Capital Beltway/Purple Line Study

Initial Findings & Recommendations

DRAFT

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S. Executive Summary

The decision coming from the Capital Beltway/Purple Line study will lay the groundwork for mid and long-term transportation decisions for Maryland's portion of suburban Washington, DC. Some elements will be recommended to progress into the next funding initiatives while other elements of the plan are just that - a plan. Through the local master planning process and/or Maryland Department of Transportation (MDOT) studies, corridors can be refined into alignments. Right-of-way can be preserved for future use. And land use adjacent to the rail corridor and more specifically near proposed stations can be changed to make the best use possible of a transit facility. MDOT, Metropolitan Washington Council of Governments (MWCOG), Washington Metropolitan Area Transit Authority (WMATA), Montgomery County and Prince George's County planning and public works departments can all use the "blue print" for their future work programs.

As we look forward to the future, there are many possibilities for transportation improvements including a transit line serving key origins and destinations in the communities and employment centers on Maryland's portion of the Capital Beltway. Though there is still much work involved in making this vision a reality, the first step is selecting system improvements. This could include one of the proposed corridors or a combination of several of those corridors. Transit could then be pursued in those segments of the corridor that will best support it. Due to the magnitude of a circumferential transit line around Washington D.C., the implementation of transit in any of the proposed corridors would be completed on a segment-by-segment basis. Those segments that would best support transit would be the first constructed and, as the region continues to grow, additional segments would be added. As these segments are identified, Montgomery and Prince George's County will begin to fit the new transit facilities into their master planning processes, whereby land uses could be planned that would support existing transit services.

With the increases in suburban Maryland's population and employment, the area's travel patterns are changing. The Metrorail system, as well as MARC and MTA's commuter bus network, is mostly radial with all lines oriented to downtown Washington, the traditional center of employment activity. Current construction and planning projects such as the Woodrow Wilson Bridge Replacement project and the Georgetown Branch Transitway/Trail project are the exceptions to that radial orientation and are not sufficient to accommodate the growing circumferential suburban travel patterns in the study area. Visions of sustainability are elusive and supporting transportation infrastructure is needed for the area to thrive and grow. Population and jobs are moving outward from the central city to urban periphery and lower density areas. Persistent and worsening traffic congestion - particularly in the suburbs - is hindering movement of people and goods. Although definitions of and criteria for sustainability differ from area to area, most have common objectives for quality of life that include clean air, quiet neighborhoods, and economic prosperity without detrimental health and environmental impacts and depletion of finite natural resources.

S.1 BACKGROUND

The Capital Beltway provides an essential link in the national highway network, serving local, regional and interstate trips while connecting major radial routes. Current traffic is projected to increase as much as 50% on some sections of the Beltway resulting in more severe and much longer periods of congestion than even those experienced today.

The Capital Beltway is the busiest highway in the State. Traffic conditions on the Capital Beltway include regular occurrences of very congested (or gridlock) conditions, particularly during rush hour periods. This condition will continue to worsen as traffic volumes increase due to the growing number of households and jobs in the region.

The Capital Beltway also provides the highway link to many of the region's other transportation services including Baltimore-Washington International, Reagan National and Dulles airports, rail and port terminals and the Metrorail and Metrobus services operated by WMATA and the Maryland Rail Commuter (MARC) Train Service. Because of the extensive linkage to other transportation facilities in the region, severe traffic congestion on the Capital Beltway has cumulative effects on regional mobility. Projected increases in population and employment will place considerable pressure on the regional transportation network to provide improved accessibility between suburban residential and business communities.

Traffic projections as measured by Average Daily Traffic (ADT) volumes for the year 2020 indicate that circumstances will worsen considerably, extending LOS "F" conditions beyond the current peak hours and to additional locations. Table S-1 highlights the measured (1999) ADT volumes and projected (2020) ADT volumes for segments of the Beltway.

Table S-1 Existing and Projected Volumes (ADT and Levels of Service (LOS)) along the Maryland Capital Beltway

Beltway Segment	ADT Volume	LOS AM/PM	ADT Volume	LOS AM/PM	Volume Increase
Montgomery Co.					
American Legion Bridge to I-270	239,700	E/F	291,000	F/F	21%
MD 355 to MD 97	212,300	F/F	273,000	F/F	29%
MD 97 to I-95	217,600	E/F	313,000	F/F	44%
Prince George's Co.					
I-95 to US 50	185,200	F/F	289,000	F/F	56%
US 50 to MD 4	186,000	E/F	271,000	F/F	46%
MD 4 to Woodrow Wilson Bridge	172,400	E/F	283,000	F/F	64%

The Capital Beltway/Purple Line study originally began as a high occupancy vehicle (HOV) study in the early 1990s. Following early public involvement activities, the project scope expanded to include bus and rail transit alternatives. The early rail transit alternatives were limited to the immediate vicinity of the Beltway itself. Following additional public involvement activities, the project scope was again expanded to include circumferential rail transit corridors both inside and outside the Beltway. This current study area is shown in Figure S-1.

Figure S-1 Project Study Area

Before developing alternates, the project team established a series of goals and objectives as well as the measures to evaluate the potential effectiveness of an alternate package. These goals and measures were reviewed and accepted by the general public and the project team. The goals are:

Goal 1: Support regional mobility and address current and projected travel demand through 2020

- provide acceptable levels-of-performance
- improve accessibility to existing and planned economic development areas
- decrease travel time

Goal 2: Provide for increased safety and maximize operational efficiencies

- increase efficient use of transportation system
- improve existing and future safety conditions
- improve level-of-service at interchange and nearby major intersection locations

Goal 3: Develop improvements that make the best use of resources and minimize negative impacts to the natural and man-made environment

Goal 4: Develop improvements that preserve capital investments

- minimize incremental public costs while maximizing transportation capacity
- optimize operations and maintenance

Many factors and criteria are considered while developing and evaluating transportation improvements. These factors can include, but are not necessarily limited to, mobility improvements, environmental benefits, public opinion/acceptance, operating efficiencies, and cost effectiveness. Consideration is also given to other issues such as transit-supportive land use, local policies, programs and national priorities. The evaluation criteria selected for this study includes the following items:

- Public Input
- Ridership
- Total Costs
- Cost Effectiveness
- Economic Development
- Natural Environmental Benefits
- Improved Mobility
- Transportation Supportive Land Use
- Community Benefits
- Accessibility
- Consistency with Local Plans, Policies, and Programs
- System Connectivity
- Operating Efficiencies
- Congestion Relief
- Encourages Tourism

S.2 ALTERNATIVES

Transportation infrastructure improvements were considered to address the needs of the Capital Beltway corridor. Though these improvements may not "fix" the Beltway, they would provide additional mobility and modal options within the study area.

S.2.1 Alternative 1 - Base Case

The Base Case, also known as the No-Build option, includes all projects in the most recent Constrained Long Range Transportation Plan for the Washington region adopted by the Metropolitan Washington Transportation Planning Board. It also includes routine maintenance and safety improvements along the Beltway. This alternate serves as the basis for comparison of all other alternatives.

S.2.2 Alternative 2 - Transportation System Management/Transportation Demand Management (TSM/TDM)

The TSM/TDM strategies are relatively low capital cost options. The TSM strategies are facility improvements that increase safety and enhance operation. TSM options include interchange reconfiguration, ramp metering, enhanced parallel roadway network, and

enhanced traveler information. TDM strategies focus on system demand and ways to change drivers' behavior. Options include park-and-ride lots, flexible work hours, and transit subsidies. TDM strategies are most effective on a regional basis and are commonly implemented through private employers. One or more of these options could be combined with other alternatives to increase their potential effectiveness.

S.2.3 Alternative 3 - High Occupancy Vehicle (HOV) Lanes

An HOV could be a bus, vanpool, carpool or any vehicle meeting minimum passenger requirements such as "2 or more," "3 or more," or "4 or more" passengers per vehicle. Three HOV options are proposed for the Capital Beltway.

The Concurrent Flow lane configuration consists of an additional lane in each direction that would be designated for HOV use only. (See Figure S-2) HOV usage would be during the peak periods only and the lane would revert to general use during non-peak periods. The lane would not be physically separated from general-purpose traffic. Access into the HOV lanes could be provided with or without direct ramp connections. Maryland's I-270 is an example of a concurrent flow HOV facility.

The Barrier Separated option consists of an additional lane in each direction for HOV, separated from general-purpose traffic by a concrete barrier or plastic pylons. (See Figure S-3 and S-4) HOV would operate on a 24-hour basis. Access for this type of facility would be provided with direct ramp connections. SR 91 in Orange County, California is an example of a barrier separated HOV facility.

Figure S-2 Concurrent Flow HOV Photo and Typical Section

CONCURRENT FLOW HOV/BUSWAY

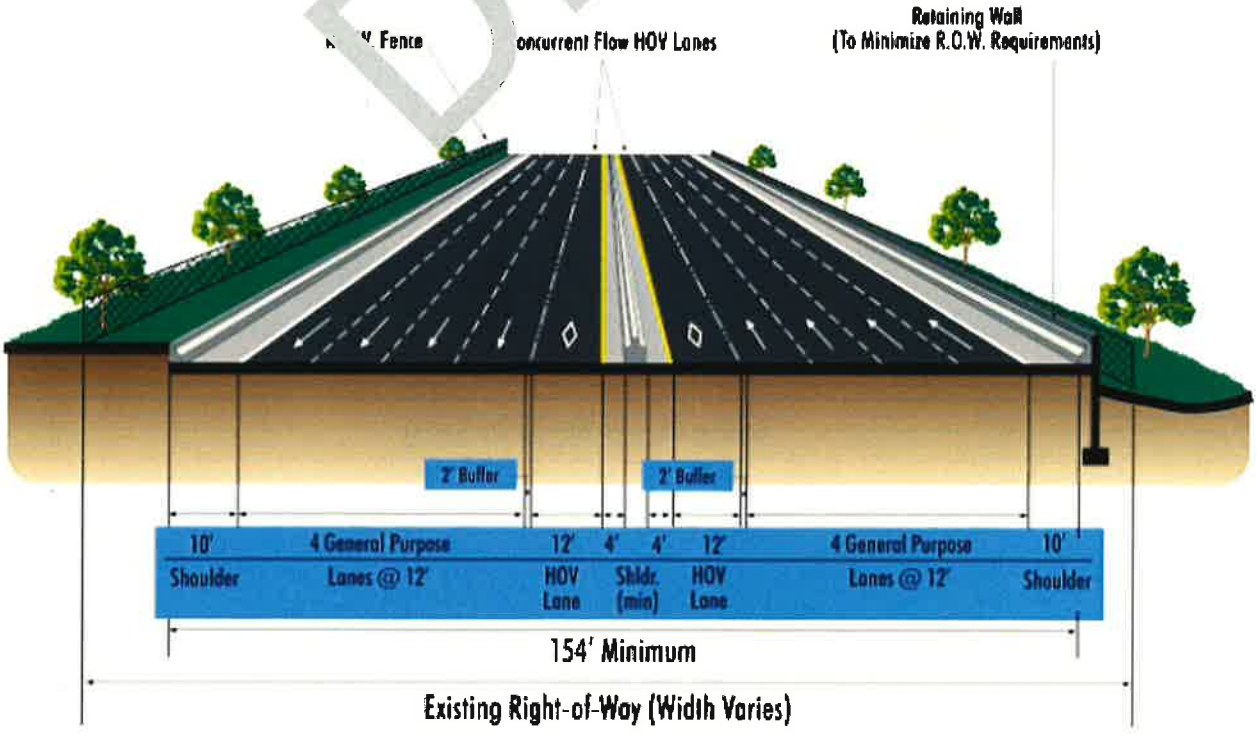


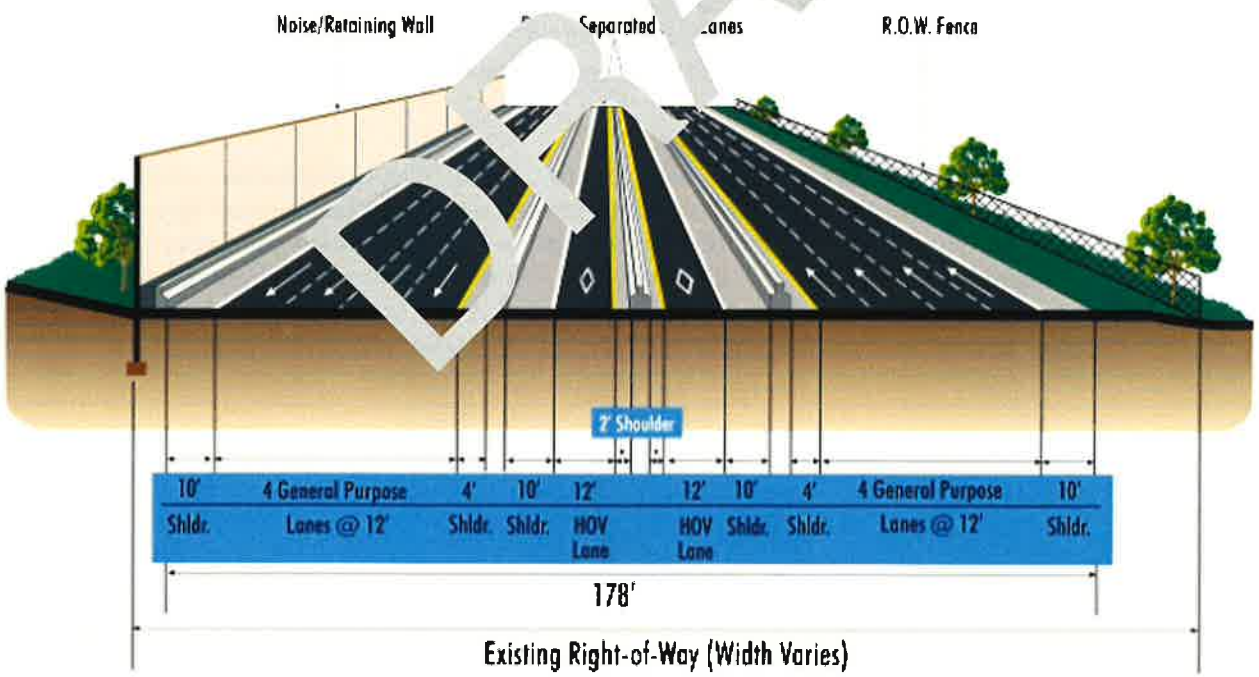
Figure S-3 Barrier Separated HOV - Plastic Pylon Photo and Typical Section

BARRIER SEPARATED HOV/BUSWAY

The High Occupancy Toll (HOT) Lane option is a modified HOV lane option that would allow single occupant vehicles to use the HOV lane for a toll. The toll would be collected using non-stop electronic fare technologies already in use elsewhere in the U.S. and costs could vary according to the level of congestion and time of day. A study to investigate the potential of value pricing strategies, such as HOT lanes, was begun in Maryland. The study was terminated at the request of Governor Parris N. Glendening who stated that HOT lanes were not consistent with state transportation goals. HOT lanes, if implemented, will only result from the addition of new lanes. Existing lanes will not be converted for managed use. The typical section of the HOT lanes would be identical to the Barrier Separated HOV lanes.

Figure S-4 Barrier Separated HOV - Concrete Barrier Photo and Typical Section

BARRIER SEPARATED HOV/BUSWAY



S.2.4 Alternative 4 - Mass Transit

The transit alternative includes both rail transit and express bus service. The original rail transit alternative developed for the Capital Beltway consisted of a single circumferential rail corridor along the Beltway referred to as the "Purple Line." As the study progressed, additional alternatives were included that proposed better, more direct connections to key activity centers. The activity centers themselves were determined through a cooperative process with participating agencies. The selected activity centers are shown in Figure S-5. These locations became the "nodes" that would be connected by the circumferential transit corridor "links."

Six (6) corridors were developed. Though each of these six corridors differs from the original Purple Line, they are referred to as corridors "P1," "P2," "P3," "P4," "P5," and "P6." Each corridor is a circumferential line that would connect key residential and employment areas as well as radial transportation facilities such as the existing Metro. These transit corridors are in areas both inside and outside of the Capital Beltway. The corridors were developed as either heavy rail or light rail transit since this region is familiar with these technologies and has a good understanding of their operating characteristics and costs. The project team determined these modes would provide a "high/low" range of potential use. The heavy rail option would have longer stationing spacing and higher operating speeds that should translate into the relatively higher potential use. The light rail option would have closer station spacing and lower operating speeds because of at-grade crossings and "in-street" operations that should translate into the relatively lower potential use.

Heavy rail differs from light rail in a number of ways including power source, separation from traffic, speed, and station spacing. Heavy rail, for example the Washington Metro system (see Figure S-6), is typically powered by an electrified "third rail," while light rail, such as the Baltimore Light Rail system (see Figure S-7), is typically powered by an overhead catenary system. The inclusion of the "third rail" requires that heavy rail be separated from other traffic for safety reasons. However, light rail often operates on streets mixing with vehicle traffic.

Although light rail and heavy rail vehicles are capable of attaining similar travel speeds, vehicles operating on heavy rail systems generally travel faster than those on light rail systems. There are typically fewer stations and more space between stations on heavy rail systems whereas light rail systems usually have more stations and less space between stations. The required separation of heavy rail systems from other traffic (due to the location of its power source) also contributes to faster travel speeds for heavy rail systems.

Figure S-5 Key Activity Centers

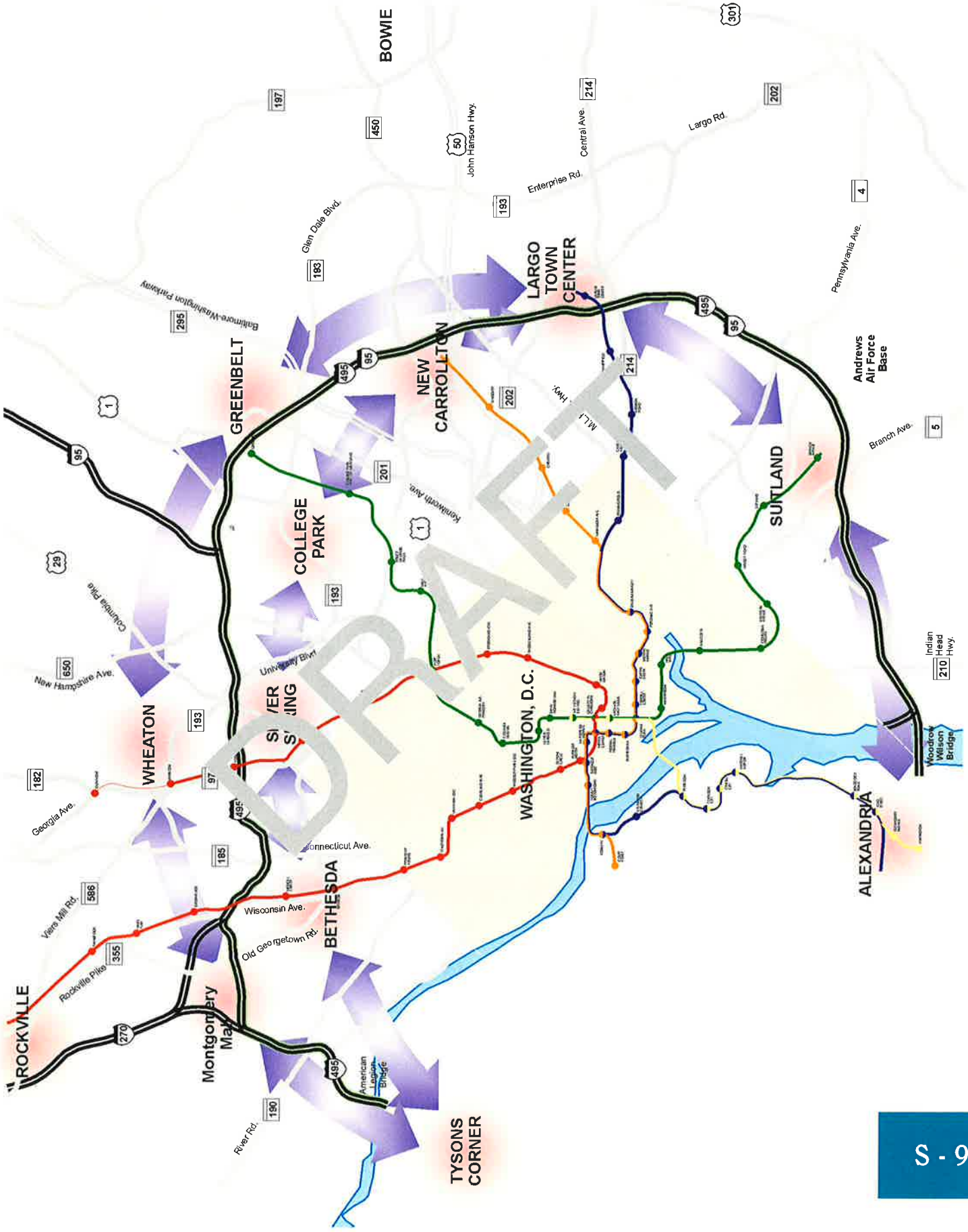


Figure S-6 Heavy Rail Photo and Typical Section

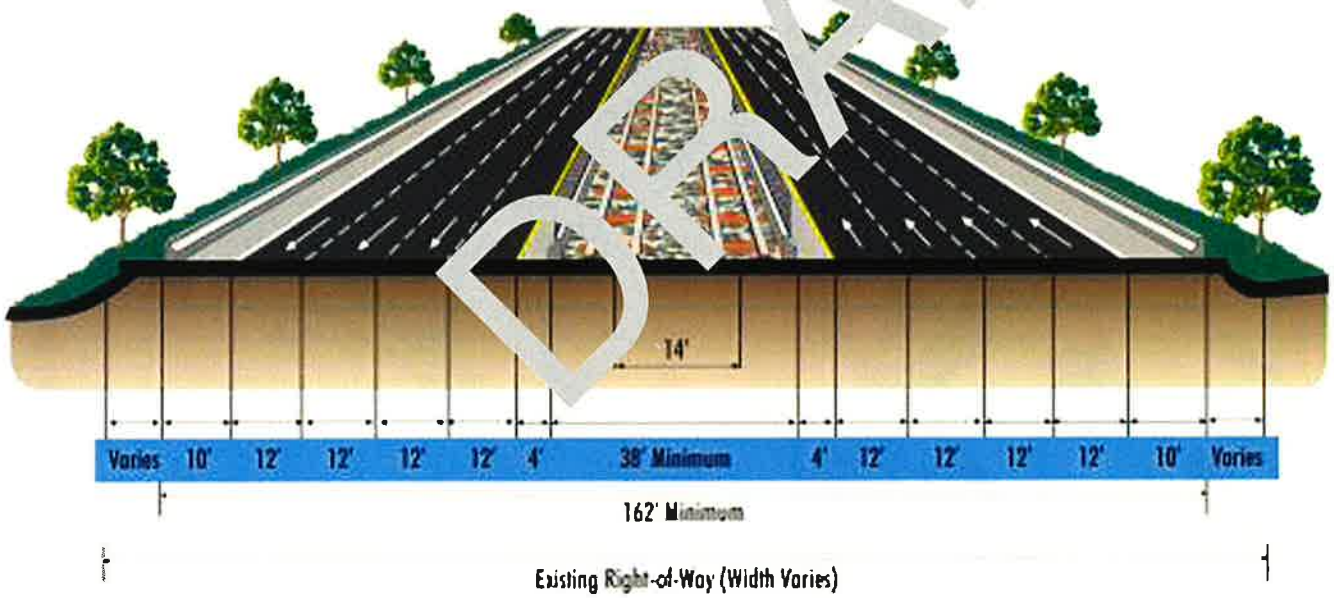
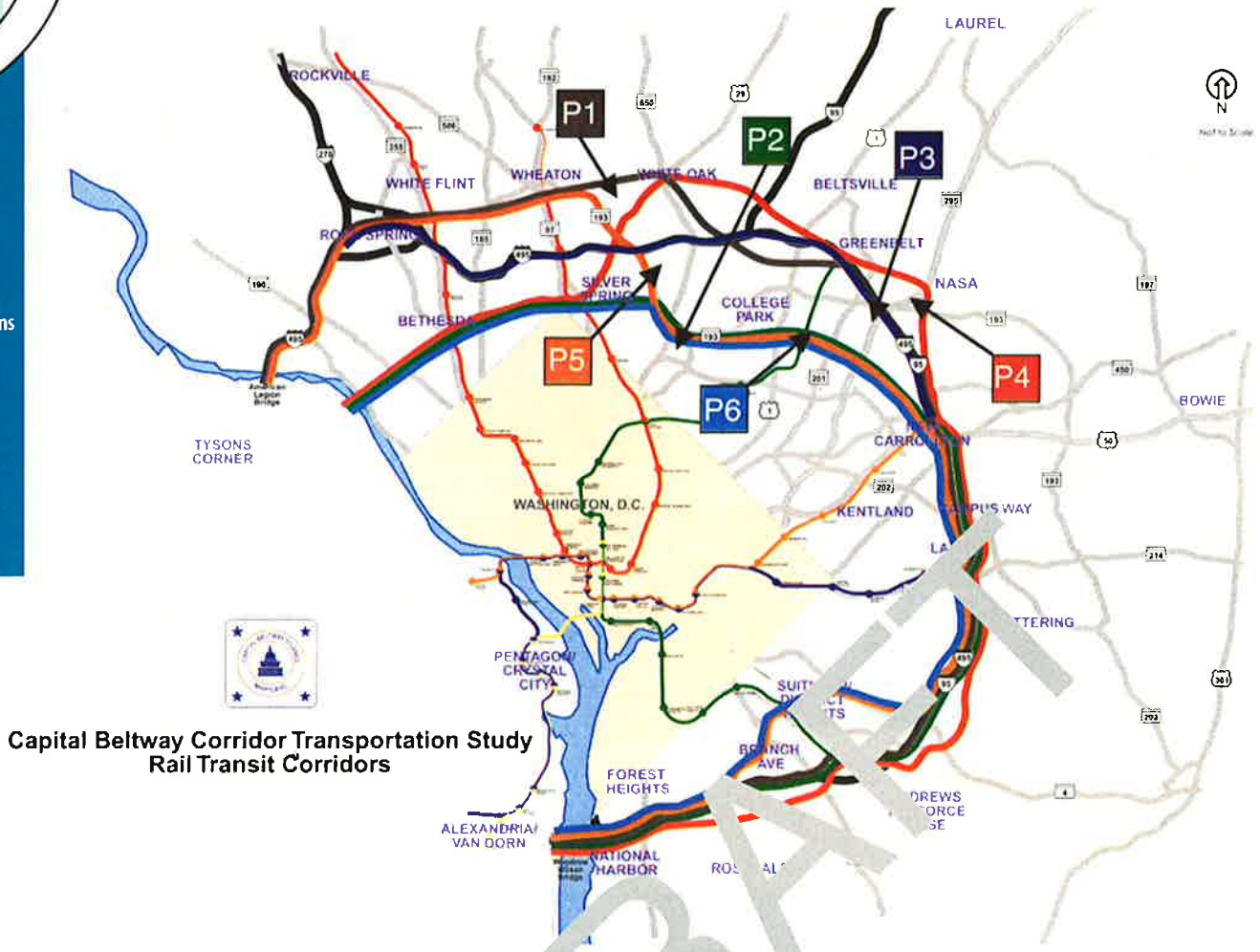


Figure S-7 Light Rail Photo and Typical Section

Figure S-8 Rail Transit Corridors



Shows the six circumferential rail corridors. A description of each follows.

S.2.4.1 Corridor P1 (Heavy Rail - Outside Beltway)

Corridor P1 consists of a heavy rail transitway that connects key locations along and mostly outside the Capital Beltway. Corridors P1, P2 and P3 follow the same alignment from the Woodrow Wilson Bridge to the New Carrollton Metro station. This corridor crosses the Potomac River on the Woodrow Wilson Bridge with the first Maryland station being in the National Harbor/MD 210 area. From here, it follows the Beltway through the Suitland area to the Branch Avenue Metro station. The corridor then returns to the Beltway and, after a stop at Pennsylvania Avenue, heads towards the future Largo Town Center Metro station, which is currently under construction. It again follows the Beltway to the Landover Mall continuing to the New Carrollton and Greenbelt Metro stations. From Greenbelt, the corridor heads west connecting to the I-95 park-and-ride lot before turning northwest connecting to White Oak (New Hampshire Avenue), the Wheaton Metro station, the Grosvenor Metro station and Montgomery Mall/Rock Spring Technology Park. The alignment follows I-270 to the Beltway where it follows the Beltway across the Potomac River (adjacent to the American Legion Bridge) into Virginia. The American Legion Bridge either would have to be widened or a new parallel bridge constructed to accommodate the crossing.

S.2.4.2 Corridor P2 (Heavy Rail - Inside Beltway)

Corridor P2 consists of a heavy rail transitway that connects key locations along and inside the Capital Beltway. Corridors P1, P2 and P3 follow the same alignment from the Woodrow Wilson Bridge to the New Carrollton Metro station. From the New Carrollton Metro station, the corridor continues to the College Park Metro station where it connects to the existing Metrorail Green Line and provides access to the University of Maryland, a regional activity center. It then travels west on University Boulevard before turning toward and connecting to the Silver Spring Metro station. The corridor then follows the proposed Georgetown Branch transitway to the Bethesda Metro station. From Bethesda, the corridor heads directly into Virginia.

S.2.4.3 Corridor P3 (Heavy Rail - Along the Beltway)

Corridor P3 consists of a heavy rail transitway that connects key locations mostly along and outside the Beltway. Corridors P1, P2 and P3 follow the same alignment from the Woodrow Wilson Bridge to the New Carrollton Metro station. From New Carrollton, the corridor continues to Greenbelt and, from Greenbelt, the corridor heads west along the Beltway connecting to the Forest Glen Metro station. The alignment proceeds west towards the WMATA Metrorail Red Line where it turns northwest. It then stops at the Montgomery Mall/Rock Spring Technology Park before following I-270 back to the Beltway and across the Potomac River adjacent to the American Legion Bridge. Corridors P1 and P3 follow the same alignment from Montgomery Mall to Virginia.

S.2.4.4 Corridor P4 (Light Rail - Outside to Inside the Beltway)

Corridor P4 consists of a light rail transitway that connects key locations along, outside and inside the Beltway. This corridor crosses the Potomac River on the Woodrow Wilson Bridge. The first station is located at the National Harbor/MD 210 area. From here, it follows Livingston Road and Brinkley Road and travels through the Rosecroft area before connecting to the Branch Avenue Metro station. The corridor then connects with Suitland Parkway (Andrews Air Force Base), Pennsylvania Avenue and Ritchie Marlboro Road before returning to the Beltway. It then continues along the Beltway to the proposed Largo Town Center Metro station, Landover Mall and the New Carrollton Metro station. From New Carrollton, the corridor heads north through the Seabrook area, NASA-Goddard and Greenbelt to the Greenbelt Metro station. It then travels through the National Agricultural Research Center and the Naval Surface Weapons Center and then into White Oak where it serves the White Oak Federal Research Center as well as the local community. From White Oak it heads south along US 29 into Silver Spring where it connects to the Silver Spring Metro station. The corridor then follows the proposed Georgetown Branch Transitway alignment to the Bethesda Metro station. From Bethesda, the corridor heads directly into Virginia along the same route as Corridor P2.

S.2.4.5 Corridor P5 (Light Rail - Inside to Outside the Beltway)

Corridor P5 consists of a light rail transitway that connects key locations along, inside, and outside the Beltway. The corridor crosses the Potomac River on the Woodrow Wilson Bridge with the first Maryland station being at the National Harbor/MD 210 area. From here, it follows St. Barnabas Road to the Suitland

Metro station and then follows Silver Hill Road to Pennsylvania Avenue to the Beltway. The corridor follows the Beltway as it heads towards the future Largo Town Center Metro station and then to the Landover Mall and into the New Carrollton Metro station. The corridor continues westward to the Kensington and Grosvenor Metro stations and Montgomery Mall/Rock Spring Technology Park. From here, the corridor follows the I-270 back to the Beltway and across the Potomac River adjacent to the American Legion Bridge.

S.2.4.6 Corridor P6 (Light Rail Inside and Outside the Beltway)

Corridor P6 is the same as corridor P5 from the Woodrow Wilson Bridge to the Takoma Park area. The corridor crosses the Potomac River on the Woodrow Wilson Bridge with the first Maryland station being at the National Harbor/MD 210 area. From here, it follows St. Barnabas Road to the Suitland Metro station and then follows Silver Hill Road to Pennsylvania Avenue to the Beltway. The corridor follows the Beltway as it heads towards the proposed Largo Town Center Metro station and then to the Landover Mall and into the New Carrollton Metro station. It then continues northwest on the inside of the Beltway to connect to College Park and then to Silver Spring. The corridor then follows the proposed Georgetown Branch transitway to the Bethesda Metro station and continues directly into Virginia. From Silver Spring to the American Legion Bridge, corridor P6 is the same as corridor P4.

S.2.4.7 Express Bus

As part of the transit alternative, consideration was given to adding Express Bus Service to provide additional connections between major residential and employment areas. It should be noted that bus service could be included in all improvement packages as a TSM measure but that the addition of HOV lanes allows the most efficient operation of the service. HOV lanes could be used exclusively for bus service and direct ramp connections could be provided into and out of the HOV lanes to enhance their operation. Two options, Express Bus Service with and without the addition of HOV lanes, were evaluated to determine the approximate ridership. This evaluation assumes that a particular bus network is in place. The portion of the bus network that utilizes the Beltway is evaluated assuming HOV lanes are present and that buses are using only this lane. The same portion of the bus network is then evaluated assuming HOV lanes are not present.

S.3 EVALUATION/FINDINGS

Travel demand forecasting tools were used to evaluate the potential effectiveness of the proposed HOV lanes and the circumferential transit corridors. MWCOG's regional travel demand model was the primary tool used. The project team developed travel forecasting projects for the year 2020 using MWCOG Version 1 Travel Demand Forecast Model and the MWCOG Cooperative Regional Forecast Round 6a.

S.3.1 HOV Results

Projections for HOV lane usage were completed (see Table S-2). Traffic in the potential HOV lane was forecasted for the year 2020 based on HOV 3+ (vehicles with a minimum of 3 passengers) standards. The volumes were projected for the Beltway on both the inner and outer loops and for both the AM and PM peak periods. The forecasted volumes of the individual segments ranged from 550 to 1,370 vehicles in the AM peak hour and from 450 to 1,460 vehicles in the PM peak hour. The projected volumes for the Beltway based on HOV 3+ standards are comparable to current HOV lane volumes on I-270 based on HOV 2+ standards. Though these projections were made based on HOV 3+ standards, the HOV lanes on the Beltway could potentially open using HOV 2+ standards. As the system grows and becomes more utilized, ridership requirements could, at a later time, be converted to HOV 3+.

Table S-2 Peak Hour Vehicle Demand (2020)

			AM				PM			
Beltway Segment	IL	OL	IL	OL	IL	OL	IL	OL	IL	OL
American Legion Bridge to I-270 West Spur	5	5	9,480	9,800	1,330	1,370	7,790	9,220	1,240	1,460
I-270 West Spur to I-270 East Spur	5	5	4,990	5,240	600	630	3,290	5,700	450	780
I-270 East Spur to I-95	5	5	10,000	10,110	900	910	8,570	9,310	860	950
I-95 to US 50	5	5	10,310	9,000	700	610	7,640	10,000	570	750
US 50 to MD 4	5	5	7,200	8,620	560	680	8,500	8,100	630	600
MD 4 to MD 210	5	5	5,000	5,890	550	640	5,750	6,060	570	610
MD 210 to Woodrow Wilson Bridge	6	6	7,900	5,180	1,100	740	5,900	6,660	870	970

IL - Inner Loop OL - Outer Loop

Notes: An average general-purpose lane is able to carry approximately 2,000 vehicles per hour. In order to provide more consistent travel times, an HOV lane is generally considered "full" at 1,800 vehicles per hour.

This table displays the demand for the HOV 3+ scenario. If HOV lanes are implemented, the new lane would open at HOV 2+ and then be converted to HOV 3+ at a later time.

S.3.2 Transit Results

Transit service parameters in the model include travel speeds, frequency of service, number of stations and parking availability, provision and extent of feeder bus, and fares. The attractiveness of transit improves as travel speeds and frequency of service increase, stations and parking are added, and feeder bus services are provided to stations.

The results of the ridership forecasting for each alternative shown in Table S-3 show that the implementation of rail transit would increase daily regional transit ridership by an average of 6.4%.

Table S-3 Ridership Forecasting Results

Changes									
Total Daily Regional Metro Trips	977,000	1,058,000	1,039,000	1,049,500	1,025,900	1,044,900	1,017,100	976,400	982,900
New Daily Regional Metro Trips	N/A	81,000	62,000	72,500	48.900	67,900	40,100	-600	5,900
% Increase in Metro Trips over 2020 No Build	N/A	8.3%	6.3%	7.4%	5.0%	7.0%	4.2%	-0.1%	0.1%
Daily Line Trips	N/A	233,000	205,000	173,500	195,600	197,300	160,250	80,200	52,850
New Daily Transit Trips	N/A	64,000	53,800	58,700	45,900	52,300	34,000	22,200	12,000

Model results indicate an increase in total regional transit trips. Both the heavy and light rail alternatives provide between 40,000 and 81,000 new regional transit trips per day. The total regional daily trips range from 1,000,000 to 1,060,000. Though that does not "relieve" the Beltway, it does provide some measure of overall improvement. The most noticeable improvement is simply having a mobility choice where none exists today.

Focusing more on the corridor alternatives, the numbers range from 160,000 to 233,000 daily line trips. These are riders that use a portion of the proposed rail for part of their trip. The new daily transit trips range from 34,000 to 64,000. This means as many as 64,000 people would no longer be driving on a daily basis.

The circumferential transit corridors positively affect WMATA's core capacity. By providing more direct connections between suburban activity centers, trips no longer need to pass through the DC core to complete their trip.

The implementation of any potential transit alignment corridors would provide an alternative to driving on adjacent, congested highways. While transit may not significantly improve conditions on the Beltway itself, it would provide additional mobility on a regional scale. The potential rail transit alignments as well as Express Bus and TSM

measures are forecasted to decrease the Average Weekday Traffic (AWDT) on the Beltway by an average of 0.82%. Individual rail transit corridors ranged from a 0.77% reduction to a 1.15% reduction. Express Bus and TSM measures reduced the ADT by 0.57% and 0.50%, respectively.

S.4 CONCLUSIONS AND RECOMMENDATIONS

S.4.1 General Conclusions and Recommendations

Congestion on the Beltway itself as well as demand on the other transportation facilities is so great that no single highway or transit will provide significant relief to the long-term demand. Therefore, both HOV and rail transit improvements are recommended for further study in the Beltway corridor.

Given the existing traffic levels and the projected growth in the region, improvements in the Beltway corridor will not solve traffic congestion on the Beltway. However, the proposed HOV lanes provide improved travel options in the Beltway corridor with free-flow conditions and consistent travel times on the HOV lanes. The circumferential transit alternatives provide additional transportation options connecting activity centers. These transportation infrastructure additions would provide mobility improvements to the region. The improvement may not be evident on the Beltway itself, but on parallel arterial and local streets where trips can be diverted back onto the major roads.

It is recommended that highway improvements and transit improvements be studied separately because they each function in a different capacity, serve different markets, and have different impacts because alignments are different. However, there should always be a clear link between the two as the general public expects to see them together. For example, during public involvement activities for the highway project, transit project updates and information should be provided. The appropriate implementing agency should include the highway and transit projects in future funding programs.

S.4.2 Highway Conclusions and Recommendations

The addition of general-purpose lanes is not recommended. Any new lanes added to the Beltway should be managed lanes. By managing the lanes, reliable trip times can be offered. If the lanes are not managed, they would be subject to the same congestion as the other general-purpose lanes during the peak periods. Currently, HOV lanes are the only form of lane management that is recommended. Though HOT lanes were considered, they are now dropped from consideration based on the Governor's decision on price-managed lanes. In a press release dated June 21, 2001, Governor Parris N. Glendening instructed MDOT to remove any proposals to study or implement High Occupancy Toll (HOT) lanes from the Department's overall strategy stating that "...it is unfair to link an easier commute with a person's ability to pay; our goal is to ease congestion for all."

As stated above, HOV lanes are recommended for further consideration. There should be one lane added in each direction for HOV use. The lanes are recommended for the entire portion of Maryland's Beltway, although the recommended termini are actually in Virginia. This allows for a transition and connection to Virginia's proposed HOV lanes in the Tysons Corner area as well as the proposed HOV lanes on the Woodrow Wilson Bridge. The HOV lanes are proposed as a continuous access, concurrent flow lane. Direct ramp connections should be developed connecting the existing and proposed radial HOV systems. Direct ramp connections should be developed on case-by-case method for the major radial arterials connecting to the Beltway. Barrier separated HOV lanes are not recommended as the footprint is wider than the non-separated option and therefore have potentially greater right-of-way impacts.

An elevated roadway section is not recommended for the Beltway. Reasons for not carrying this option forward include:

- Access - Ramp connections would be complicated leading to multi-level interchange configurations. Access into the elevated facility could be limited and allow it to carry the longer distance trips. However, given the average trip length on the Beltway is roughly five miles, that form of limited access does serve the commuter users very well.

- Maintenance - Operations during a snow event is a significant concern. There would be minimal room for snow storage on the structure itself. Snow could be plowed on the elevated facility, but the thrown snow would end up on the lower, at-grade roadway creating an unsafe situation. Another option would be to close the elevated facility during a snow event however that significantly reduces available capacity.

- Cost - The cost of an approximately 42-mile facility is simply too great.

A tunnel roadway section is not recommended for the Beltway. Reasons for not carrying this option forward include:

- Access - Ramp connections would be complicated leading to multi-level interchange configurations. Access into the tunnel facility could be limited and allow it to carry the longer distance trips. However, given the average trip length on the Beltway is roughly five miles that form of limited access does not serve the commuter users very well.

- Constructability - Depending on the construction technique used, the median would have to be widened to provide a construction zone. This requires the widening of the Beltway during the construction period. Though the long-term footprint would not be as wide as a widened Beltway, the construction impacts are approximately the same.

- Cost - The cost of an approximately 42-mile facility is simply too great.

TSM and TDM improvements are recommended for further consideration. They should be included in all alternate packages for the next level of study.

S.4.3 Transit Conclusions and Recommendations

Asking two basic questions can summarize the conclusions and recommendations for the transit portion of the study:

- Is fixed guideway transit justified in this circumferential corridor?
- If so, what are the highest priority segments?

Starting with the larger, overall question, transit does make sense in the circumferential corridor. The primary reason for adding new rail transit is to improve the mobility of residents and workers in the area, the accessibility to employment and activity centers such as the University of Maryland, Silver Spring and Bethesda central business districts, and the reliability of transit services in this area of Suburban Maryland.

In addition, all the proposed rail corridors provide the following benefits:

- Transportation system capacity to address current and future demand
- Supports Maryland's goal to double transit ridership
- Transportation links to the existing, redeveloping and emerging suburban activity centers
- Supports Smart Growth and areas of potential economic development and/or community revitalization
- Transportation choices that do not currently exist
- Essential links to the WMATA's radial transit lines
- Connects to MARC Penn and Camden corridors, which provides links to the Baltimore CBD and to BWI Airport
- Connects to AMTRAK's Northeast Corridor
- The circumferential transit corridors positively affect WMATA's core capacity

Model results indicate an increase in total regional transit trips. Both the heavy and light rail alternatives provide between 40,000 and 81,000 new regional transit trips per day. The total regional daily trips range from 1,000,000 to 1,060,000. Though that does not "relieve" the Beltway, it does provide some measure of overall improvement. Focusing more on the corridor alternatives, the numbers range from 160,000 to 233,000 daily line trips. These are riders that use a portion of the proposed rail for part of their trip. The new daily transit trips range from 34,000 to 64,000.

A full circumferential fixed guideway system is recommended for Maryland connecting Tyson's Corner, Virginia and Alexandria, Virginia by passing through both Montgomery County and Prince George's County. The recommendation includes both an inner and outer corridor. Generally speaking, the recommended corridors are P1, P3 and P6. Note that P3 and P6 are the same corridor with P3 being heavy rail with tunnel segments and P6 being light rail with predominately at-grade segments.

As this study serves to set the transportation "blue print," including both the inner and outer corridors has merit. The corridors serve two different user markets by connecting a different set of activity centers. They both support local and regional growth initiatives consistent with Smart Growth for different segments of the local priority funding area (PFA). Often we do not think of two such transit facilities so close to each other, but in this case, they could be warranted. If the two facilities in this discussion were roadways, one could more easily see where there is independent utility between the two. However, when discussing rail transit facilities, one usually would not consider both predominately because of capital costs. In this location, there is enough demand and need for transportation infrastructure that both are recommended for long term consideration.

As most of the recommended corridors are not included in area master plans at any level, it is important to recognize that all levels of government have roles to play in assuring that effective policy options are identified and implemented. Involvement of all stakeholders in the urban and suburban travel system - be they residents, elected officials, civic and community organizations, the business community, or environmental advocacy groups - is an important factor in policy development and implementation of sustainable travel. Integration of land use and transportation policies that support the proposed corridors is imperative to enhancing the potential effectiveness of all the proposed transit corridors.

Fixed guideway transit is not recommended wholly along the Beltway itself. A Beltway corridor takes advantages of existing transportation right-of-way, but it does not effectively connect activity centers. Reasons for not carrying this option forward include:

- People do not live and work "on the Beltway." Transit will better serve patrons by more directly connecting activity center locations.

- Depending on alignment and station configurations, station locations would be within several communities. It is probable that this would not be well received by existing communities as cut-through traffic could increase as riders drive to the stations. Additional bus service would be provided adding to neighborhood congestion and noise. This becomes a quality of life issue for neighborhoods near the Beltway.

No mode recommendations are made at this time. Those decisions should be made based upon more detailed transit planning studies. The appropriate transit characteristics such as specific alignment and station locations and vehicle type will be better defined during further engineering studies and continued coordination with WMATA and the local jurisdictions. Future studies will determine the design concept and scope to be submitted to FTA for inclusion in the next Federal transportation authorization bill.

Having established that transit makes sense in the corridor and should be included in master plan updates, the question turns to where should transit be pursued first?

The recommended corridors to carry forward into the next phase of study have been selected through a screening process based on evaluation factors such as public input, agency coordination, preliminary costs, improved mobility, system connectivity, potential ridership, constructability, surrounding transit supportive land use and a cursory identification of environmental concerns.

Two segments are recommended to be pursued first. All other segments should be included in local master plans and considered for future transit studies. The recommended segments are:

- Bethesda to New Carrollton along the inner corridor (P3, P6)

- Green Line Metro (Suitland & Branch Avenue) to Alexandria across the Woodrow Wilson Bridge (all corridors)

It is recommended that the corridor segments between I-270/Rock Spring Technology Park and New Carrollton (outer corridor) and the New Carrollton and Suitland/Branch Avenue, where the daily transit demand was projected lower than other segments, be included in the Prince George's County local master plan updates for implementation at a later time, or when conditions change which make this latter corridor more attractive for improved transit service.

Reasons to support inner segment as one of the first two segments to carry forward include:

- Shows some of the highest ridership of all corridors evaluated

- As expected, the heavy rail corridors demonstrated the overall highest projected ridership numbers. Both the inner and the outer corridors in Montgomery County showed a maximum projected ridership of approximately 50,000 daily riders (both directions).

- Provides transportation relief in areas where Beltway congestion is the worst

- The worst recurring daily congestion can be found between the I-270 Spurs and I-95. Traffic routinely operates on a "stop and go" basis through this segment. Exacerbating the issue is the projected 44% projected increase in traffic volumes in this area.

- Supports local vision with extension of Georgetown Branch

- The Georgetown Branch transit study has been included in the regional transportation network and is part of the Base Case for this study. The Georgetown Branch study is in the detailed planning phases.

- Supports local vision by connecting the key significant activity and transportation centers of Bethesda, Silver Spring, College Park and New Carrollton

- Though all proposed corridors connect activity centers, the inner corridor connects the primary centers.

- Most directly links key centers in Montgomery and Prince George's counties

- The inner corridor provides direct connections between Bethesda, Silver Spring, College Park and New Carrollton.

- Supports local vision by providing additional capacity into Silver Spring - a major revitalization area; investment by others is already occurring. This transit service would support these investments.

- Connects directly into the University of Maryland campus both from the east and west

- Serves more than just work commuters. Connects to attractions at University of Maryland - cultural, athletic, educational, conferences
- Shows high ridership without accounting for University of Maryland student use
- Most consistent with Smart Growth initiatives
- Allows Maryland to pursue State initiatives without multi-state coordination issues

The inner corridor between Bethesda and New Carrollton is recommended to be carried forward and considered in the next authorization bill.

There are trade-offs with recommending the inner corridor versus the outer corridor in Montgomery County. Building off the proposed Georgetown Branch light rail, a light rail facility could be extended to New Carrollton. Because there are several existing transportation facilities, the light rail could operate at-grade adjacent to the roadways. An outer corridor would most likely be in tunnel as there are few, if any, existing transportation facilities the rail could operate along. The trade-off here is predominately potential capital costs. For the same cost, you can certainly build more at-grade facility than you can a tunnel facility. The inner corridor is projected to be more cost effective

Reasons to support the "Woodrow Wilson Bridge" segment as one of the first two segments to carry forward include:

- Shows some of the highest potential ridership of all corridors evaluated
- Provides transportation relief in areas where Beltway congestion is the worst - As with the Montgomery County segments, traffic routinely operates on a "stop and go" basis. The widening of the Woodrow Wilson Bridge will provide some relief but congestion is still expected in this segment.
- Supports local vision by connecting residential areas of Prince George's Country and Southern Maryland to key employment areas of Alexandria, Crystal City and Washington, DC.
- Supports local initiatives by potentially using available bridge space on the new Woodrow Wilson Bridge structures - The Woodrow Wilson Bridge has been designed not to preclude the addition of a future transit line. The rail line would be located on the innermost bridge lanes thus using the physical space currently allocated for the HOV lanes. If such an upgrade becomes necessary, the HOV lanes proposed by this project would terminate prior to reaching the bridge.
- Consistent with Smart Growth initiatives - This segment provides transportation choices for Prince George's County and Southern Maryland. Rail "on" the Woodrow Wilson is a high-capacity option connecting Maryland, Virginia and Washington DC employment and residential activity centers.

S.4.3.1 Monorail - Not Recommended for Further Study

The public and the project team expressed some interest in adding monorail to the list of rail transit technologies being considered for a circumferential rail line in the Capital Beltway Corridor. Based on the lower capacity and increased cost of monorail as compared to heavy rail and light rail, the project team recommends that monorail not be considered for the corridor.

Compared to heavy rail and light rail systems, monorail systems are generally characterized as lower speed and lower capacity systems. The capacity of a standard monorail system would not be able to meet the capacity needs anticipated in the Capital Beltway Corridor. Higher capacity monorails can be constructed, but because the larger trains must straddle a larger beam, heavier structures must be built and turning radii must be larger. These factors result in a system that does not have any design advantages over light rail. Finally, the provision of crossovers, which allow trains to move from one track to another, is complex and expensive. In some cases crossovers cannot be provided at all. Without crossovers, service would be disrupted for track maintenance or if a train or track segment fails. Because of the anticipated capacity in the Capital Beltway, the ability to move trains between the tracks is very important.

Monorail does not provide any cost savings when compared to light rail and heavy rail. Monorail systems must be grade separated. This makes monorail more expensive than at-grade light rail systems. Because "trackside" components and the central underbody location of on-vehicle components are difficult to access, it is possible to assume that monorail maintenance costs would be higher than those for light rail or heavy rail. A final cost consideration is that monorail systems are proprietary. This means that any new vehicles and any additional track must continue to use the manufacturer that installed the original system. The reason for this is that there is no standard monorail system; each monorail manufacturer uses a unique monorail design. As a result, the transit provider becomes locked into a system and, if it wants to expand the system, it must use the original provider regardless of price.

In addition to the reduced capacity and increased cost of monorail, there are some additional issues that diminish the usefulness of monorail in the Capital Beltway Corridor. First, monorail would not be compatible with any other rail systems in the region. The proposed transit alignments being studied for the Capital Beltway Corridor include connections to the existing Metrorail system. At some later date, these alignments could be used to provide Metrorail service. Building a monorail system, which has track and vehicles that are not compatible with the existing Metrorail system, would preclude the possibility of providing seamless service between the proposed circumferential system and the existing system. Second, a monorail system able to serve the anticipated demand of the Capital Beltway Corridor would be at least as visually obtrusive as a typical elevated rail system. Monorail advocates have suggested that monorail would be less visually obtrusive. This may be true for smaller systems, but again, a smaller system would not be able to meet the anticipated demand. Therefore, a larger system with larger aerial structures and stations would be needed. Finally, monorail has typically been implemented to serve smaller areas and shorter routes. Monorail has never been applied to an area as large as the one that would be required for the Capital Beltway Corridor. Since reasonable alternatives exist, the project team recommends that the Capital Beltway Corridor not be the testing ground for the largest monorail system ever built.

S.5 NEXT STEPS

The next phase of the project will include data collection and analyses to better identify and develop more specific project solutions that will address engineering constraints, right-of-way impacts, compatibility with adjacent communities and the transportation network and minimum impact to Capital Beltway traffic during construction. Major environmental and other physical constraints will also be identified to determine the feasibility of alternative alignments, vehicle mode, transfer points if necessary, and station and parking locations. Ridership projections will be updated and refined to aid in decisions regarding vehicle and pedestrian access. Construction staging will also be addressed. The vehicle mode (i.e., heavy rail or light rail) for the recommended corridor segments will be chosen so that it does not preclude considering a different mode for future segments. However, where it may become necessary in the future to connect segments, transfer points with identifiable and comfortable pedestrian connection paths would be provided.