Regional Monorail Exploratory Study

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Wilmington Area Planning Council (WILMAPCO)

February 2004

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CONTENTS

APPENDICES

LIST OF SELECTED TABLES AND EXHIBITS

EXECUTIVE SUMMARY

The Wilmington Area Planning Council (WILMAPCO) Regional Exploratory Study was designed to answer specific questions regarding the technical feasibility of monorail. Since the early 1980s, there have been discussions among some state officials about monorail service connecting a number of tourist, recreational, cultural centers, and several suburban office parks surrounding and to the north of Wilmington. Leaders in the Delaware Legislature recently issued a discussion document entitled, Innovative Transportation Opportunities for Delaware in the 21st Century that proposes a statewide multi-modal (high speed ferries, rail, Monorail/AGT) approach to addressing traffic congestion and air quality problems in the State of Delaware. Monorail is the centerpiece of this strategic approach.

In this report, the term monorail is used in a generic sense in that it refers to a broader class of driverless fixed guideway technologies referred to as Automated Guideway Transit (AGT).

Where and how have monorails been implemented, and with what results? How do these locations compare with the WILMAPCO region?

In recent years, a number of Monorail/AGT technologies have been built in urban areas. The existing monorail systems in Jacksonville, Seattle and Las Vegas serve as circulators/ distributors. The systems in Seattle and Las Vegas have extensive system expansions that will change them from small-localized services to major regional line-haul systems. The most extensive current line-haul AGT is the 32-mile Vancouver SkyTrain.

The plans for expansion of the Seattle and Las Vegas systems are moving forward as their existing small scale localized systems have met with much success. The Jacksonville Skyway ridership has not met the projected levels. The transit authority attributes the lack of riders to a declining downtown economy during the 1990s that led to a decrease in development in the area. The impact of the Vancouver SkyTrain has been very positive. The ridership and route length of SkyTrain has had several economic benefits, including an increase in land development along the right of way.

The Seattle Green Line and Vancouver are probably most similar to what is being considered for the WILMAPCO region. All are regionally oriented line-haul systems. The Seattle Green Line is just one part of an extensive regional network with good linkages between bus, train, and ferry services, which is identical to the objectives contained in Delaware Legislature discussion document.

The Las Vegas Monorail will be a line-haul service that is somewhat similar to Wilmington in that linkages are provided between major employment and recreational generators. The markets each system is expected to serve, however, are quite different. The Jacksonville Skyway is least like what is being considered for Wilmington because it is a downtown oriented circulator/ distributor system. The Skyway was of interest because of its bridge crossing the St. John River, similar to the Tyler McConnell Bridge crossing contained in one of the potential Wilmington alignment segments.

Leaders and stakeholders in the Wilmington region have a great opportunity to monitor developments in Las Vegas and Seattle as their large-scale monorail projects begin to take shape. Both of these projects have extensive public outreach programs that have been crucial in moving these projects forward. Lessons can be learned from these efforts as Wilmington proceeds with the development of its regional transportation plans.

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

A Monorail/AGT system is technically feasible and sufficiently effective to be included in a future transit alternatives analysis. The feasibility of two Monorail/AGT system concepts (large/high speed versus small/moderate speed) was assessed from the perspective of FTA New Start criteria and as well as the refined alternative land use scenarios contained in the WILMAPCO 2025 Regional Transportation Plan. The projected 2025 daily ridership was estimated at 12,800 total boardings with the surged peak-hour demand estimated at 1,500 passengers in the peak direction.

The system operations analysis showed that both the small and large systems were capable of effectively meeting the peak-hour demand with headways in the four-minute range. The large monorail, provided end-to-end travel times that would be 17 minutes (approximately 30%) less than the slower, small monorail technology. All of the Metropolitan Transportation Plan (MTP) land use scenarios show projected increases in transit ridership compared to current levels. There were two scenarios chosen to assess monorail implementation in the region, one reflected current zoning while the other featured greater concentrations of development in the transit service areas. The number of additional transit daily trips projected ranged from 2,500 to 3,500 for the two scenarios with the implementation of Monorail/AGT. The ridership gains reflected in both scenarios as well as the ridership projections based on the 2025 MTP trip tables show that the Monorail/AGT is effective in the WILMAPCO region.

There were no technical or environmental fatal flaws identified that would eliminate Monorail/AGT from further consideration. Public acceptance, as shown through public meetings and a Workshop, has been very strong, however, there have been some concern about the cost of the system. The life cycle cost analysis showed that there is no significant cost difference between the large and small systems. The large Monorail/AGT 24-mile system is estimated to cost $1.4 billion or $59 million per mile. As with other areas that have implemented Monorail/AGT, a shorter initial system could be built for approximately $250 million.

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 major obstacles would be needed to make a Monorail/AGT system a success?

A feasible, initial Monorail/AGT alignment is shown at the end of the Executive Summary. The key segments that comprise the initial 24-mile alignment corridor begins at Peoples Plaza on Route 40, proceeds via Route 1 to downtown Wilmington and then on to Route 202 to the Blue

Ball Properties. The estimated capital costs for a Monorail/AGT system using this alignment is between $1.3 and $1.4 billion. A life cycle cost estimate showed that there is no significant cost difference between the large and small Monorail/AGT systems. Transit has the potential to influence the direction of land use development as New Castle County grows. In accordance with MTP goals, land use and future transit should be carefully coordinated and developed to promote higher residential and commercial density. Careful attention should be paid to the areas immediately surrounding the proposed Monorail/AGT stations.

Assuming that the final alignment has been developed to complement the land use and development patterns in the region, the principal environmental issues that need to be addressed are floodplain impacts, wetlands impacts, park and recreation facilities, and noise impacts. Generally, anticipated impacts can be mitigated with minor shifts in the alignment, construction of physical barriers, and other means to affect alignment feasibility.

Since the early 1990s, the federal government has played a lead role in facilitating the development innovative procurement and finance techniques that can be applied to the process of implementing public mass transportation systems. Many of these techniques result in credit enhancement, advance construction financing, pooled financing, and public/private partnerships. Many of these techniques require state and local legislative authorization in order to proceed with the public financing process. There is certainly a role for innovative financing in support of advancing a Monorail/AGT project in the WILMAPCO region. The following steps would be required to advance a Wilmington Monorail/AGT project:

- Conduct a FTA Transit Alternatives Analysis
- Prepare a FTA New Start Evaluation
- Conduct an Environmental Impact Study

Once these steps are completed, the project can begin to take on physical form with preliminary and final design engineering and, eventually construction. Public outreach will continue to be important throughout all of these steps. Appropriate outreach programs would need to be included in each of these phases.

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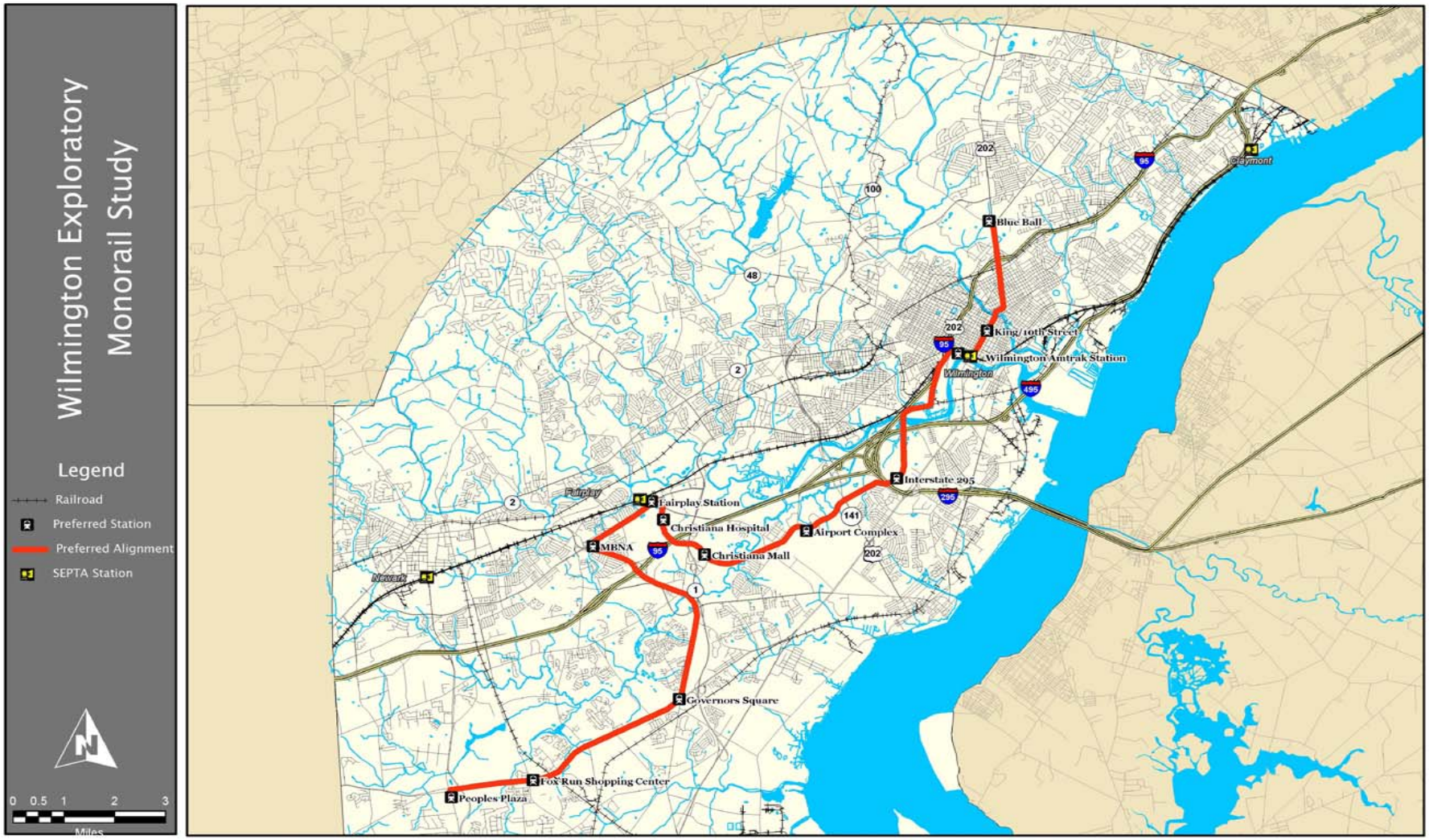
Wilmington Exploratory Monorail Study
Legend
Railroad
Preferred Station
Preferred Alignment
SEPTA Station
0 0.5 1 2 3
Miles
Blue Ball
King/10th Street
Wilmington Amtrak Station
Interstate 295
Fairplay Station
Christiana Hospital
Airport Complex
MBNA
Christiana Mall
Governors Square
Fox Run Shopping Center
Peoples Plaza
Claymont
Wilmington
Fairplay
Newark

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1.0 INTRODUCTION

The purpose of the WILMAPCO Monorail Exploratory Study is to investigate the feasibility of monorail transit in Northern New Castle County. The study is to determine if driverless fixed guideway technology referred to herein as "Monorail", also referred to in the industry as "Automated Guideway Transit (AGT)", should be incorporated into a larger Alternatives Analysis of other high capacity transit options for the Wilmington metropolitan area.

1.1 REPORT ORGANIZATION

In addition to the Executive Summary, the report is comprised of seven major sections. The first section provides the background for the study along with the comments the study process and methodology. Section 2 describes the study area and existing conditions. It also refers to recent studies and presents regional goals and plans. The third section presents the study's Purpose and Need Statement developed by the project Management and Steering Committees and lists the major questions contained in the study's Scope of Work. Section 4 summarizes driverless technologies and describes system in four North American cities. Section 5 addresses the feasibility of Monorail/AGT in the Wilmington Metropolitan area and Section 6 outlines the major implementation issues. The final section presents recommendations and describes the steps required to move the Monorail/AGT project forward towards implementation.

1.2 BACKGROUND

In the early 1980s, state officials began serious discussions about connecting a train station north of Wilmington with a monorail-type technology that would serve 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 provided the leadership in the establishment of a Task Force that recommended the opening of 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. A new station opened in Newark, Delaware, as well as on Route 4 at Fairplay/Churchman's Crossing. The Task Force also called for the reestablishment of train service to the State Capital in Dover.

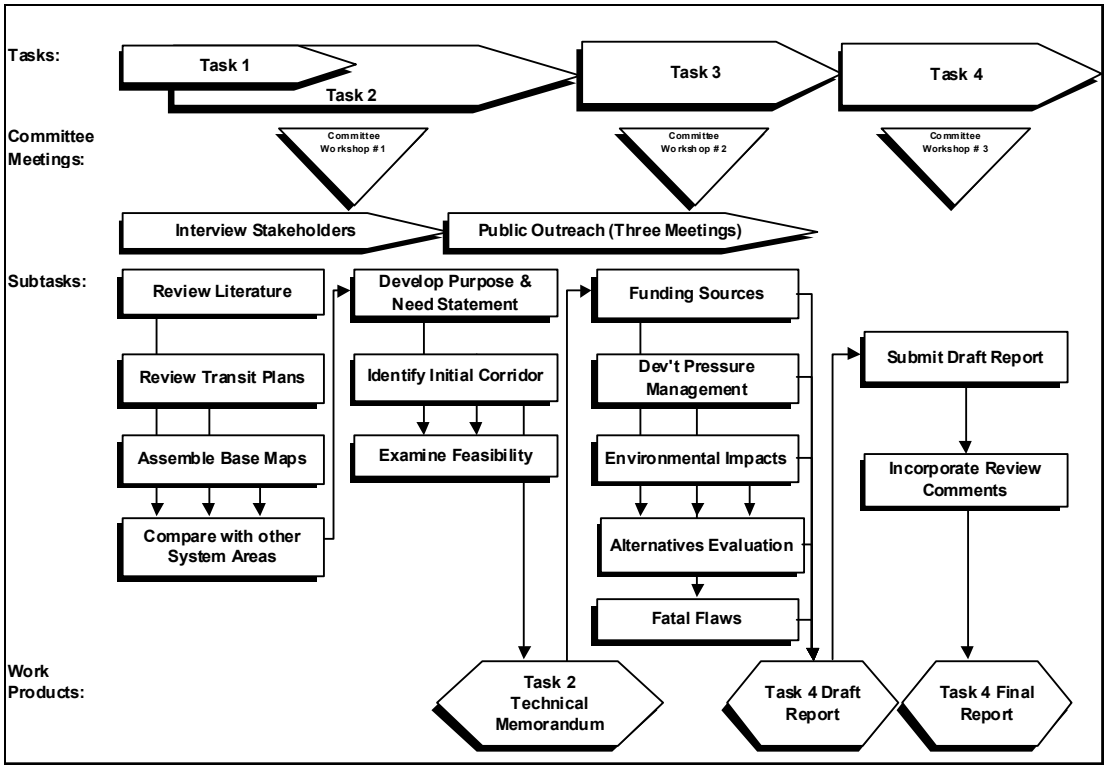
In the mid-1990s, the Delaware Department of Transportation (DelDOT) performed a rail study that contained the observation that Amtrak might be willing to stop some of their regular trains at station (s) north of Wilmington if the station was part of an intermodal system.

In 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, WILMAPCO has undertaken this exploratory study to determine if Monorail/AGT should be incorporated in a comprehensive study of high capacity transit options. The study was conducted in a partnership with DelDOT, Delaware Transit Corporation (DTC), the City of Wilmington, New Castle County and elected officials in the region.

1.3 THE STUDY PROCESS

The report chronicles the processes used and salient issues addressed regarding the feasibility of a Monorail/AGT in the Wilmington metropolitan area. While the feasibility questions are addressed in this report, a separate task technical memorandum entitled Feasibility Analysis was produced and may be considered a companion document to this report. The Work Schedule (Figure 1.3-1) shows the approach to the study. Each of the project tasks were reviewed and commented on by the project Steering Committee and decision making and overall study guidance was provided by the project Management Committee. The Management Committee was made up of eight representatives from the project partner organization entities. The Steering Committee consisted of more than ninety individuals representing a cross section of stakeholder groups, transit and transportation officials, community and civic organizations, business leaders and elected officials. Membership was open to anyone who wished to participate. Public outreach was a critical component of the process. Modes of outreach included a Workshop, a Project web page, contacting elected officials and business leaders, and the Steering Committee Meetings and available Minutes.

Figure 1.3-1: Work Schedule



The study process was designed with the premise that valuable information can be gained from prior studies of the region, and from discussions and working sessions with members of the Management and Steering Committees, as well as from stakeholders and members of the community at-large. The study process and project background is described fully in the Task 2 Feasibility Analysis Technical Memorandum.

1.4 STUDY METHODOLOGY

The study methodology combined sketch planning and consensus-building techniques to develop and assess an identified monorail corridor in exploring the feasibility of Monorail/AGT in northern New Castle County. Due to the nature and scope of this project, these techniques are used at a macro analysis level. On the demand side, GIS based sketch planning techniques are used to identify areas in the region that are transit supportive. This type of analysis utilizes data items such as land use, population and employment indices, and the locations of major trip generators.

On the supply side, sketch planning data on the most important transit system characteristics such as vehicle capacity, maximum and average speed, vehicle costs, civil (station, guideway, etc.) costs, operations and maintenance cost are used to identify the most appropriate transit technology, if any, to fit the demand and topographic/geographic characteristics.

Consensus building is a critical element of the feasibility analysis. The process involved working with three distinct groups. The first group was comprised of the study team, the project 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 may overlap with members of the Steering Committee. The third group was the general public.

Providing as many opportunities as possible to comment on the project can insure that a public consensus is gained. Opportunities such as public meetings, a project web site, and other tools such as newsletters, mailouts and comment sheets were utilized on the Project.

The project technical work was presented before the Management and Steering Committee where consensus was attained and guidance given. This process was used to:

- Develop a Purpose and Need Statement
- Develop Potential Alignment Corridor Segments
- Select an Initial Alignment Corridor
- Obtain Concurrence on Feasibility Analysis
- Obtain Concurrence on Recommendations

The Project Steering Committee provided the following categorical motivations in support of the Purpose and Need Statement:

- Transportation Improvement (Intermodal Connectivity)
- Monorail/AGT as an impetus for improved Quality of Life
- Work, home, retail, and tourist destinations
- Insure a logical and sound Monorail/AGT system

The contents of the resulting Purpose and Need Statement was the rationale behind the seven (7) proposed alternative alignment corridor segments. The Project Management Committee led their subsequent evaluation. A group consensus was attained by both the Management and Steering Committees through the use of seven evaluation criteria contained in the Purpose and Need

Statement to assess the alternative segments and assemble the initial 24-mile alignment corridor for further analysis.

The feasibility of two Monorail/AGT system concepts (large/high speed versus small/moderate speed) was then assessed from the perspective of FTA New Start criteria and recently refined alternative land use scenarios contained in the WILMAPCO 2025 Regional Transportation Plan.

2.0 EXISTING CONDITIONS

This section describes the major characteristics of the study area, lists recent studies performed in the region and describes the regional goals and objectives.

2.1 DESCRIPTION OF THE STUDY AREA

The project study area encompasses the portions of New Castle County, north of the Chesapeake and Delaware Canal and into neighboring Maryland. As a practical matter, potential monorail corridors are being considered in a corridor approximately 3 to 5 miles north and south of I-95. The area of influence of any future transit connection would have an impact beyond this area and so a broader geographic area is considered as necessary. At the same time, the territory directly affected by any future monorail is encompassed in the more limited area shown in Figure 2.1-1.

The subsections that follow provide study area highlights and a more detailed discussion is contained in the Task 2 Feasibility Analysis Technical Memorandum.

2.1.1 Major Roads

The State of Delaware is mostly rural, resulting in few limited-access highways. The exception to this is northern New Castle County. Here, major highways connect Delaware to regional, national, and even international destinations. Starting at the highest tier, I-95 is one of the most traveled interstates in the United States, linking Miami to Maine and the Atlantic Provinces of Canada.

On the regional level, New Castle County is considered part of the Philadelphia tri-state area (Pennsylvania, New Jersey, and Delaware). Interstates and limited-access highways provide linkages within this metropolitan area. Major regular highways 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.

2.1.2 Major Rail Lines

Considerable freight traffic travels by rail along the Northeast Corridor. Over 21 million tons of freight was carried across the state. Norfolk Southern, CSX, and Conrail are three of the five 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 service is available at four passenger rail stops in the area: Wilmington, Newark, Churchman's Crossing, and Claymont. The National Railroad Passenger Corporation (Amtrak) serves the Wilmington station with Acela Regional and Express Service. The Southeastern Pennsylvania Transit Authority (SEPTA) serves all four stations with connections to Philadelphia, suburban Pennsylvania, and New Jersey.

[1] Association of American Railroads, Jan. 2002.

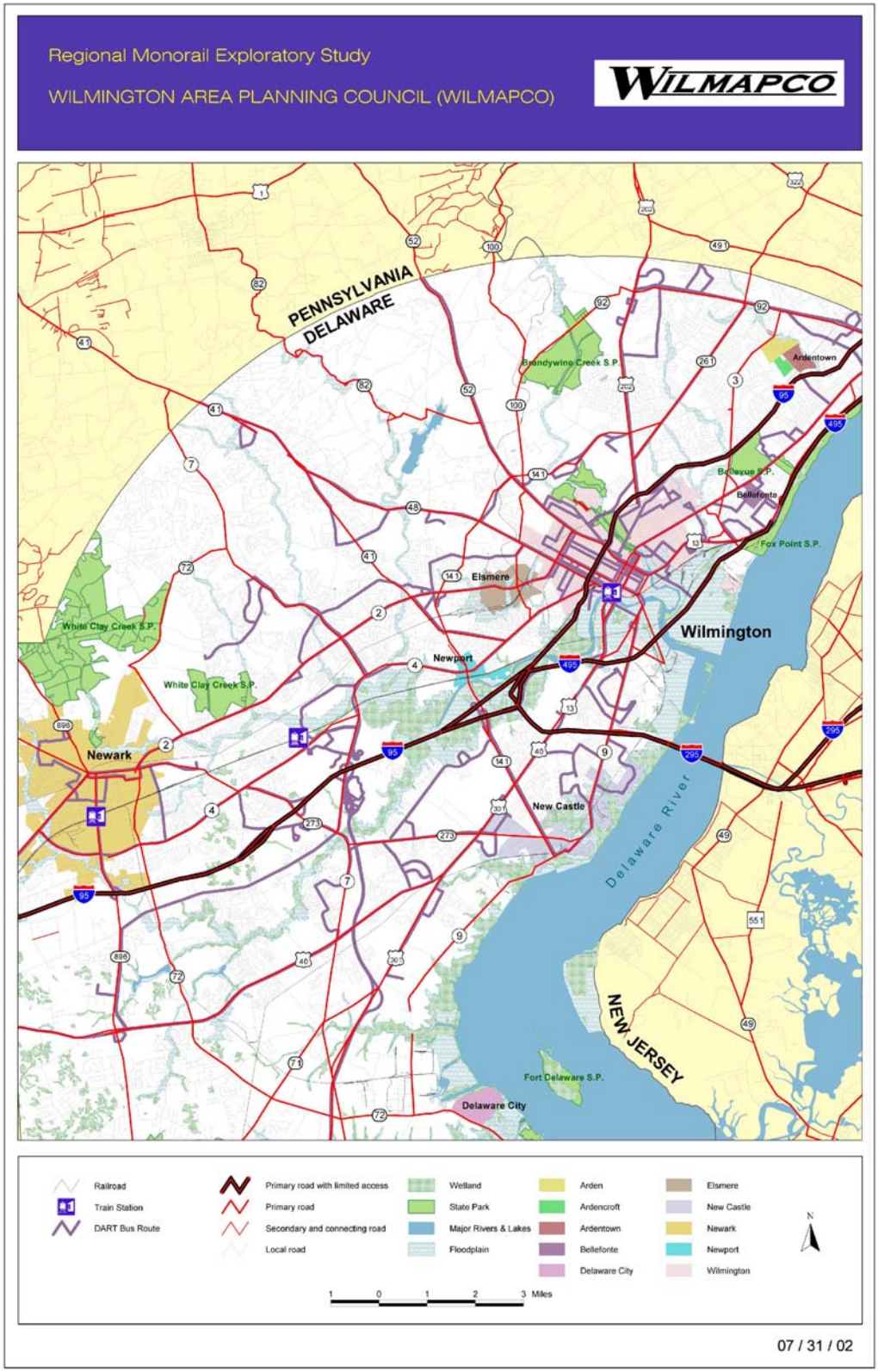


Figure 2.1-1: Environmental Features

2.1.3 Demographic and Housing Characteristics

New Castle County's population accounts for the majority of the state's population at around 500,000 persons[2]—64 percent of the state's population. This number is projected to increase approximately 54,000 by the year 2025[3]. Year 2000 Census information shows that this area is the densest of the three counties. At the county sub-region levels, the highest densities are also located in New Castle County.

2.1.4 Major Environmental Features

Northern Delaware, with its woodlands and water bodies, is home to several environmental features as shown in Figure 2-1. This section, addresses three major features that indicate the complexity of the ecosystem contained in this area and represent the most relevant potential environmental obstacles. Should this study lead to future Environmental Impact Statement, a detailed environmental analysis would be performed. State Parks represent protected land in the region, while flood regions represent regional protected wetlands and waterfronts. Finally, air quality gives an idea of how the previous two features can be affected (negatively and positively) should it remain at it present state. The corridor evaluation considers the level of impact a particular alignment would have on each of these environmental features.

2.1.4.1 State Parks

Nine Delaware State Parks are located in New Castle County. Among the largest is White Clay Creek Park north of Newark, with approximately 3,200 acres. Brandywine Creek Park is located near the busy 202 Corridor with approximately 900 acres. Fox Point Park (approximately 500 acres) is along the Delaware riverside adjacent to the SEPTA/Amtrak line just south of the Claymont Station. Fox Point Park is near Bellevue Park to the West. Wilmington State Parks are the newest addition to the State Park System and include the Brandywine Zoo, Alapocas Woods, Rockford Park and others.

2.1.4.2 Wetlands and Flood Region

Small, fragmented wetlands areas encompass the 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 riverside. Another cluster is along I-95 near the 95/295 interchange. The flood region takes up much space along the Christiana 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 95/295 interchange. After this point, the flood region breaks into two paths in tandem with the two rivers and reaches a width of about 1,300 feet.

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

2.1.4.3 Air Quality

New Castle County, as well as neighboring Cecil County, Maryland, is located in a severe non-attainment area due to unsatisfactory levels of ozone. This problem not only applies to these two counties, but the entire Consolidated Metropolitan Statistical Area, which stretches from Wilmington across Philadelphia to Trenton, New Jersey. This unsatisfactory 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 has submitted its Air Quality Conformity Determination for the FY 2003-2005 Transportation Improvement Program (TIP) for the 2025 Metropolitan Transportation Plan (MTP), and it has been approved by the State of Delaware as conforming to the State's Clean Air Act Implementation Plan with approvals pending from the EPA, FHWA, and the FTA.

2.2 RECENT STUDIES

A review of existing transportation and land use plans and studies was conducted to obtain an understanding of 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 listed below propose an intermodal approach to these growth challenges. These approaches involve significant enhancements to the regional transit network. These studies are described in the Task 2 Feasibility Analysis Technical Memorandum

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

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

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

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

WILMAPCO 2025 Metropolitan Transportation Plan, February 2000.

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

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

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

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

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

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

2.3 REGIONAL GOALS AND PLANS

As part of examining Monorail/AGT feasibility in northern New Castle County, this assessment evaluates how the recommended alignment/technology would help meet the following regional goals. The Monorail/AGT system would have particular impact on goals 2 through 5. The WILMAPCO 2025 MTP outlines the following 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.

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3.0 PROJECT PURPOSE AND NEED

The following section identifies the study purpose. The study has a number of objectives, many of which are detailed in the Purpose and Need Statement. Through the objectives obtained in the Purpose and Need Statement the study analyzes how well the Monorail/AGT system will help meet the MTP goals as well as answers specific questions contained in the study's Request for Proposal.

The Purpose and Need Statement outlines the issues that need to be addressed, as well as the logic behind the study. The consultant team worked closely with the project Steering Committee to develop a Purpose and Need Statement. Using the FTA New Start Evaluation criteria as a guideline, the Steering Committee generated a list of motivations behind considering Monorail/ AGT in the Wilmington region. Utilizing this list, which centered on such issues as mobility/ connectivity and quality of life, and previous transportation studies done in the Wilmington region, the study team created a Purpose and Need Statement, which was subsequently approved by both the project Steering Committee and Management Committee.

3.1 PURPOSE AND NEED STATEMENT

The purpose of exploring a monorail 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, and using the Region's waterways for ferry service 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, the development of 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 respond to the principal transportation needs of the Region by:

- Effectively serving central city and suburban employment centers
- Encourage shift from single occupancy vehicles to higher 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.

3.2 WILMAPCO'S PRINCIPAL CONCERNS

The study will answer the following questions which were specifically asked in the study's Scope of Work:

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

- Would a monorail 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 planning, i.e., what changes in land use, innovative sources of funding, and overcoming of major obstacles would be needed to make a monorail system a success?

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4.0 SUMMARY OF ALTERNATIVE TRANSIT TECHNOLOGIES

This section both describes and compares various types of driverless fixed guideway technologies. It also summarizes the Monorail/AGT technologies under consideration. There is a wide range of performance capabilities and not all are applicable to the Wilmington study area. After describing and comparing some of the more applicable technologies, a discussion of technological maturity is provided.

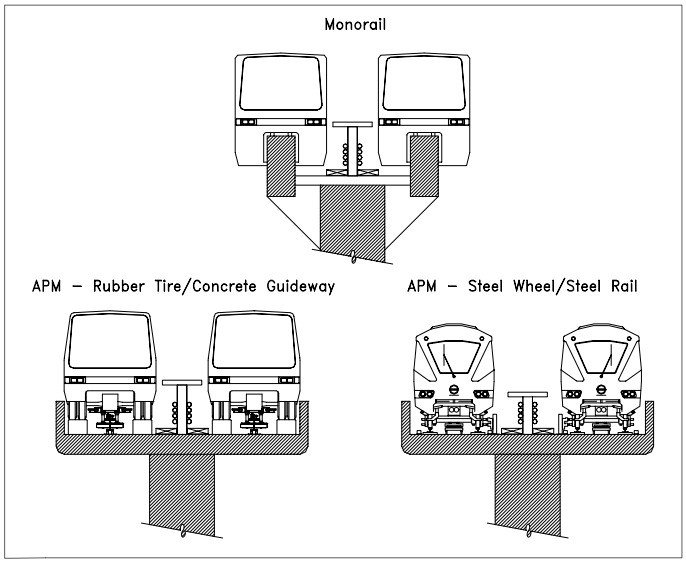
A review of the literature on driverless fixed guideway technologies would reveal that the terms Automated Guideway Transit (AGT) and Automated People Mover (APM) are used interchangeably. The American Public Transportation Association (APTA) defines AGT as, "guided transit passenger vehicles operating singly or in multi-car trains with a fully automated system (no crew on transit units). Service may be on a fixed schedule or in response to a passenger-activated call button".

4.1 AUTOMATED GUIDEWAY TRANSIT

AGT describes a fully automated and driverless transit system that operates on an exclusive right-of-way guideway. Monorail is considered a subset of AGT technology. The various AGT technologies are typically proprietary system designs with components that are not interchangeable. These systems have varying operating characteristics and facility design requirements.

Rubber tire systems, including monorails, are the most common type of existing AGT application due to their carrying capacity and operational characteristics. Steel wheel technologies offer similar carrying capacities, potentially higher speeds, and do not require guideway heating in climates with ice and snow. The latter is a significant operational and maintenance expense of rubber tire systems. Steel wheel systems offer less flexibility in alignment layout due to substantially increased crossover length requirements. A limited number of crossovers reduce operational flexibility, particularly for failure management.

Monorail systems are a form of AGT distinguished by a unique transit vehicle that rides on top of, or is suspended from, a single concrete or steel beam. Urban monorail systems exhibit virtually all of the same operational characteristics as other driverless AGT systems. Monorails can operate on short headways like other urban systems. They can achieve the same high speed operation as well. Monorail systems typically use electrically activated moveable steel beam segments for branching and electrically activated merging and the systems employ proven wayside and vehicle subsystems to ensure high system reliability and availability.



Since monorails use a concrete or steel guidebeam for both the vehicle's running surface and structural support, less guideway maintenance is required than for more conventional steel-wheel on steel-rail or rubber-tired technologies. The monorail guidebeam does not require periodic adjustment, replacement, grinding, tightening, or other similar maintenance. Monorail systems generally have a smaller footprint on the environment and the narrow guidegeams are less obtrusive than conventional through-type guideways that almost look like aerial road structures.

In general, comparable monorail systems can operate within the same alignment corridor as rubber tire and steel wheel technologies as long as the alignment is not laid out to the absolute minimums for the latter technologies.

4.1.1 Service Proven Systems

Service proven AGT systems include both cable-propelled and self-propelled systems. The term "service proven" means the technology has been successfully implemented as an integrated system in current or seasonal passenger service operation for a period of time sufficient to demonstrate satisfactory operation, which is approximately two years. The approximate two-year time period is significant in that it provides time to detect any technological or design deficiencies that occur in service conditions and make adequate corrections for any deficiencies and then attain steady state performance. There are five main categories of risks inherent in selecting and implementing an emerging technology for the Wilmington region. These categories, which apply in varying degrees to each of the technologies discussed, are as follows:

1. Adopting a Technology Before it is Fully Developed
2. Market Obsolescence
3. Incomplete Understanding of Costs
4. Unanticipated Safety Hazards
5. Level of Competition

Cable-propelled technology consists of small-to-large capacity vehicles using cable propulsion with various suspension systems. Cable-propelled vehicles do not have engines, motors, or braking systems. System line speeds of 30 to 40 miles per hour can be achieved. Cable technology controls are stationary and typically located in the passenger terminal building. Because each vehicle is attached to a cable and unable to cross over to a parallel

guideway, switching is not possible. Cable propulsion is best suited for two- or three-station shuttle applications with relatively straight guideway alignments of one mile or less and therefore not applicable to the WILMAPCO region.

Self-propelled technologies (such as the INNOVIA pictured) perform well over a wide range of distances and are relatively easy to expand in terms of capacity and coverage. Power distribution is provided by power rails mounted along the guideway lane. Self-propelled AGTs typically run on dual lanes enabling operational switching. The unique designs of guideway cross-section and vehicle suspension have a great impact upon the complexity, performance and feasibility of operational switching. These unique designs can be expensive because they require sophisticated controls to avoid collisions, operate switches, and maintain headways.

4.1.2 Emerging Systems

There is a wide range of emerging automated technologies, which have yet to reach a "mature status". These technologies range in terms of size, support mechanism, speed and development status. None of the following systems are being considered for the Wilmington metropolitan area:

Personal Rapid Transit (PRT). PRT systems have been developed to the full-scale test track level in the case of one supplier or are still at the concept level for other suppliers. Small or "personal" size vehicles carrying groups of one to three passengers operate automatically over a grid-like network with numerous off-line stations. System line capacity is very configuration dependant but has been estimated in conceptual studies to range between 300 and 1,000 passengers per hour per direction. It is not considered appropriate for the high volume line-haul application anticipated for the WILMAPCO region.

Maglev Systems – Vehicles are magnetically levitated and propelled by linear motors (either linear induction motors or linear synchronous motors). Electromagnetic maglev systems use permanent magnets and develop their levitation using a moving magnetic field. There are high-speed (90 mph) and low-speed (30 mph) maglev systems. High-speed maglev technology in the development stage on test tracks in Germany and Japan are inappropriate for the system length under consideration in this study. There are several low speed systems in test track and passenger service operation, and others are under development.

Monobeam – The monobeam technology is still at the concept level with an elevated single or mono-beam that supports two-way travel on a single triangular guideway. Vehicles ride along both sides of the monobeam in opposite directions by means of cantilevered suspension. Trains "turnback" at the end of an alignment via a loop. Failure management capabilities are very limited compared to other fixed guideway technologies.

Given the potential breath and scope of a Wilmington AGT system, it would be most prudent to procure a service proven technology rather than an emerging technology that has not been adequately "tested" in actual field service.

4.2 MONORAIL/AGT IMPLEMENTATION AND LOCAL IMPLICATIONS

In recent years, a growing number of Monorail/AGT technologies have been built in urban areas primarily serving as circulators/distributors. As shown in Table 4.2-1, there are a number of comparable urban AGT systems in operation that can be useful to the Monorail/AGT development and decision making process in the Wilmington metropolitan area. These urban systems are located in Las Vegas, Seattle, Jacksonville, and Vancouver. These systems have been implemented within subsystems of the urbanized area. The key concern has been insuring that a relatively strong transportation demand exists between the urban subsystems.
The number of driverless rapid transit systems have steadily increased in Europe and Asia; however, in North American this growth has not yet occurred, 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.

4.2.1 Las Vegas Monorail System

The Las Vegas Monorail began as an upgradeable 0.7-mile dual beam system with two stations at the MGM Grand Hotel and Bally's Hotel and Casino. An expanded system will be implemented in two phases during the period between 2003 and 2006. The first phase will be 3.6 miles of dual lane guideway from the MGM to the Sahara Hotel. This segment will have seven stations. The second phase adds 3.2 miles of dual-lane guideway and six stations between the Sahara and Downtown.

The Las Vegas Monorail is considered by project stakeholders to be an effective means of positively influencing land values and redevelopment efforts. With the monorail, it is expected that there will be commercial and retail growth, a conversion of residential to commercial and a higher density of development for tourist commercial 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

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	22	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 4.2-1: EXISTING AND PLANNED URBAN AGT SYSTEMS

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.

4.2.2 Seattle Monorail System

The current Seattle Center Monorail (pictured) is 0.9-miles of dual lane guideway. The proposed Green Line will serve several communities between Ballard and West Seattle. According to the Draft Seattle Popular Transit Plan, the Green Line was chosen for the first regional monorail line because the 14-mile (18 stations) alignment would connect neighborhoods with each other and with the downtown and meet the City of Seattle's goals for intermediate capacity transit. Requests for proposals should be issued to monorail suppliers in late 2003.

In addition, the Green Line 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 intermodal linkages between bus, train, and ferry services, which is very similar to the objectives described in Innovative Transportation Opportunities for Delaware in the 21st Century. The Seattle Monorail Project staff have collected information on the impact of west coast rail transit and reported that residential and commercial property values within one-half mile of a station increase up to 30 percent.

4.2.3 Jacksonville Monorail System

The Jacksonville Automated Skyway Express has evolved over many years. The initial system was 0.7 miles and served three stations. The first 0.6-mile extension included two new stations. There were two more extensions involving a river crossing that added three more stations and 1.2 miles to the 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 river crossing over the St. Johns River involved the construction of 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 if considering the option for Wilmington's Tyler McConnell Bridge project becomes necessary.

4.2.4 Vancouver Rapid Transit System

The Vancouver SkyTrain is a steel-wheeled AGT system. The system consists of two major lines, the Expo Line and the Millennium Line. The Expo Line is approximately 19 miles and the Millennium Line is approximately 13 miles. There are 33 stations and the fleet consists of over 200 vehicles.

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 recently opened Millennium Line are being built in Vancouver, creating jobs and an investment of $175 million in local goods and services. In terms of the impact on real estate values adjacent to Sky Train stations, values have increased from 15 to 40 percent for residential properties and from 10 to 20 percent for commercial properties.

4.2.5 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 or cost effectiveness, trip timesavings, and safety. These are summarized as follows:

Aesthetics – elevated rail systems are often viewed negatively from an aesthetics standpoint. Monorails, with their relatively narrow beams, are much less intrusive than traditional AGT, LRT or heavy rail.

Construction – the construction impact of an elevated system in a dense urban setting can be significant in terms of utility relocation, station locating and column placement.

Cost – the elevated structure, which separates the system from other traffic and congestion delays, also adds to its overall cost. A relatively short initial system that is more affordable was the "path" that Seattle, Las Vegas and Jacksonville all took in implementing their systems.

Cost Effectiveness – the cost per rider measure is a very important one to consider for any transit system and is one of the more important criteria applied by FTA when it considers a project for Federal Funding.

Trip Time Savings – this is one of the main benefits of an elevated system and should be significant enough to warrant the investment in such a system.

Safety – the reduction is accidents and personal injuries due to the separation of traffic and the safer operations provided by automated train control.

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5.0 FEASIBILITY ANALYSIS

This section summarizes the results of analysis used to determine the feasibility of a Monorail/AGT system in the WILMAPCO region. The section begins with a discussion of the identification of an initial corridor for the alignment. Then, the technical feasibility is presented including systems, operational data and costs. Finally, the feasibility of a Monorail/AGT system under alternative land use scenarios is discussed.

5.1 ALIGNMENT CORRIDOR DEVELOPMENT

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"; and
- Input from the WILMAPCO staff and Steering Committee.

A major transportation 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 5.1-1 shows the inter-district work trip volumes. Additional transportation data factors included transit usage, major trip generators, and the potential for the monorail to interface with the proposed Wilmington-Dover passenger rail service. The innovative transportation opportunities "talking document" developed by Representative David Ennis suggests monorail 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 proposed high-speed ferry services.

Monorail service in the US 40 corridor would supercede the bus service enhancements contained in the twenty-year plan for the corridor and would likely call for more park 'n ride activities than contained in the current plan. All of the alignment options are shown in Figure 5.1-2 and are defined as "segments" that would be fashioned into an initial alignment.

5.1.1 Corridor Evaluation Criteria

The study team, working closely with both the Management and Steering Committees, conducted a comprehensive evaluation of the propose 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
- Encourage shift from single occupancy vehicles to high occupancy vehicles
- Mitigating growing highway congestion
- Mitigating deteriorating air quality conditions
- Integrating with other modes of travel
- Supporting regional growth
- Improving connectivity between the Wilmington region, Philadelphia & other urban centers

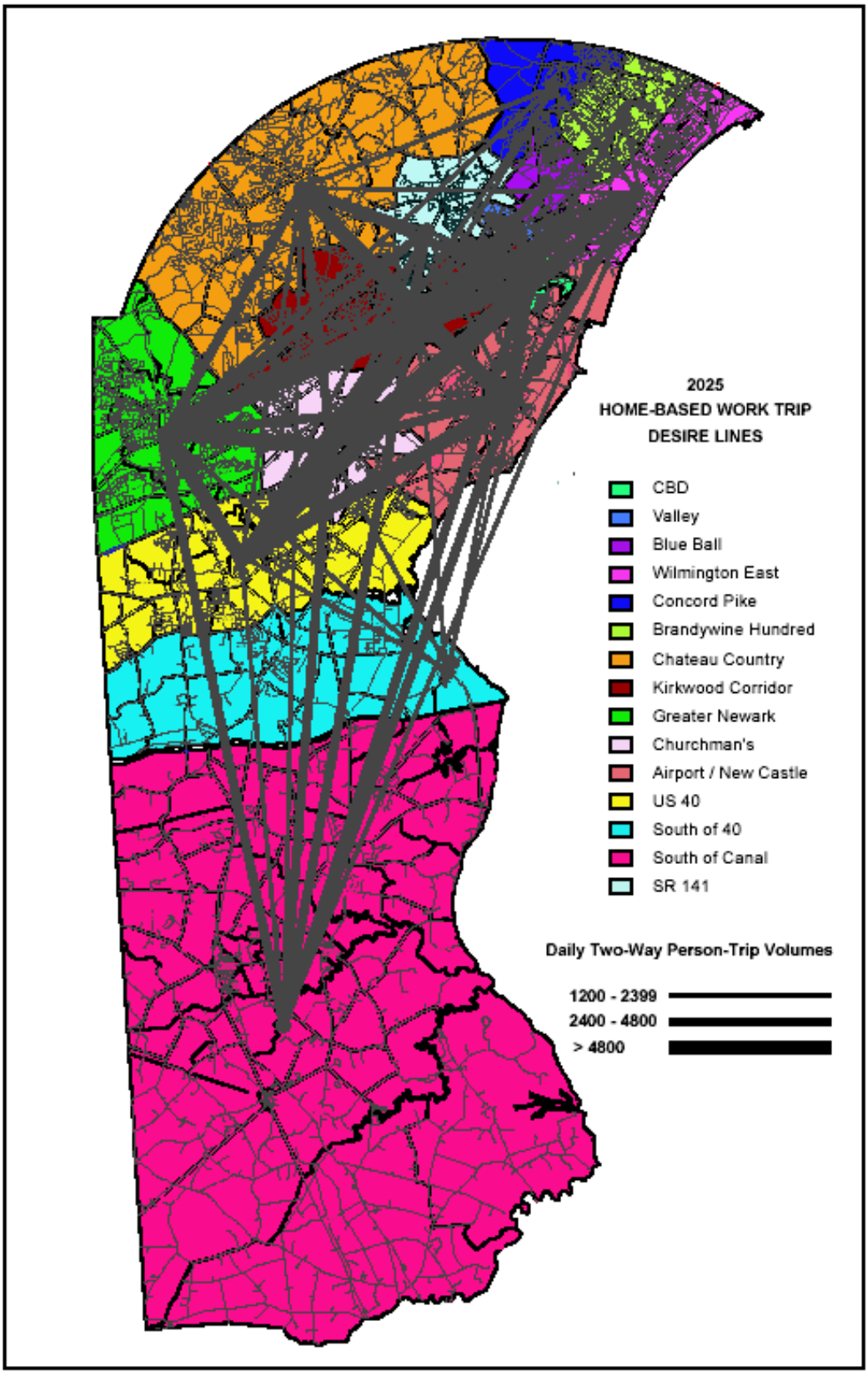

Figure 5.1-1: Inner-District Work Trip Volumes

Figure 5.1-2: Segments Identified Map

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
Raw Score	8	11	12	10	8	6	14

Key	Definition	Value
Y	Yes	2
M	Maybe	1
N	No	0

Figure 5.1-3 shows the initial alignment corridor.

5.2 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 project Purpose and Need Statement.

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

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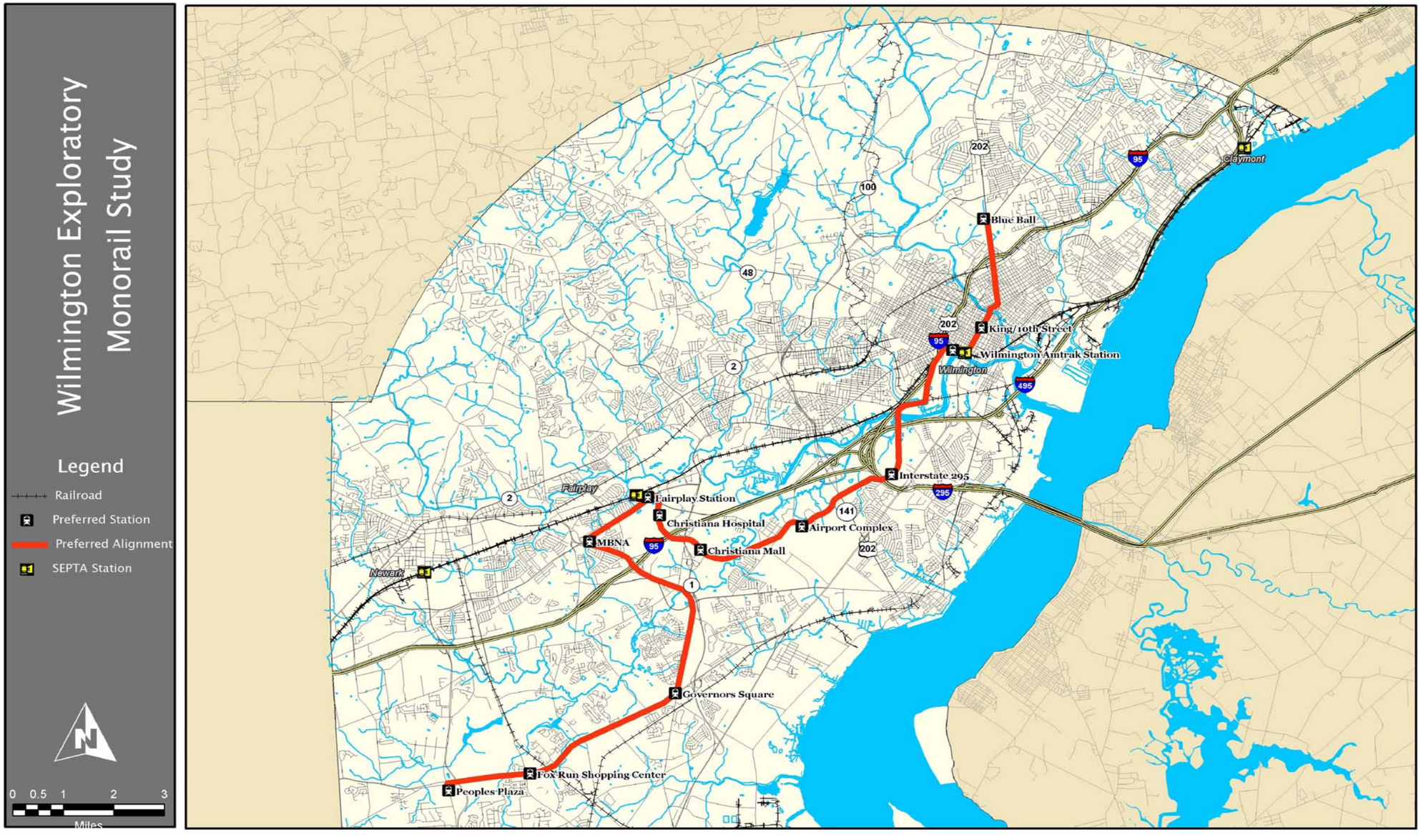

Figure: 5.1-3: Initial Alignment Corridor

Castle County Airport" complex and "State Hospital" into "Downtown Wilmington" and proceeded north via Route 202 to the "Blue Ball Properties". Figure 5.1-3 is a base map showing the initial alignment corridor.

5.3 TECHNICAL FEASIBILITY ASSESSMENT

Monorail/AGT feasibility is assessed from two perspectives. The first point of view is that of the goals and objectives contained in the Purpose and Need Statement. The second perspective is based on the recently refined alternative land use scenarios contained in the WILMAPCO 2025 Regional Transportation Plan.

5.3.1 Feasibility Evaluation Criteria

The following evaluation criteria were developed based on the FTA criteria for their New Start 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 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 end 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.

5.3.2 Assessment of Technical Feasibility

The following assesses the general feasibility of the two Monorail/AGT system concepts (large/high speed versus small/moderate speed). 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.

The feasibility assessment used Monorail/AGT ridership forecasts developed by the Project Team. These forecasts are derived from trip tables provided by DelDOT. These are the same trip tables used for WILMAPCO's 2025 Metropolitan Transportation Plan efforts. The procedure developed to provide the forecasts is based on a 1997 model previously developed for

the DelDOT transit service area. The model utilizes parameters related to mode choice such as walk to local transit, walk to Monorail/AGT, drive to transit, drive alone, and shared rides. 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.

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.

Approximate four-minute headways are achieved with the small monorail using 29 six-car trains and with 19 two-car trains for the large monorail. The large monorail can traverse the twenty-four mile one-way guideway length in 41 minutes as compared to 58 minutes for the small monorail.

5.3.3 Capital, Operating and Life Cycle Costs

The capital cost of the large system is 6 percent more than the small system while operations and maintenance cost of the small system is 6 percent more than the large system.

The following tabulates and compares the Present Value of 30 Years Life Cycle Costs based on a 5% discount rate for the large and small Monorail/AGT systems and a hypothetical express type bus service that could operate in the alignment corridor. Details of capital and operating cost estimates are contained in Appendix A.

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 slightly less costly (about 5%) than the small Monorail/AGT in life cycle costs, the difference is within the accuracy of the estimates; therefore, there is no real difference 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 15 - 60% 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.

5.3.4 Feasibility of Monorail/AGT in the Initial Corridor

Considering the above and the summary contained in Table 5.3-1, 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/higher speed 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-guideway 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 transit 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.

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.

CRITERIA	ASSESSMENT
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.	b. Little or no requirement for land use other than the public rights of way. c. 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 5.3-1: Feasibility Criteria Assessment Summary

5.4 FEASIBILITY UNDER LAND USE SCENARIOS

WILMAPCO is using the EPA Smart Growth INDEX (SGI) 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. The SGI Model allows the comparison of various scenarios for impacts on housing densities, vehicle miles traveled, transit proximity and ridership, as well as other environmental performance indicators. WILMAPCO developed the following scenarios:

Scenario 1: The Current WILMAPCO Metropolitan Transportation Plan (MTP)
Scenario 2: Updated Agency Plans
Scenario 3: Transit Expansion with Transit Oriented Development
Scenario 4: New Castle County Redevelopment Scenario

Each scenario is described fully in the Task 2 Feasibility Analysis Technical Memorandum provided as Appendix F.

5.4.1 Smart Growth INDEX Model Results

WILMAPCO ran the SGI Model for Scenario 2 (current zoning) and Scenario 4 (greater development in transit service areas). The results are shown below.

	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 5.4-1: Smart Growth Index Model Results including Proposed Monorail – 2025

The land use scenarios show projected increases in transit ridership, compared to currents levels, of roughly 50 percent for the current MTP scenario to 130 percent for a scenario that features strong links between transit and land development. Under Scenarios 2 and 4, the SGI 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/AGT could achieve up to 35% greater ridership under Scenario 4 featuring redevelopment 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 analysis procedures and illustrate the added benefits that can be achieved through coordination of transit investment and land development policies.

Considering the additional findings above, 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/AGT system using the 2025 person-trip tables developed by DelDOT and used in the WILMAPCO 2025 MTP. The Mode Choice Procedure assumes the current background transit system and no attempt is made to estimate ridership on modes other than Monorail/AGT. The current background transit system is used to conform with FTA New Start requirement that travel demand background systems for alternatives evaluation be either in-service, be fully funded planned service systems or have their costs included as part of the alternative under study. This background system assumption could positively or negatively impact Monorail/AGT ridership 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 impact the ridership estimate of 12,800 daily passengers. If there is further planning for the Monorail/AGT, 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.

The Mode Choice Procedure ridership estimate is 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.

5.5 RECOMMENDATIONS FOR MONORAIL/AGT IN THE REGION

The large Monorail/AGT system has an estimated cost of $1.4 billion. This translates to a per mile cost of $59 million. Most fixed guideway systems of substantial length are constructed in phases. Such approaches can ease financing issues and build demand for the system over a period of 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 Wilmington city 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 alternative analysis that would consider this system along with other viable transit alternatives for the region. If selected as the locally preferred alternative, the system would then be incorporated into the long-term plan for the region and the State would apply for FTA New Start funding. It is recommended that the entire 24-mile system be studied with special emphasis on the initial segment between downtown Wilmington and the Blue Ball Properties.

5.6 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 below 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 active study by DTC. Several alignment alternatives 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 achieved 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.

6.0 OTHER MAJOR IMPLEMENTATION ISSUES

Having found Monorail/AGT to be technically feasible, and worthy for further consideration, this section discusses the following issues that must be addressed for further consideration of the transit system:

- Sources of Funding
- Development Pressure Management
- Environmental Impacts
- Public Involvement

6.1 SOURCES OF FUNDING

In the past 30 years there has been a dramatic increase in the number of automated guideway systems installed in the United States. These systems have been applied to urban applications but are more prevalent at airports. There are innovative procurement and finance techniques for these systems. This section examines the different sources of funding that may be available to finance the Regional Monorail System.

6.1.1 Public Finance Tools

Special Purpose Agencies

Some systems built have been financed through a special purpose agency that focuses on a single project development and is very mission-oriented. They have the ability to operate under budget. They limit the credit exposure of other government agencies. These agencies can be established as public agencies under state law or nonprofit corporations which act as “instrumentalities” of a state or local agency.

Exclusive Development Agreements

The special purpose agency maximizes the role of private sector innovations and efficiency and minimizes the need for public revenues. Private funds are available and revenues needed to operate the system can be obtained from commercial operations such parking fees at stations and their locations. The special purpose agency has the authority to over see the building of the revenue producing improvements associated with the system. Recently in the final phase of building the Vancouver Sky Train system, land owners recognized the economic value of having stations adjacent to their property and three developers came forth at their own cost to finance, design and build and operate three stations.

Design-Build Contracts

With this type of development this contract fixes the project cost early in the design phase and assures that the project schedule will be met. This is the basic building block for many innovative tools.

Long Term Warrantees

A long-term warranty is a promise that ensures the supplier will stand behind the technology. With this instrument, the risk that the technology would not perform is transferred from the public agency to the private company providing the warranty. Long-term warranties show some confidence by manufacturers that their technology system will work properly. In addition, these warranties tend to increase product quality and lower life-cycle costs. Contractor innovation is encouraged and there is the reduced need for public agency inspection/oversight.

Outsourcing Maintenance and Asset Preservation

The direct cost of outsourcing the maintenance of the Monorail/AGT system can be perceived to be higher than hiring in-house. When such cost as capital, operational, and overhead are considered, outsourcing is much more cost-effective over an extended period of time. Outsourcing requires payment for services only when changes are needed. Such cost saving practices support innovation in maintenance/preservation techniques.

Federal Finance Tools

The Transportation Infrastructure Finance and Innovation Act of 1998 (TIFIA) authorized the U.S. Department of Transportation to provide three forms of credit assistance – secured (direct) loans, loan guarantees, and standby lines of credit – for surface transportation projects of national or regional significance. Such major transportation investments include intermodal facilities, border crossing infrastructure, highway trade corridors, and transit and passenger rail facilities. The TIFIA credit program is designed to fill market gaps and leverage substantial private investment by providing supplemental and subordinate capital. The amount of federal credit assistance should not exceed 33 percent of total project costs. Projects must cost at least $100 million or 50% of the State's annual apportionment of federal-aid funds, whichever is less.

Section 311 of the National Highway System Designation Act of 1995 (NHS Act) significantly expanded the eligibility of bond and other debt instrument financing costs for federal-aid reimbursement. This change was codified in an amendment to Section 122 of Title 23 USC. Section 122 makes bond-related costs eligible for federal reimbursement of any federal-aid project eligible under Title 23. As a result, many States have structured project financing that utilizes bond or other debt instrument financing mechanisms to include the payment of future federal-aid funds to retire debt. These mechanisms are called Grant Anticipation Revenue Vehicles or "GARVEE" bonds and Grant Anticipation Notes or "GANS". The bond-related costs eligible for reimbursement include:

1. interest payments and retirement of principal under an eligible debt financing instrument (including any capitalized interest);
2. issuance costs and credit enhancement fees; and
3. any other costs incidental to the sale of an eligible debt financing instrument (as determined by the Secretary of Transportation).

Section 122 clearly states that the eligibility of a debt financing instrument for reimbursement with future federal-aid, to the extent such funding may be available, does not constitute a

commitment, guarantee, or other obligation by the United States to provide for payment of principal or interest, or create any right of a third party against the federal government for payment.

State and Local Finance Tools

State and local government utilize user fee financing techniques such as revenue bonds. Revenue bonds are a type of municipal bond where principal and interest are secured by revenues paid by users of the facility built with the proceeds of the bond issue or from another source of dedicated payments. Some examples include farebox revenue bonds, assessment district bonds, and sales tax and motor vehicle registration fee revenue bonds. These funds may be used to finance project costs that cannot be paid from federal sources.

Joint Development Revenues

The Federal Transit Administration allows considerable flexibility in its treatment of joint development, particularly as it relates to transit supportive development as part of its "Livable Communities Initiative". Grantees can lease air rights above a transit station, or transfer the FTA interest in one property to another, to allow the private development or other use of the property. Examples of this flexibility has been demonstrated in several transit station/housing joint development projects between transit authorities and developers that created both housing and increased parking and intermodal transfers facilities at transit stations.

Collocated Telecommunications Revenue

Transit project right-of-way and stations present an opportunity to enhance both private and public telecommunications capabilities. The transit project owner may charge fair and reasonable rates for the use of its project facilities by those who require telecommunications capacity for themselves or their customers. Facilities can also be designed in conjunction with improvements to the transit agency's radio and emergency response system.

6.1.2 Local Considerations

Responses to the following questions will assist in the development of a strategy for implementing the procurement and financing techniques available for any proposed Monorail/AGT project in the Wilmington region.

Special Purpose Agencies

(1) Does state law allow the affected public agencies to form a separate public agency and/or nonprofit corporation, which could serve as the owner/developer of the monorail project?

(2) Can such an agency issue revenue bonds and grant anticipation notes?

Exclusive Development Agreements, Design-Build Contracts, Long-term Warrantees and Outsourcing Maintenance and Asset Preservation

(1) Does state law allow for a procurement process for the design, construction, maintenance and operation of the project, which results in the award, and execution of a contract following a pre-qualification of bidders and "best and final offer" negotiations?
(2) What are the state law requirements for posting of bonds by contractors on large public works projects?
(3) Does state law require payment of prevailing wages by contractors on public works projects?
(4) Is the public agency owner authorized under state law to make change orders and what is the process for doing do?
(5) Can the public agency owner agree to a dispute resolution process that does not involve filing an action in court or with a regulatory body?

Federal Finance Tools

(1) Which agency acts as the "MPO"(DelDOT/WILMAPCO) for purposes of programming federal grant funds for the project?
(2) How much in STP Urban and CMAQ funds could be available to finance the project?
(3) What sources of funds are available to fund the "local match"?
(4) Describe senior transit management's success in securing local support funding; meeting FTA project performance and performance requirements; establishing and implementing service priorities; operating and maintaining the existing transit system; and track record in completing other projects.

State and Local Finance Tools

(1) Does state law authorize issuance of assessment district, redevelopment tax increment and/or special tax district bonds to pay project costs?
(2) Are motor vehicle fuel taxes and/or vehicle registration fees available at the state or local level to secure revenue bonds and pay operation and maintenance expenses?
(3) Are local governments authorized to levy impact fees on new development that can be used to pay project costs and operation and maintenance expenses?
(4) Are local governments authorized to acquire and dedicate property for right-of-way?
(5) Has an "investment grade" ridership and revenue study been prepared?

Joint Development Revenues, Collocated Telecommunications Revenue

(1) Is the public agency authorized under state law to enter into agreements with private developers regarding parking and station improvements?

(2) Is the public agency authorized under state law to enter into agreements with private telecommunications companies regarding leasing ROW and/or facilities for the creation and/or expansion of a communications (i.e., fiber-optic cable) network?

6.2 DEVELOPMENT PRESSURE MANAGEMENT

New Castle County, the site for the proposed Monorail/AGT system, encompasses approximately 433 miles. Today, the region is home to approximately 200,000 households containing over 494,000 residents. The County is also the site of more than 278,000 jobs across all industrial sectors. This situation will change over the next two decades as evidenced in the projections prepared by WILMAPCO and shown in Table 6.2-1. Both population and employment will grow at a moderate rate of between 10 and 20 percent over the approximately 23 years or between less than one-half and up to one percent per year.

Table 6.2-1
Current and Projected Population and Employment
New Castle County, Delaware

	2000	2025	Percent Growth
Population	494,396	541,949	10%
Households	199,157	237,724	19%
Employment	278,149	324,200	17%

Currently, most of the County, excluding those areas within the City of Wilmington, is primarily residential and of that, the housing stock is primarily single-family dwellings. Table 6.2-2 shows the distribution of land use by major zoning categories.

Table 6.2-2
Land Use by Major Zoning Category

Land Use	Percent of Total
Commercial	14%
Industrial	7%
Multi-family	3%
Single-family	70%
Park	5%
	100%

Ample opportunity exists within the County to accommodate the projected growth in population and employment. While some areas, primarily surrounding I-95 and the urbanized areas have

reach a state of near build-out, most of the region is open to future development. An important element in directing that growth will be the future transportation network for the region.

Transit has the potential to influence the direction that the County takes as it grows. Today, the region is unquestionably auto-oriented. Despite the presence of DART First State bus operations, SEPTA, and inter-city Amtrak service, the majority of trips in the region continue to be made by automobile.

6.2.1 Relationship Between Land Use and Transportation

The New Castle region can be viewed from several perspectives in evaluating its transportation and land use systems. Typically, communities are evaluated from four components:

- Mobility – the ease with which people can move within the region
- Accessibility – the extent to which people can access the various activities within the region
- Livability – generally, the quality of the urban environment and how desirable a place it is to live and work
- Sustainability – the ability of the society to meet its needs without depriving future generations.

Generally, all of these measures increase within a community that coordinates its land use and transportation. Further benefits can accrue by concentrating development and promoting the use of transit through a coordinated and integrated system of higher density development that is oriented toward transit.

Land use organized around a rail transit line, tend to focus development at the various stations. The primary area of greatest development is within walking distance of the station. Development often continues in lower densities as the influence of the transit station dissipates. Properly developed, corridors of higher density development can be created while limiting the corresponding increase in traffic that development typically brings.

6.2.2 Guidelines on Development and Development Levels

Land use and future transit should be carefully coordinated and developed so as to produce both a desirable environment and cost-effective transit operation. Experience has shown that transit functions most effectively in areas in which the level of activity, both population and employment, exceeds 50 persons per square mile. Generally, residential areas with a gross density of 12 dwelling units per acre can generate sufficient ridership to support a high capacity transit line. Increasing densities beyond this level would produce a corresponding increase in ridership. Studies have shown that a 10 percent increase in density can yield a 2 to 3 percent increase in overall transit ridership.

Careful attention should be paid to the areas immediately surrounding the proposed Monorail/AGT stations. Generally, mixed use development with an FAR of 1.0 to 1.5 would develop with proper guidance, around Monorail/AGT stations. Increases of 2 to 3 percent can be

produced by ensuring that the mixed use development includes a significant component of consumer retail development.

Development tends to cluster around the station with most dense development occurring within one-half to one mile of the station. Densities typically taper off rapidly as the distance from the station increases. Land values similarly decline with distance from the station.

The development around the station should be both pedestrian-oriented and transit-friendly. The scale of the development and orientation should focus on the pedestrian and downplay the automobile. Sidewalks and the placement of any parking behind buildings tend to create the type of environment most conducive to transit operations. Buildings themselves should be oriented toward the street. Overall, the area around a transit station should present a safe and comfortable environment.

The organization of the streets and blocks should also promote a pedestrian orientation. Streets of two to four lanes, maximum, are most effective. Relatively short blocks also favor the pedestrian in moving around an area.

6.3 ENVIRONMENTAL IMPACTS

The National Environmental Policy Act of 1969 (NEPA), and associated amendments, regulations, and guidelines, generally sets the scope of study for environmental issues associated with transit projects. NEPA requires that any major federal action, in this case the use of federal funds to implement transit in New Castle County, be preceded by a study of the potential environmental impacts associated with the project. As nearly all transit projects make use of some federal funds it is reasonable to assume that the environmental issues raised in NEPA will need to be investigated prior to constructing and operating a Monorail/AGT system in the Wilmington region.

Table 6.3-1 lists the various categories of study for a typical environmental impact statement of a transportation project. Within the various major headings of natural resources, socioeconomics, and manmade environment are several sub-categories. General procedures and practices are followed in carrying out these studies so that a project proponent can both evaluate the impact of a potential transportation project but also identify means of mitigating the consequences.

Generally, most of the potential impacts can be mitigated. At this feasibility phase, few of the potential environmental impacts should be considered as an absolute barrier to advancing a project. Mitigation measures, up to and including relocating the alignment, will generally eliminate or reduce impacts to acceptable levels. In fact, many of the potential impacts are quite site specific. At this early stage, these impacts are far from certain. Other areas, however, give an indication of the potential to be significant obstacles and/or result in appreciable delays to a project's completion.

Table 6.3-1
Environmental Subjects Considered in NEPA Studies

Natural Resources
Wild and scenic rivers
floodplain impacts
coastal zone impacts
wetlands impacts
water quality
threatened and endangered species
prime and unique agricultural lands
stream modifications
visual impacts
roadside vegetation
wilderness areas
Socioeconomics
environmental justice
community cohesion
community impacts
development, revenues, and public expenditures, etc.
park and recreational facilities
bicycles and pedestrians
Manmade Environment
relocation impacts
land use impacts
joint development
hazardous and toxic wastes
corridor preservation
scenic byways
Historic and archeological preservation
Air quality
Noise
Cumulative & secondary impacts

Assuming that the alignment has been developed to complement the land use and development patterns for the region, the principal issues that need to be noted at this stage of the project are:

- Floodplain impacts – encroachment of the alignment upon floodplains.
- Wetlands impacts – encroachment of the alignment upon wetlands.
- Park and recreational facilities – encroachment of the alignment upon or near park and recreational facilities.
- Noise impacts –alignments that pass in close proximity to sensitive noise receptors. At this level of detail, residential property is the principal type of sensitive noise receptor.

Environmental data for this project was supplied by WILMAPCO through their GIS mapping. Table 6.3-2 identifies the extent of potential impacts of the proposed Monorail/AGT route on the various items.

Table 6.3-2
Potential Environmental Impacts of Proposed Alignment

Potential Impact	Measure	Quantity (feet)	Comments
Floodplain	Linear feet and number of stream crossings	11,150 13	Encroachment of the alignment onto the floodplain will be unavoidable in most cases. Adjustments could be made that will reduce stream crossings.
Wetlands	Linear feet	5,150	Adjustments to the alignment would reduce length of the Monorail/AGT line in wetland, however some encroachment will be necessary to provide service to Wilmington Amtrak Station.
Parks & recreational facilities	Linear feet and number of facilities	700 1	The line may run along the edge of a small section of Brandywine Park in Wilmington. A small adjustment to the alignment could avoid this.
Noise impacts	Linear feet through both single-family and multi-family residential areas	37,800	More detailed analysis would be necessary to identify areas with significant noise impacts.

Additional impacts can be expected to accrue at the Monorail/AGT stations. While the typical station would be elevated and with a minimal footprint, it is likely that feeder bus service, parking, and passenger drop-off facilities would be constructed at some of the station locations. Appreciable land taking and encroachment into manmade and natural environments could result. The extent of any impacts would depend upon the magnitude of the passenger interchange facilities.

Similarly, any Monorail/AGT operation would require a storage and maintenance facility. The size of the facility would depend upon the fleet size required to serve the corridor but would encompass as much as 90 acres. Storage and maintenance facilities are generally industrial in nature requiring designs and practices to mitigate resulting noise and toxic and hazardous wastes, and therefore must be carefully located to as not to adversely affect communities. The facility itself, including any additional tail track to connect the facility with the mainline, would have potential environmental consequences. The full extent of the impacts could only be ascertained after the facility is sized and located.

Mitigation Measures

Generally, the anticipated impacts can be mitigated. Coordination with resource agencies, minor shifts in the alignment, construction of physical barriers, and other means should render the alignment feasible. Subsequent to this study, the following actions should be taken to clarify potential impacts and respond accordingly.

- Floodplain impacts – check Federal Emergency Management Administration flood plain mapping. Given that the Monorail/AGT is likely to be entirely on structure, proper placement of support columns should minimize any significant impacts. Station areas would require special attention and could represent the greatest encroachment on floodplains. U.S. Army Corps of Engineers 404 permit(s) could be required.
- Wetlands – check Federal Emergency Management Administration and United States Geological Survey mapping. Given that the Monorail/AGT is likely to be entirely on structure, proper placement of support columns should minimize any significant impacts. Station areas would require special attention and could represent the greatest encroachment on wetlands. U.S. Army Corps of Engineers 404 permit(s) could be required.
- Parks & recreational facilities – alignments potentially affecting publicly owned parks, wildlife/waterfowl refuges, recreational facilities, and significant historical sites may require a Section 4(f) statement. These lands may not be crossed except after demonstrating no "prudent and feasible alternative." Station areas would need to be established that did not encroach upon these facilities. Orientation to create pedestrian-oriented facility that tied into the park or recreational facility would be beneficial.
- Noise impacts – detailed noise studies would be required. The Federal Transit Administration offers guidelines on permissible noise thresholds that cover both changes in ambient noise and maxima. Construction of sound barriers could be required. Noise impacts could be most significant in the vicinity of the stations where vehicles would be stopping and accelerating. Noise from buses and automobiles could also be significant in the station areas. Appropriate screening and operational practices might mitigate adverse impacts.

6.4 PUBLIC INVOLVEMENT

The Wilmington Monorail Exploratory Study was carried out with a significant public participation element. Stakeholders in the eventual outcome of this project were included at several levels. The public was therefore given an opportunity to stay informed on the project and to offer the Project Team input and comment as the study progressed.

The project was managed by the Management Committee. This committee composed of staff from Delaware Department of Transportation, as well as WILMAPCO and the localities within New Castle County. The Committee advised the Project Team and reviewed the data, methods, and findings of the project.

A Steering Committee, composed of nearly 90 individuals representing the private sector, public interest organizations, and various public agencies. The Steering Committee Meetings were open to the general public and offered participants an opportunity to review the direction of the project and influence its course.

One Open House Meeting was conducted on September 25, 2002, in which WILMAPCO presented the status of the project and again, gave members of the general public an opportunity to offer input to the project. The results of an unscientific survey collected during the meeting is presented in Appendix C.

WILMAPCO, www.wilmapco.org/monorail/index.htm, also maintains a website, located on the WILMAPCO home page www.wilmapco.org. The website presents the intermediate products, general information on monorail systems, and minutes of the various Management and Steering Committee meetings.

6.4.1 Summary of Key Meetings

At the first Steering Committee Meeting, held on June 24, 2002, the Project Team presented background on the project. A Purpose and Need Statement was discussed and input received on key issue that members of the committee and the general public would like to see considered. The committee also received a presentation on Monorail/AGT systems including their relative merits and case studies of where they have been deployed.

The second Steering Committee Meeting was held on August 28, 2002. At this meeting, the Project Team reviewed and finalized the purpose and need statement and worked with the committee to formulate an initial corridor for analysis. The Project Team also presented additional information on Monorail/AGT technologies.

A meeting with the Management Committee was also conducted in advance of the August 28 Steering Committee meeting at which similar topics were reviewed. Minutes from both meeting dates are contained in Appendix B.

6.4.2 Direction from the Public

Generally, the public has been supportive of efforts to develop a Monorail/AGT system for the New Castle Region. Among the motivations for such a system would include:

- Traffic congestion
- Deteriorating air quality and the prospect of non-attainment status
- Remedying suburban sprawl
- Stimulating economic growth

The public also identified several needs to which Monorail/AGT might be respond. These comments responded both to regional needs and future prospects for a high quality transit system within the New Castle Region.

- Effectively serve both the central city and suburban employment centers
- Encourage shift from single occupancy vehicles to high occupancy vehicles
- Mitigate growing highway congestion
- Mitigate deteriorating air quality conditions
- Integrate the proposed system with other modes of travel
- Supporting regional growth
- Improving connectivity between the Region and Wilmington, Philadelphia and other urban centers.

6.4.3 Future Public Involvement

Both the Federal Transit Administration New Start Program and the NEPA environmental study process strongly encourage a public involvement program that actively solicits input from the general public. An effective public involvement program also creates a dialogue between the project proponents and the affected community. The public involvement program initiated in this exploratory study will need to be continued and expanded as this study moves forward.

7.0 FINDINGS AND NEXT STEPS TOWARD IMPLEMENTATION

The project Purpose and Need Statement, presented in Section 3.0 outlines the issues that support the need for fixed guideway transit and services in the Wilmington region. The project Steering Committee presented the following categorical motivations behind this support:

- Transportation Improvement (Intermodal Connectivity)
- AGT as an impetus for improved Quality of Life
- Work, home, retail and tourist destination
- Insure a logical and sound AGT system

The statement subsequently developed provided the rationale for the alternative alignment corridor segments presented as fixed guideway coverage in the New Castle County service area. These alignment corridor alternatives varied in terms of optimal speed characteristics, routing, station location, number of stations, environmental impacts, and potential costs. Working closely with the project Management and Steering Committees, the study team evaluated the alternative segment base on seven evaluation criteria contained in the Purpose and Need Statement. The key segments that comprise the initial 24-mile alignment corridor begins at Peoples Plaza on Route 40, proceed via Route 1 to downtown Wilmington and then on the Route 202 to the Blue Ball Properties.

In addition to the mobility benefits of a Monorail/AGT system, there would be monetary benefits to residents, businesses and governments located near the system. Residents within a half-mile of a station benefit from higher property values and reduced automobile expenses. Businesses also benefit from higher property values and increased access for workers and clients. Finally, local governments will capture additional tax revenues from those higher property values.

The feasibility of two Monorail/AGT system concepts (large/high speed versus small/moderate speed) was assessed from the perspective of FTA New Start criteria and recently refined alternative land use scenarios contained in the WILMAPCO 2025 Regional Transportation Plan. The projected 2025 daily ridership was estimated at 12,800 total boardings with the surged peak-hour demand estimated at 1,500 passengers in the peak direction.

The life cycle cost analysis shows that there is no significant cost difference between the large and small systems. The large Monorail/AGT system is estimated to cost $1.4 billion or $59 million per mile. A logical first segment for the system that conforms to Wilmington city and regional goals, would be from downtown Wilmington (Amtrak Station) to the Blue Ball Properties. It is recommended that the potential of this segment be studied further. There were no fatal flaws identified that would prohibit inclusion of Monorail/AGT in a study of mass transportation alternatives in the Wilmington metropolitan area. **The overall Monorail/AGT system is worthy of further study in the context of a larger alternatives analysis that would consider this type of system along with other viable transit alternatives for the region.**

An appropriate step subsequent to this study would be an FTA Transit Alternatives Analysis. Under such a study, the full range of transit options would be explored. Public input would clearly be important in helping to define the route such a system might take, the location of any

stations, and the relative importance of competing demands and potential impacts that might result from its implementation.

The conclusion of the Transit Alternatives Analysis is the New Start Evaluation. This evaluation compares the proposed transit alternative for the subject location with other proposed systems around the country. In addition to the quantitative measures is the need to establish local support. The public involvement program will be key in demonstrating support for the project.

Beyond the Transit Alternatives Analysis would be an environmental impact study. Such a study is initiated with a scoping meeting. Scoping is the process whereby responsible parties offer guidance on key issues and concerns that should be addressed in the course of the study. Both in scoping, and throughout the study, public participation would be essential to both inform the public of the project's progress but also to gain insight on local conditions that might otherwise not be evident.

As the project moves into design and construction, public outreach will continue to be important. Appropriate outreach programs would need to be included in each subsequent phase.

APPENDIX A: CAPITAL AND OPERATING COST ESTIMATES

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Capital Costs and Annual O&M Costs have been estimated for the two Monorail/AGT system applications. 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/AGT 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**

The Capital Cost for a Monorail/AGT application was found to be in the range of $1.3 to $1.4 billion. The large Monorail/AGT application is estimated to be about $81 million more than the small Monorail/AGT application. This additional 6% 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/AGT.

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 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% higher annual operating cost is due mainly to the maintenance of the required larger fleet size.

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APPENDIX B – MEETING MINUTES

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Regional Monorail Exploratory Study

Meeting Summary
Steering Committee Meeting #1 June 24, 2002

1. Introduction – Tigist Zegeye
   Opening remarks and self-introduction of attendees

2. History – Rep Dave Ennis
   Credited Mr. Doug Andrews who has been working on a Monorail Plan in Delaware for the past (12) years

   Spoke about concept drawing from 1912 showing DuPont Highway with passenger cars and trains and in 1970 Secretary Maginess proposed a figure (8) monorail system, which proved to costly for implementation

   He noted how the Fair Play Station and Claymont Station have proven to be very successful light rail lines and filled the needs of commuters traveling to Wilmington and Philadelphia

   He spoke about intermodal transportation connecting bus and water centers with monorail stations (Fox Point State Park) He emphasized that a monorail system must connect to Wilmington and not go around it
   He showed slides on a monorail system in Jacksonville, FL connected to a bridge and built at the same time

3. Project Background and Tasks – Randolph Richardson (Lea+Elliott)
   Mr. Richardson discussed the major questions raised in the Request for Proposals for the monorail study and outlined the consultant team's approach. The five-month study will examine existing monorail systems and assess the potential for such technologies in the Wilmington region. The study team is using a broad interpretation of the term "monorail" where a wide range of automated guideway technologies (AGT) will be considered. These AGT systems include steel-wheeled and rubber tired self-propelled people mover systems. An initial corridor will be recommended and technical feasibility will be assessed along with the accompanying demographic, land use, and financial issues.

4. Purpose and Need Statement – Alan Brick-Turin (HNTB)
   What problems will the project address?
   Creates a framework for evaluating the solutions

   Principal Issues:
   Anticipated travel demand
   Capacity deficiencies in the existing system
   Relationships to the Regional Transportation Systems
   Social/Economic Development needs

FTA Criteria:
Mobility
Environmental Quality
Operating Efficiencies
Cost Effectiveness
Land Use

5. Purpose and Need Discussion

- World economy thru the Port of Wilmington
- Gain National Exposure
- Growth and Development at the Port
- Promote third wave economy
- Safety
- Improve transportation system efficiency
- Improve mobility (individual mode to mass mode)
- Improve transit connections
- Duplication of transportation services
- Connect communities with urban amenities in region and NE corridor
- Promote denser development and transit
- Promote tourism
- Serve future residents
- Air Quality compliance/Environmental needs
- Is this achievable or is it a dream
- What is the cost per passenger
- What are the impediments (land control, political obstacles)
- Is it cost effective
- Public and Political acceptance
- Must serve residential, retail and other employment centers
- Must serve off peak centers
- Where do people want to go
- Need to get people from suburbs to work
- Must utilize underutilized transportation right of ways
- Must convince commuters to use transit and leave cars at home
- Duration (from concept to completion- 10 years)
- Must support the goals of "Livable Delaware"

6. Issues for Monorail Planning – Randolph Richardson (Lea+Elliott)

   Mr. Richardson discussed North American monorail/AGT projects that are or are evolving into major line-haul mass transportation systems. The projects discussed were monorail efforts in Las Vegas, Seattle and Jacksonville and the automated rapid transit system in Vancouver, British Columbia. System characteristics such as daily ridership, peak capacity, dual lane miles, number of stations, and intermodal connections were described for each system as they evolved from a simple distribution system to a line haul service. This type of development is particularly true for Las Vegas and Seattle. Jacksonville is still essentially a local distribution system and Vancouver actually began as a major line haul system.

7. General Discussion – Public

   - Monorail System should serve the inner city commuter and residents? It appears that all proposed alignments are suburban related (Del Park, Christiana Hospital, U of D, Fox Point Park)
   - If it doesn't serve Wilmington, it is not viable
   - The alignment must serve center city Wilmington
   - Does current modeling give us real world future mass movement of people?
   - Does current modeling address rapid evacuations of large masses of people?
   - The existing infrastructure of transportation can not accommodate future population growth trends
   - Currently little community acceptance of more density
   - Relieve congestion in busy corridors
   - Tie to Brownfield redevelopment
   - Monorail system must align with population density centers to be viable (estimates indicate people will only walk appox 1/4 mile to a rail station and will only drive appox one third of the total travel distance to a rail station)

8. Project Schedule – Heather Ehrlich Dunigan (WILMPACO)

   - Steering Committee Meetings/Workshops in Aug/Sept (dates TBA)
   - Information on www.wilmapco.org/monorail
   - Dissemination of Steering Committee minutes and Public Comments forthcoming
   - Additional meetings with individuals or groups can be arranged upon request

Regional Monorail Exploratory Study
Management Committee Meeting Summary (August 28, 2002)
(Unofficial)

A. After a self-introduction prompted by Tegist Zegeye of WILMAPCO a slide presentation was given to the Management Committee Members in support of various handouts from the Consultant team and WILMAPCO.

1. The first pr There were no fatal flaws identified that would prohibit inclusion of Monorail/AGT in a study of mass transportation alternatives in the Wilmington metropolitan area.

   There were no fatal flaws identified that would prohibit inclusion of Monorail/AGT in a study of mass transportation alternatives in the Wilmington metropolitan area.

   Presenter was Alan Brick-Turin from HNTB who reviewed the "Purpose and Need" statement developed from the first Steering Committee meeting on June 24, 2002. The project "Purpose and Need" section is number 3.0 through 3.2 of the "Technical Memorandum", Part A – Feasibility Analysis draft copy dated August 28, 2002. The initiation of a shift from single occupancy vehicle to high occupancy vehicle will be incorporated into the "Purpose and Need"
   Mr. Turin walked the committee members through the development process emphasizing the FTA criteria for measurement of:
   - Mobility
   - Environmental quality
   - Operating efficiencies
   - Cost effectiveness
   - Land use

   He then addressed the motivations for consideration of AGT (automated guide way transit) generated at the first meeting. These include:
   - Transportation Improvement
   - Improved Quality of Life offered by this type of transportation system
   - Destinations desired (work, home, retail shopping, tourism)
   - Is the final product logical and realistic

   In closing, Mr. Turin discussed what role AGT systems including monorails might play in the overall transportation system for the Wilmington region and what benefits are gained such as mitigating highway congestion, improved air quality, integration with other modes of travel and improving connectivity with other cities and urban centers.

2. The next presenter was Frank Spielberg of SG Associates who discussed the methodologies use in defining the proposed corridor alignment centers and

segments. He explained how "trip generators" were use to identify the seven segments which became the framework of the proposed corridor alignment. Mr. Spielberg addressed issues in the "Study Area" such as major roads, major rail lines, demographics and housing and other centers of population densities.

This generated some discussion on a possible tie into Southeastern Pennsylvania along the Route 202 corridor. There was also some discussion of how recent studies tie into the WILMAPCO 2025 year (MTP) Metropolitan Transportation Plan and its long-range goals

3. The final presenter was Randy Richardson of Lea+Elliott who addressed the measures to be evaluated by the Management Committee to define and recommend the most feasible corridor alignment among the identified segments in the study. Mr. Richardson also presented cost figures for both existing and planned AGT systems in other cities. He emphasized that these figures did not include land acquisition costs, which triggered some comments on land use issues, and the development of employment centers in suburban areas (offices in cornfields concept).

   Mr. Richardson also cited some figures on public and private funding of AGT systems in others cities and then he detailed the technologies currently available and where they are presently in use. He offered handouts on the alignment corridors of both existing and planned systems and how the footprints of different technologies are very similar and interchangeable thereby answering concerns over lack of parts and engineering in future years if manufactures are not here to support the product.

   After considerable debate among Management Committee members, a proposed corridor alignment was agreed upon for recommendation to the Steering Committee. The seven segments outlined in the "Draft Technical Memorandum" were narrowed to four areas and the most viable corridor was determined to be from the "Route 40 area to the A. I. DuPont Hospital Site". Specifically, the alignment will follow a path from "Peoples Plaza through "Governors Square" to the "Christiana Hospital" then moving east to the "New Castle County Airport" complex and "State Hospital" into "Wilmington" and proceeding north to the "Blue Ball Properties" and ending at the "A. I. DuPont Hospital"

   The Management Committee meeting ended in late afternoon with the Steering Committee meeting schedule for later that night at which time the same agenda would be followed including the recommendation of the proposed corridor alignment to the Steering Committee.

Regional Monorail Exploratory Study
Steering Committee Meeting Summary (August 28, 2002)
(Unofficial)

A. After an introduction by Tegist Zegeye of WILMAPCO a slide presentation was given to the Steering Committee Members in support of various handouts from the Consultant team and WILMAPCO.

1. The first presenter was Alan Brick-Turin from HNTB who reiterated that monorails are just one of many AGT (automated guide way transit) systems and how a possible monorail in New Castle County would fit into other planned transportation projects. He then reviewed the "Purpose and Need" statement developed from the first Steering Committee meeting on June 24, 2002. The project "Purpose and Need" section is number 3.0 through 3.2 of the "Technical Memorandum", Part A – Feasibility Analysis draft copy dated August 28, 2002. The initiation of a shift from single occupancy vehicle to high occupancy vehicle will be incorporated into the "Purpose and Need"
Mr. Turin walked the committee members through the development process emphasizing the FTA criteria for measurement of:
    - Mobility
    - Environmental quality
    - Operating efficiencies
    - Cost effectiveness
    - Land use

    He then addressed the motivations for consideration of AGT (automated guide way transit) generated at the first meeting. These include:
    - Transportation Improvement
    - Improved Quality of Life offered by this type of transportation system
    - Destinations desired (work, home, retail shopping, tourism)
    - Is the final product logical and realistic

    In closing, Mr. Turin discussed what roles AGT systems including monorails might play in the overall transportation system for the Wilmington region and what benefits are gained such as mitigating highway congestion, improved air quality, integration with other modes of travel and improving connectivity with other cities and urban centers.

    The next presenter was Frank Spielberg of SG Associates who discussed the methodologies use in defining the proposed corridor alignment centers and segments. He explained how "trip generators" were used to identify the seven segments proposed as a framework for the corridor alignment.

Mr. Spielberg addressed issues in the "Study Area" such as major roads, major rail lines, demographics and housing and other centers of population densities. The comments from the Management Committee meeting earlier in the day regarding the possibility of a secondary corridor into Pennsylvania along Route 202 were mentioned but it was noted that previous dialogue with officials in Southeastern Pennsylvania resulted in no interest on possible new AGT links since the SEPTA line is currently in operation.

2. The final presenter was Randy Richardson of Lea+Elliott who explained how the Management Committee debated and narrowed the possible corridor segments from seven to four before agreeing on the final proposed alignment. Mr. Richardson also presented cost figures for both existing and planned AGT systems in other cities to the Steering Committee. He emphasized that these figures did not include land acquisition costs and noted how this had triggered some comments at the Management Committee meeting on land use issues, and the development of employment centers in suburban areas (offices in cornfields concept).

   Mr. Richardson also cited some figures on public and private funding of AGT systems in others cities and then he detailed the technologies currently available and where they are presently in use. He offered handouts on the alignment corridors of both existing and planned systems and how the footprints of different technologies are very similar.

   Mr. Richardson then presented the Steering Committee with the Management Committee's recommendation on the proposed corridor alignment. He relayed how the seven segments outlined in the "Draft Technical Memorandum" were narrowed to four areas and the final alignment was determined. He then highlighted the path from the "Route 40 area to the A. I. DuPont Hospital Site". Specifically, the alignment will follow a path from "Peoples Plaza through "Governors Square" to the "Christiana Hospital" then moving east to the "New Castle County Airport" complex and "State Hospital" into "Wilmington" and proceeding north to the "Blue Ball Properties" and ending at the "A. I. DuPont Hospital"

3. Feedback from Steering Committee members

   The following comments were recorded from members of the audience:

   - Representative Lavelle requested that consideration be given to the track alignment and its overall impact before the final corridor alignment is approved
   - Question from the audience if businesses have been approached regarding use of their property for parking at proposed stations. It was noted by the Consultant team this is only a study.
   - Why wasn't Hockessin included in the proposed alignment since it generates many trips to Wilmington and other activity centers

- Why was Newark excluded? Noted that SEPTA already operates at Fairplay Station.
- There is no guarantee that people will use a monorail or other AGT if built (will not give up the automobile)
- The advocate from the Sierra Club suggested dropping the use of the word "Monorail" in favor of a generic form of AGT (automated guide way transit). Monorail conveys wrong message to the public about this study.
- Question are we looking at future population growth and how transportation demands will be accommodated
- Have Pennsylvania transportation officials been contacted regarding this study. Yes and they are not interested in linking with Delaware.
- There was a comment from the audience comparing the estimated cost of an Urban AGT per mile to the approximate cost to build SR 1 per mile ($ 50-$75 million per mile vs. $ 38 million per mile) unconfirmed.
- A representative from MBNA read a visionary letter he sent to politicians in 1999 highlighting the benefits of a monorail system not only for New Castle County but also for the entire state of Delaware.

4. Public Workshop

The Steering Committee meeting ended with the announcement by Heather Dunigan of the next public workshop on the "Regional Monorail Exploratory Study" scheduled for September 25, 2002 to provide outreach and solicit public opinion.

APPENDIX C – UNSCIENTIFIC SURVEY RESULTS

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Regional Monorail Exploratory Study - SURVEY

Please take a minute to fill out this survey. Your answers will be used to determine if we should continue to consider monorails in New Castle County. Space is included after each question for any comments you wish to make or you may write additional comments on the back. ***Please note: Monorail is used in this survey as a generic term for automated guideway transit (AGT). The actual type of system has not yet been determined.***

1. Do you feel increasing traffic congestion will justify a monorail system in New Castle County within the next 30 years? Yes-6 No-2 Maybe-1

   Comments:

   - Yes, traffic is only going to get worse, as projections show. Air quality must also be solved.
   - We may be under water in 30 years. We need relief now!
   - Yes, but only in certain corridors.
   - Traffic is at a standstill now. There is no more room for roads. I think this is a wonderful alternative.
   - It should become viable much sooner.
   - A monorail system is so expensive for the number of people it serves, that it would be difficult to justify on a cost/benefit basis. The cost is prohibitive and communities won't let it be built in their neighborhoods.
   - No, however depending on my "feeling" or those of the multitude is fundamentally absurd when REAL information could be generated by simple LOCAL experiments to measure demand elasticity's with respect to price (fare levels) and time saving potential.

2. Would you use a monorail, instead of driving, for travel within New Castle County? Yes-5 No-1 Maybe-3

3. What factors would you consider in making your decision?
   [Rate in order of importance from 1 (most important) to 7 (least important)]

   Average ranking:

2.0 Station locations	3.7 Hours of operation
2.4 Price	4.3 Speed
2.5 Reliability	Other:
3.0 Safety	• Clean attractive design
	• Living with global warming
	• Ridership
	• Time saving potential
	• Frequency

   Comments:

   - Public health—air quality—is the major factor in addition to growing congestion.
   - Must start where people live or frequent and go to somewhere they want to go.
   - If it doesn't have a 5-10 minute headway, it won't be sufficiently usable. Delaware is so small; you can get everywhere quickly and conveniently. People won't ride a monorail anymore than they do buses. It takes too much time compared to cars.

4. Do you support the route alignment proposed for initial analysis? Why or why not. Yes-5 No-3 Maybe-1

Comments:

- Suggest extending to rapidly growing MOT area south of the canal.
- It makes sense to run it where there are population centers and where a majority of people are traveling from (southern NCC growth area). It should continue to the Philadelphia Airport.
- It follows the same route as the already running rail system.
- Route is ABSURB. That would be readily demonstrated with a few ballpark estimates of right of way costs
- Routes 141, 202 or 2 would also be good. Route 40 is good, but people there don't want it.
- Alignment needs to serve greatest population and employment densities but Delaware doesn't have great enough density to justify cost. We're not that urban.

5. Do you support tbe goals and criteria for evaluation identified by the consultants and the project committees? What additional goals and criteria should we consider? Yes-5 No-1 Maybe-1

Comments:

- Needs to serve people where they work and live.
- Reduce SOV.
- Create public/private partnerships to market as economic development tool.
- Some roads and harbors will be underwater in 30 years.
- We should first consider financial feasibility—including up front funding—of the cheapest among the several monorail alternatives, and how that would compare with a bus system with and without HOV lanes where possible, are the only RELEVANT concerns.
- Most important: cost-benefit ratio. If this doesn't have realistic cost associated with it (and numbers so far seem unacceptable) then we should continue wasting money on what is not feasible.

6. Would you be opposed to a monorail station or rail line in your neighborhood if it benefited everyone overall? Yes-4 No-4 Maybe-1

Comments:

- Clearly no place for it to go near me.
- If it is attractively designed and quiet design and spurs economic development appropriate and infill with community amenities, it will succeed.
- Only because there is not enough buffer between the monorail and housing. Careful balance between access and disturbance is crucial.
- It would be quiet and nonpolluting. Make sure there is enough parking.
- Depends on routing and station arrangements.

APPENDIX D: STAKEHOLDER COMMENTS

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APPENDIX E: PRESS REPORTS

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A POTPOURRI OF MISCELLANEOUS NEWS SCRIBBLED IN A REPORTER'S NOTEBOOK

May 2002

Wilmington Area Planning Council has hired a consultant, Lea & Elliott, to study the feasibility of a monorail transit system in New Castle County. It will cost about $150,000 and is due to be completed in six months.

Such a system looping through Brandywine Hundred from a commuter railroad station at or near Edgemoor to the Brandywine and continuing along the Route 141 highway corridor to the station at Delaware Park has long been advocated by state Representative David Ennis. Most recently it or a light railway line was considered as a long-range adjunct to the expansion of the Tyler McConnell Bridge crossing. Critics have said that such systems, which are in use in a few urban areas in this nation and more widely in Europe, are too expensive relative to the benefits they offer and require support structures not likely to find favor with residents along their right-of-way.

Heather Ehrlich, the council's senior planner said the study will address public acceptance, technical feasibility and the possibility of tapping "innovative sources" of financing. If deemed feasibility, the consultant is to come up with a recommendation concerning a route and outline future steps necessary to make the idea a reality. One element of the report is "identification of fatal flaws, if any, that will prevent implementation" of a monorail. She said that the study process is to include council-sponsored public meetings Ennis has maintained that a monorail would invite both commuter and tourist patronage and, as such, should draw financial and other support from businesses and other private interests.

WILMAPCO study of monorail feasibility makes a lot of sense

06/05/2002

There are no simple solutions to the crowded, polluted highways in New Castle County. Everything from staggered working hours to high-occupancy vehicle lanes has been considered. Mass transit is a wise and efficient option to automobile commuting, but it hasn't made a significant dent in the rush-hour traffic in the greater Wilmington metropolitan area. The Concord Pike and I-95 are crawling parking lots each morning and evening. Granted, our "rush hours" can't compare with those in the nation's big cities, but the pollution and aggravation are no less real.

There has been on-again, off-again talk of light rail as an alternative not only to the problems of congested New Castle County but also as a way to link Wilmington, the state capital, Dover, and, ultimately the beach areas. The state Department of Transportation is now contemplating a study of linking Dover and Wilmington with light rail. A study of whether such a link would work and be used will cost between $150,000 and $200,000, according to Nathan Hayward III, DelDOT's secretary. Mr. Hayward's enlightened view of mass transit is a far cry from the days of Kermit Justice, DelDOT secretary when Del. 1 was on the drawing board. Many people urged the state to incorporate into the highway plans a design for light rail that could be added later. The suggestion was ignored.

For about the same amount of money being spent to study the north-south rail link, the Wilmington Area Planning Council (WILMAPCO) is going to study the feasibility of construction of a monorail system in the northern part of New Castle County. Rep. David Ennis of Fox Point has long advocated a monorail system that would wend its way through Brandywine Hundred and then on to points west. A monorail that would run along Del. 141 was considered when the problems with the J.H. Tyler McConnell Bridge were examined during the efforts to mitigate traffic congestion that a new AstraZeneca headquarters would bring.

Now, WILMAPCO, the bi-state group that essentially controls the federal transportation dollars for New Castle and Cecil (Md.) counties, will try to discern if such a plan might work. Any plan that

offers efficient alternatives to automotive travel is worth exploring. The majority of Delawareans have resisted mass transit. Their reasons vary, but the day will come when mass transit will be absolutely necessary, and it's always good to have several options available for consideration.

www.delawareonline.com The News Journal

Meeting on monorail feasibility to be Monday

Possible northern Delaware system might ease traffic, help clean air

By STEPHANIE L. ARNOLD
Staff reporter
06/20/2002

A Steering Committee to determine public acceptance and the technical and financial feasibility of a monorail system in northern Delaware will have its first meeting Monday.

The committee includes members of the Wilmington Area Planning Council and residents. The council recently agreed to pay $150,000 to Virginia-based transportation and design firm Lea+Elliott Inc. to conduct a six-month study on the need for the rail system. The council, which is responsible for coordinating New Castle County and Cecil (Md.) County transportation plans, operates on state and federal tax dollars.

The council's commitment to studying a monorail system is due in large part to the crowded roads and Delaware's urgent need to meet federal clean air laws, state Rep. David H. Ennis, R-Fox Point, said.

"I just think that the whole idea of public transportation has matured," said Ennis, a longtime advocate of a monorail. "As it stands, we have until 2004 to comply with the clean air standards. This means encouraging our residents to take other modes of transportation. We should not preclude alternative forms like monorails."

The study would determine the best locations for a monorail system. One idea is to run the rail along the Del. 141 corridor with connections at Delaware Park in Stanton and Fox Point State Park.

Critics say monorails are too expensive. Last week consultants in Seattle, Wash., released drawings of downtown stations on a proposed $1.2 billion monorail system. Seattle voters will decide the fate of the proposal in November.

State Rep. Greg Lavelle, R-Sharpley, said the cost and the system's impact on neighborhoods worry him.

"We have to be careful when we look at putting up a monorail in and around neighborhoods," Lavelle said. "Some people talk about the possibility with such a cavalier attitude, but you've got to be careful. We have to keep in mind that people live here."

Daniel Bockover, president of the Council of Civic Organizations of Brandywine Hundred, said many people who have criticized the idea have never researched it.

"You can't really say it won't work until you know what needs to be done first," Bockover said. "Once we outline what difficulties need to be addressed, then we can start talking money. Right now, no one knows enough to say yes or no."

The idea of a monorail was one suggestion given to an advisory group looking for ways to ease congestion on the Tyler McConnell bridge early this year. Delaware Department of Transportation officials said they had not ruled out the option, but said it would be decades before it would be possible.

The council's senior planner, Heather Ehrlich, said the study will gauge the public's interest in a monorail system, whether it would make sense financially and whether there is enough room for it. The study will also consider the exact route of the monorail and its possible environmental impact. The council's findings will be forwarded to DelDOT.

www.delawareonline.com The News Journal

Monorail must connect city, panel says

Wilmington link an important part of regional system

By STEPHANIE L. ARNOLD
Staff reporter
06/25/2002

A successful monorail system in northern Delaware would need to make connections in Wilmington and not only the suburbs, members of a monorail Steering Committee told consultants Monday.

The demand differs slightly from the initial plan presented by Rep. David H. Ennis, R-Fox Point. His proposal was to run the rail along the Del. 141 corridor, with connections at Delaware Park in Stanton and Fox Point State Park.

Nearly 50 community members, politicians and transportation officials attended the monorail Steering Committee meeting Monday sponsored by the Wilmington Area Planning Council. The meeting was held at the Delaware Transit Corp. in Wilmington.

The meeting comes about a month after the council paid $150,000 to Virginia-based transportation and design firm Lea+Elliott Inc. to conduct a six-month study on the need for a rail system. Representatives from the company made presentations consisting of project schedule information and the general objectives of the study. They asked committee members and others in the audience what they thought should be the primary uses of the proposed Delaware monorail.

In addition to the Wilmington connections, the monorail would have to include the northern part of New Castle County and improve connections from suburban areas to city shopping, jobs and recreation, committee members said.

Steering Committee member Beverley Baxter said she is skeptical of the study. She said she is not convinced that Delaware's population would justify a project that would cost hundreds of millions of dollars.

"We need to know how cost-effective this project is before we spend our tax dollars on something we ultimately won't be able to do," she said. "We need to look at everything from a practical standpoint."

The council's commitment to studying a monorail system is due in large part to crowded roads and Delaware's urgent need to comply with federal clean air laws.

"I am pleased with the community participation," Ennis said. "I want people to understand that my proposal was just that. Nothing is in stone."

The committee will meet two more times - once in August and once in September - before the firm and the committee make a final recommendation to the Wilmington Area Planning Council. The council will forward those findings to the Delaware Department of Transportation.

Monorail system considered by state

BY BLAIR KAHORA
City News Editor

Plans for a new monorail system were publicly reviewed at a meeting in Wilmington Wednesday.

To combat increasing traffic congestion, insufficient parking and growing environmental concern, city and state officials developed a plan for a monorail to stretch across northern Delaware.

State Rep. David H. Ennis, R-6th district, said he has championed the construction of a monorail in the state for the past 20 years.

"It all started as an idea to connect parklands," he said. "Then I realized the value of mass transit."

Ennis said he believes a monorail would be a useful solution to the increasing environmental problems facing the state.

Several types of pollution have caused the state to violate the ozone standards set forth by the Federal Environmental Protection Agency, he said. Auto emissions are the No. 1 contributor.

"We have the greatest control over vehicle pollution," Ennis said. "We can get people out of their cars."

If the state does not meet sufficient ozone levels by 2004, he said, the EPA will start enforcing more stringent standards.

"[The state] will lose federal highway funding," Ennis said.

Heather Dunigan, senior planner for the monorail project, said the state continually combats traffic congestion.

"We can't keep building more roads because it will just produce more cars," she said. "[A monorail] is a nice alternative."

Roger Roy, executive director for the state Transportation Management Association, said the plans focus on residential and corporate densities.

"The selected alignment was chosen to service the downtown business district, the airport and Glasgow, where there is great residential growth," he said.

Roy said the chosen alignment will follow already-established highways in the state, but also stretch into areas with no rail systems.

Dunigan said the state would be unable to fully fund the monorail, which would cost approximately $40 million per mile.

"We are hoping the state will be matched on a federal level," she said. "We are also hoping private companies will chip in, too."

Ennis said financial support from MBNA would be helpful and logical.

MBNA runs its own bus service to take employees from suburban areas to downtown Wilmington, he said. A monorail system would remove the buses from traffic congestion.

"It's almost a tradeoff," Ennis said. "We are encouraging businesses to look at the big picture and chose the lesser of the two evils."

Ennis said the New Castle County Airport will be increasing employment in the near future, and the monorail would diminish the need for additional parking at the airport facility.

"[By instituting the monorail], we are stimulating the establishment of new employment," he said.

Randolph Richardson, manager of planning projects for the consultant group Lea+Elliott Inc., said different committees examined typical factors that supply traffic.

Employment, shopping centers, schools, hospitals and residential housing helped them develop the path stretching from Blue Ball to Peoples Plaza, he said.

"The objective is to look at feasibility," Richardson said.

Dunigan said monorails have become successful in many cities around the world.

"Europe and Asia have monorails that are successful regional systems," she said. "Japan has a 25-mile system that connects suburban areas with the city."

Monorails have also proved profitable in Seattle and Las Vegas, she said.

"Seattle is making a profit from the segment around the Space Needle," she said. "They just received more funding for an extension to the suburban areas."

Ennis said although the monorail will not be constructed for another 20 to 25 years, the state is already planning long-term extensions to the shore areas and Dover.

"We want to target the young people at the beaches," he said. "We also want to help students who commute from Dover to the university."

Dunigan said planners have received mixed opinions from the public, although most people are concerned with the price of construction.

"People are very interested," she said. "We can't keep building roads."

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