

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

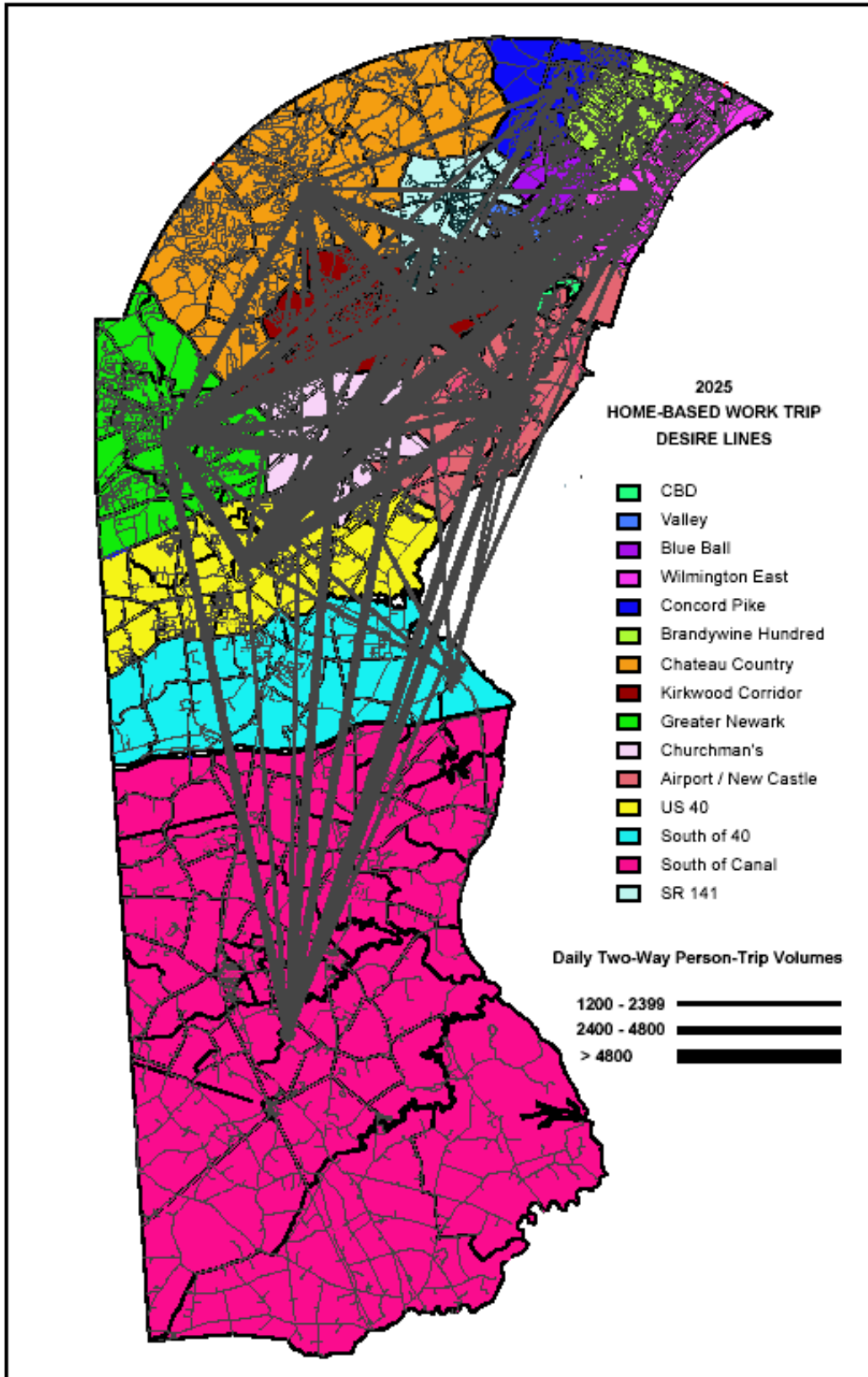


Figure 5.1-1: Inner-District Work Trip Volumes



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 employment 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

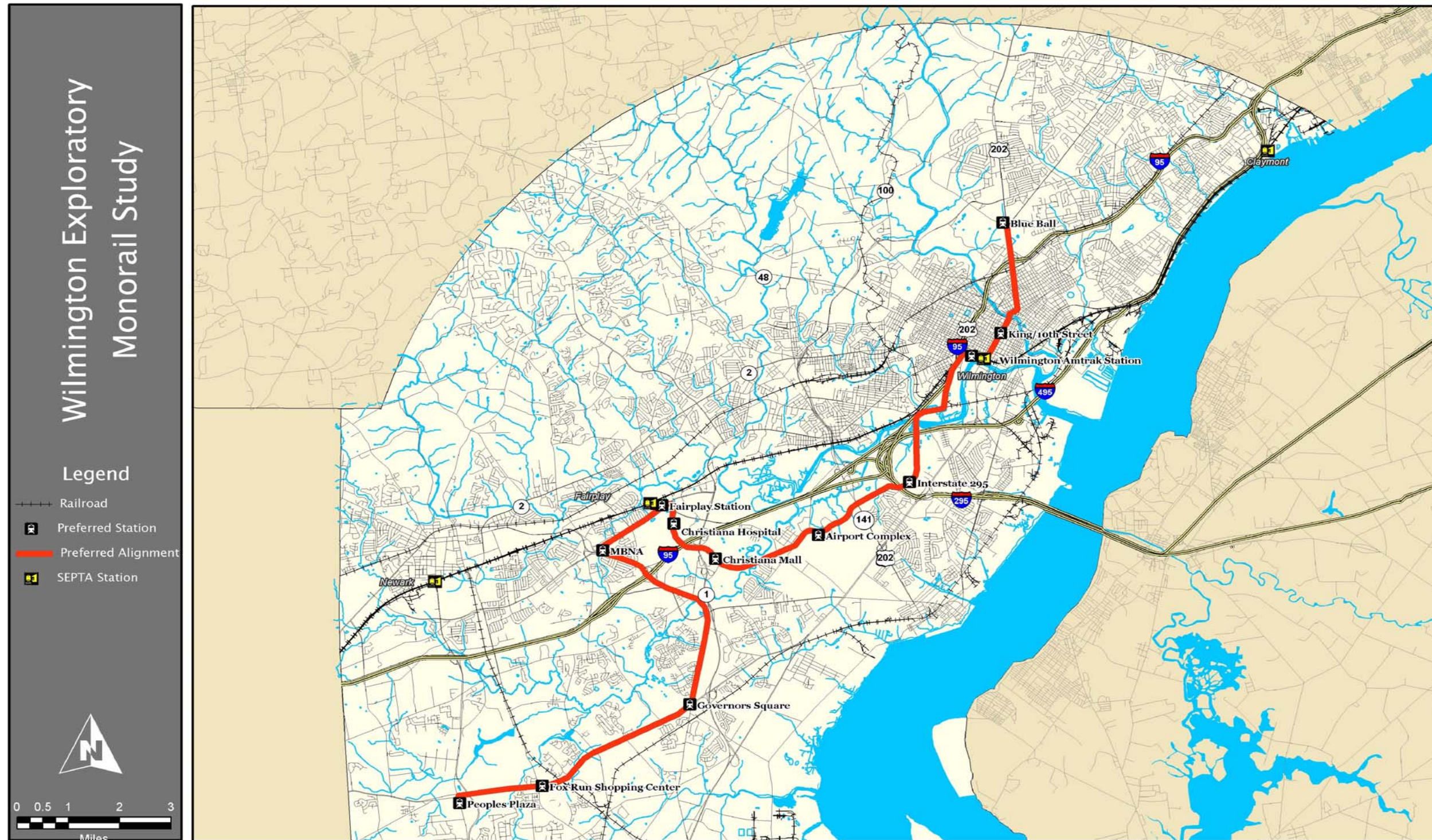


Figure 5.1-3: Initial Alignment Corridor

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

For illustrative purposes, the monorail costs are compared to a hypothetical articulated bus service that follows the general monorail alignment while operating in mixed traffic. The one-way travel time is more than 100 minutes longer than the monorail, however, four-minute peak hour headways can be maintained using 84 sixty-foot articulated buses with the capacity of 92 passengers. Given the slower travel times achieved by the limited-stop bus service operating in mixed traffic, the demand is estimated to be in the range of one-third to two-thirds of the estimated Monorail/AGT ridership. This life cycle cost comparison suggests that it costs roughly 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. <u>Mobility</u> – 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. <u>Environmental quality</u> – 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. <u>Operating efficiencies</u> – that are better than existing bus operations.	<ul style="list-style-type: none"> 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. <u>Cost effectiveness</u> – in terms of the Capital Costs and Operation and Maintenance (O&M) costs per annual ridership.	<ul style="list-style-type: none"> 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. <u>Land use</u> – in terms of the need for any additional land and the use of public rights of way.	<ul style="list-style-type: none"> 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. <u>Technical feasibility</u> – to insure that the end product is buildable from a technical standpoint (i.e., grades, curves, crossings/spans, room for stations).	<ul style="list-style-type: none"> 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 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 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
- 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.

5.4.1 Smart Growth INDEX Model Results

WILMAPCO ran the Model on Scenario 2 (reflecting current zoning) and Scenario 4 (featuring greater concentration of development in the 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 current 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 Smart Growth INDEX Model projects a further increase in transit ridership with the Monorail/AGT in place. For Scenario 2 transit ridership would increase by almost 4 percent while for Scenario 4 the increase would be almost 5 percent. The number of additional transit daily trips projected ranges from 2,500 to 3,500 for the two scenarios. This result indicates that Monorail/AGT could achieve up to 35% greater ridership under Scenario 4 featuring redevelopment and infill when compared to Scenario 2, which is an update of current agency plans. When compared to the ridership estimate developed under the mode choice procedure, this result also indicates that approximately 25 percent of the Monorail/AGT patronage would consist of new riders. These results show a consistency between the two travel demand 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 is somewhat of a double-edged sword given the projected transit service improvements contained in the 2025 MTP. Improved transit service can provide better feeder access to the Monorail/AGT system but also would offer a more attractive alternative to the new fixed-guideway service. Given these facts, it is reasonably safe to assume that improved overall transit services in the region would not significantly impact the ridership estimate of 12,800 daily passengers. If there is further planning for the Monorail or a similar system, a more

detailed ridership analysis considering the joint effects of the fixed-guideway system and an enhanced and complementary bus system will need to be undertaken.

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. These facts demonstrate the role that a Monorail/AGT system can play and the need to study the concept further.

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.