent) than the small Monorail/AGT in life cycle costs the difference is within the accuracy of the estimates; therefore, no real difference can be said in the life cycle costs between the two applications.

For illustrative purposes, the monorail costs are compared to a hypothetical articulated bus service that follows the general monorail alignment while operating in mixed traffic. The one-way travel time is more than 100 minutes longer than the monorail, however, four-minute peak hour headways can be maintained using 84 sixty-foot articulated buses with the capacity of 92 passengers. Given the slower travel times achieved by the limited-stop bus service operating in mixed traffic, the demand is estimated to be in the range of one-third to two-thirds of the estimated Monorail/ AGT ridership. This life cycle cost comparison suggests that it costs roughly 60 percent more per rider to achieve a travel time saving on the Monorail/AGT system that is three to four times faster than a dedicated limited stop bus service.

7.2.4 Performance and Cost Summary

The station-to-station travel times presented in Table 7.2-2 show that the large monorail has faster operating speeds than the small monorail. The large monorail can traverse the twenty-four mile one-way guideway length in 41 minutes compared to 58 minutes for the small monorail. These travel times reflect an average operating speed for the large monorail that is 46 percent faster than the small monorail.

The operations summary presented in Table 7.2-2 shows the minimum and maximum train consist sizes required to meet the surged peak hour demand. Examining performance based on the most effective operating headway, the M-III maximum consist and the M-VI minimum consist was selected for further cost analysis. The M-III minimum consist headway of two minutes was considered too short with respect to turnback requirements. The M-VI maximum consist headway of 16 minutes was too long given typical level of service needs during the peak hour.

As pointed out above, the capital cost of the large system is 6 percent more than the small system while the operations and maintenance cost of the small system is 6 percent more than the large system. The 30-year life cycle cost of the two systems is within the error tolerance range of the estimates and can therefore be said to have no significant life cycle cost difference.

7.2.5 Feasibility of Monorail/AGT in the Initial Corridor

The following summary table applies to both small and large Monorail/AGT systems:

CRITERIA	ASSESSMENT
1. Mobility – particularly to provide connectivity and increased mobility through a multi-mode system of public transportation.	a. Monorail/AGT will serve to connect existing modes of transit (Amtrak, SEPTA Commuter Rail and DART First State Bus) into an integrated multi-mode system. b. Monorail/AGT travel times are competitive with automobile modes.
2. Environmental quality – as an impetus for improved quality of life.	a. Monorail/AGT, being electric propelled, is less dependent upon petroleum than buses. b. Less dependency upon automobile transport. c. Increased accessibility of public transit.
3. Operating efficiencies – that are better than existing bus operations.	a. Greater dependability due to better scheduled adherence as a result of exclusive right of way and automated operations. b. Shorter headways during all periods of operation. c. O&M labor costs less dependent upon rising labor costs (no drivers). d. Improved all-weather operation. e. System service availabilities exceeding 99.5% are routinely demonstrated by existing applications.
4. Cost effectiveness – in terms of the Capital Costs and Operation and Maintenance (O&M) costs per annual ridership.	a. Life cycle cost of $15-16 (in CY2003 $) per rider based on 30 years ridership of 12,800 boardings per weekday and assumed 4,267 boardings per Saturday, Sunday and holiday.
5. Land use – in terms of the need for any additional land and the use of public rights of way.	a. Little or no requirement for land use other than the public rights of way. b. Allow high-density land uses to be connected with minimal impact on intervening (lower density) land uses.
6. Technical feasibility – to insure that the end product is buildable from a technical standpoint (i.e., grades, curves, crossings/spans, room for stations).	a. Monorail/AGT is a mature service-proven technology with multiple suppliers. b. Can be procured through competitive procurement. c. Recommended alignment is technically feasible in terms of grades and curves routinely engineered by Monorail/AGT suppliers.

Table 7.2-3: Feasibility Criteria Assessment Summary

Considering all of the above, Monorail/AGT can be said to be technically feasible within the context of inclusion in an alternative analysis that considers a variety of fixed guideway modes. Given the negligible cost differences between small and large Monorail/AGT systems in this application of these technologies, the performance characteristics can be a primary factor in selecting the most appropriate technology. In this case, the Wilmington metropolitan area would be best served by the large Monorail/AGT technology.

There is no need to choose a specific technology at this time. The performance and physical similarities of various technologies can be carried forward in an alternative development and evaluation process as a single generic fixed-guide way mode. Such evaluation process or competition would be through a "performance" rather than a "detailed design" specification process. This performance-based, system equipment, limited turnkey process has been used for some urban trans systems, including Miami, Jacksonville, Detroit, and Las Colinas (Texas) downtown people movers and some line-haul systems. This approach would allow greater competition among technology suppliers, and thus should result in lower capital costs.

7.3 DESCRIPTION OF LAND USE SCENARIOS

As part of the WILMAPCO 2025 Regional Transportation Plan update, Council members and staff developed four possible land use scenarios to consider in accordance with federal requirements that call for the selection of a scenario for the final Plan that is financially reasonable and air quality conforming. Future transit, population and employment patterns in New Castle County and transit fare assumptions vary between scenarios. It is important to note that the Monorail/AGT system is not included in the updated scenarios. Section 7.4 discusses the special analysis conducted to assess the feasibility of the Monorail/AGT system within the context of two scenarios described in Section 7.4 below.

7.3.1 Scenario 1: The Current WILMAPCO Metropolitan Transportation Plan

This Scenario contains currently projected population patterns for New Castle County, which assumes no major changes in land use policy or roadway and non-motorized projects beyond what is currently planned. It also makes no assumptions about transit fare policy, and evaluates a future transit system contained in the current WILMAPCO transportation plan. This includes major extension of bus service areas in the region, and enhanced rail service, including rail service from Elkton to Newark, from Wilmington to the Porter area, and from Wilmington to Rt. 202/141 area. It also includes the Wilmington transit connector, or trolley.

7.3.2 Scenario 2: Updated Agency Plans

Since the 2025 WILMAPCO transportation plan was adopted in 2000, the Delaware Transit Corporation and the Maryland Transit Authority updated their transit plans for the region and this scenario incorporates those updates. In place of the transit system presented in the adopted WILMAPCO plan, it evaluates the transit system outlined in the updated transit agency plans for

the region and includes extensions of bus services and enhanced rail services, including an Elkton to Newark rail connection. It assumes that transit fares will remain constant over the 25-year life of the plan, which means that the relative cost of fares will actually decrease over time. This scenario also uses currently projected population patterns for New Castle County.

7.3.3 Scenario 3: Transit Expansion with Transit Oriented Development

This scenario builds off the transit expansion "vision" component of the updated Delaware Transit Corporation plan, and includes expanded rail service to Cecil County. In addition, in New Castle County, transit supportive, concentrated land use was modeled around theoretical transit stations, consistent with development patterns permissible under the New Castle County Unified Development Code and where such development was theoretically possible. In Cecil County, the land use patterns were not varied. The enhanced transit system in this scenario includes:

- Rail service from Perryville to Elkton and Newark, connecting the existing east-west service across the region.
- North-south rail service from Wilmington to south of the canal, and potentially to Dover.
- Transit fares remaining constant over the 25 years of the plan.

7.3.4 Scenario 4: New Castle County Redevelopment Scenario

This scenario considers a theoretical redevelopment pattern for New Castle County where a greater degree of population is concentrated in an infrastructure and density rich corridor across the middle of the region. The population patterns were altered from projected patterns to show an increased concentration pattern of growth in northern New Castle County. This scenario includes the updated transit agency plans included in Scenario 2 but also includes rail service connecting Perryville to Elkton and Newark, and assumes that transit fares will remain constant over the life of the plan.

7.4 FEASIBILITY UNDER LAND USE SCENARIOS

WILMAPCO is using the EPA Smart Growth INDEX Model to evaluate scenarios for their plan 2025 update. The Smart Growth INDEX is a sketch model for simulating the effects of alternative land-use and transportation scenarios. It can compare various scenarios for impacts on housing densities, vehicle miles traveled, transit proximity and ridership, as well as other environmental performance indicators.

7.4.1 Smart Growth INDEX Model Results

WILMAPCO modeled Scenario 2 (reflecting current zoning) and Scenario 4 (featuring greater concentration of development in the transit service areas) with the monorail alignment added. The results are shown in Table 7.4-1.

	Scenario 2	Scenario 2 with Monorail	Diff.	Scenario 4	Scenario 4 with Monorail	Diff
Transit Ridership	63,505	66,014	2,509	69,904	73,331	3,427
SOV trips	1,700,253	1,698,522	(1,731)	1,695,412	1,692,820	(2,592)
VMT (x1,000,000)	24.67	24.64	-0.12%	24.11	24.07	-0.17%
Proximity to Transit Stop (Residential)	74.88%			77.75%		
Proximity to Transit Stop (Employment)	88.77%			88.79%		

Table 7.4-1: Smart Growth Index Model Results including Proposed Monorail – 2025

The land use scenarios project increases in transit ridership, compared to currents levels, of roughly 50 percent for the current MTP scenario and 130 percent for a scenario that features strong links between transit and land development. Under Scenarios 2 and 4, the Smart Growth INDEX Model projects a further increase in transit ridership with the Monorail/AGT in place. For Scenario 2, transit ridership would increase by almost 4 percent while for Scenario 4 the increase would be almost 5 percent. The number of additional transit daily trips projected ranges from 2,500 to 3,500 for the two scenarios. This result indicates that Monorail could have 35 percent greater ridership under Scenario 4 featuring redevelopment and infill when compared to Scenario 2, which is an update of current agency plans. When compared to the ridership estimate developed under the mode choice procedure, this result also indicates that approximately 25 percent of the Monorail/AGT patronage would consist of new riders. These results show a consistency between the two travel demand analyses and illustrate the added benefits that can be achieved through coordination of transit investment and land development policies.

The Model supports the finding that a Monorail/AGT can be said to be a practical and useful component of the future transit system for New Castle County. As discussed earlier, the Mode Choice Procedure yields an estimate of 12,800 daily riders on the Monorail system using the 2025 person-trip tables developed by DelDOT and used in the MTP. The Mode Choice Procedure assumes the current transit system and does not estimate ridership on modes other than Monorail. The current transit system is used to conform with FTA New Start requirement that systems for alternatives evaluation be either in-service, fully funded planned or have their costs included in the alternatives under study. This assumption is a double-edged sword given the projected transit service improvements contained in the 2025 MTP. Improved transit service can provide better feeder access to the Monorail/AGT system but also would offer a more attractive alternative to the new fixed-guideway service. Given these facts, it is reasonably safe to assume that improved overall transit services in the region would not significantly affect the ridership estimate of 12,800 daily passengers. If there is further planning for the Monorail or a similar system, a more detailed ridership analysis considering the joint effects of the fixed-guideway system and an enhanced and complementary bus system will need to be undertaken.

While there is no relationship between the ridership estimate given in the Mode Choice Procedure and the estimate from the SGI Model, both demonstrate some benefit from the Monorail. The Mode Choice Procedure ridership estimate can be best associated with Scenario 1: The Current WILMAPCO MTP. Scenario 2 and to a greater extent Scenario 4 show significant increases in transit ridership over Scenario 1 without the Monorail/AGT system. The addition of the Monorail/AGT system then further increases overall transit ridership. There also appears to be a significant further reduction in single occupant vehicles. These facts demonstrate the role that a Monorail/AGT system can play and the benefits of studying the concept further.

7.5 RECOMMENDATIONS ABOUT MONORAIL/AGT IN THE REGION

The large Monorail/AGT system has an estimated cost of $1.4 billion-- a per mile cost of $59 million. Most fixed guideway systems of substantial length are constructed in phases. This approach can ease financing issues and build demand for the system over time. A logical first segment for the Wilmington region would be from downtown Wilmington (Amtrak Station) to the Blue Ball Properties. This segment supports the City of Wilmington and regional goals such as improving connections among major activity centers of the Downtown and Riverfront and improving accessibility to the Central Business District that were established in the Wilmington Trolley project. It is recommended that the potential of this segment be studied further.

A Monorail/AGT system is worthy of further study in a larger alternatives analysis that would consider this system along with other viable transit alternatives for the region. If selected as the locally preferred alternative, the system should then be incorporated into the long-term plan for the region and Delaware could apply for FTA New Start funding. It is recommended that the entire 24-mile system be studied along with other types of transit, with special emphasis on the initial segment between downtown Wilmington and the Blue Ball Properties.