Purple Line

Energy Technical Report

September 2008

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1. Introduction to Purple Line

The Maryland Transit Administration is preparing an Alternatives Analysis and Draft Environmental Impact Statement (AA/Draft EIS) to study a range of alternatives for addressing mobility and accessibility issues in the corridor between Bethesda and New Carrollton, Maryland. The corridor is located in Montgomery and Prince George’s Counties, just north of the Washington, D.C. boundary. The Purple Line would provide a rapid transit connection along the 16-mile corridor that lies between the Metrorail Red Line (Bethesda and Silver Spring Stations), Green Line (College Park Station), and Orange Line (New Carrollton Station). This *Energy Technical Report* presents the analysis of potential energy effects that were summarized in the AA/DEIS. It describes the methodology used for the analysis and the results of that analysis.

1.1. Background and Project Location

Changing land uses in the Washington, D.C. area have resulted in more suburb-to-suburb travel, while the existing transit system is oriented toward radial travel in and out of downtown Washington, D.C. The only transit service available for east-west travel is bus service, which is slow and unreliable. A need exists for efficient, rapid, and high capacity transit for east-west travel. The Purple Line would serve transit patrons whose journey is solely east-west in the corridor, as well as those who want to access the existing north-south rapid transit services, particularly Metrorail and MARC commuter rail service.

The corridor has a sizeable population that already uses transit and contains some of the busiest transit routes and transfer areas in the Washington, D.C. metropolitan area. Many communities in the corridor have a high percentage of households without a vehicle, and most transit in these communities is bus service. Projections of substantial growth in population and employment in the corridor indicate a growing need for transit improvements. The increasingly congested roadway system does not have adequate capacity to accommodate the existing average daily travel demand, and congestion on these roadways is projected to worsen as traffic continues to grow through 2030.

A need exists for high quality transit service to key activity centers and to improve transit travel time in the corridor. Although north-south rapid transit serves parts of the corridor, transit users who are not within walking distance of these services must drive or use slow and unreliable buses to access them. Faster and more reliable connections along the east-west Purple Line Corridor to the existing radial rail lines (Metrorail and MARC trains) would improve mobility and accessibility. This enhanced system connectivity would also help to improve transit efficiencies. In addition, poor air quality in the region needs to be addressed, and changes to the existing transportation infrastructure would help in attaining federal air quality standards.

1.1.1. *Corridor Setting*

The Purple Line Corridor, as shown in Figure 1-1, is north and northeast of Washington, D.C., with a majority of the alignment within one to three miles of the circumferential I-95/I-495 Capital Beltway.

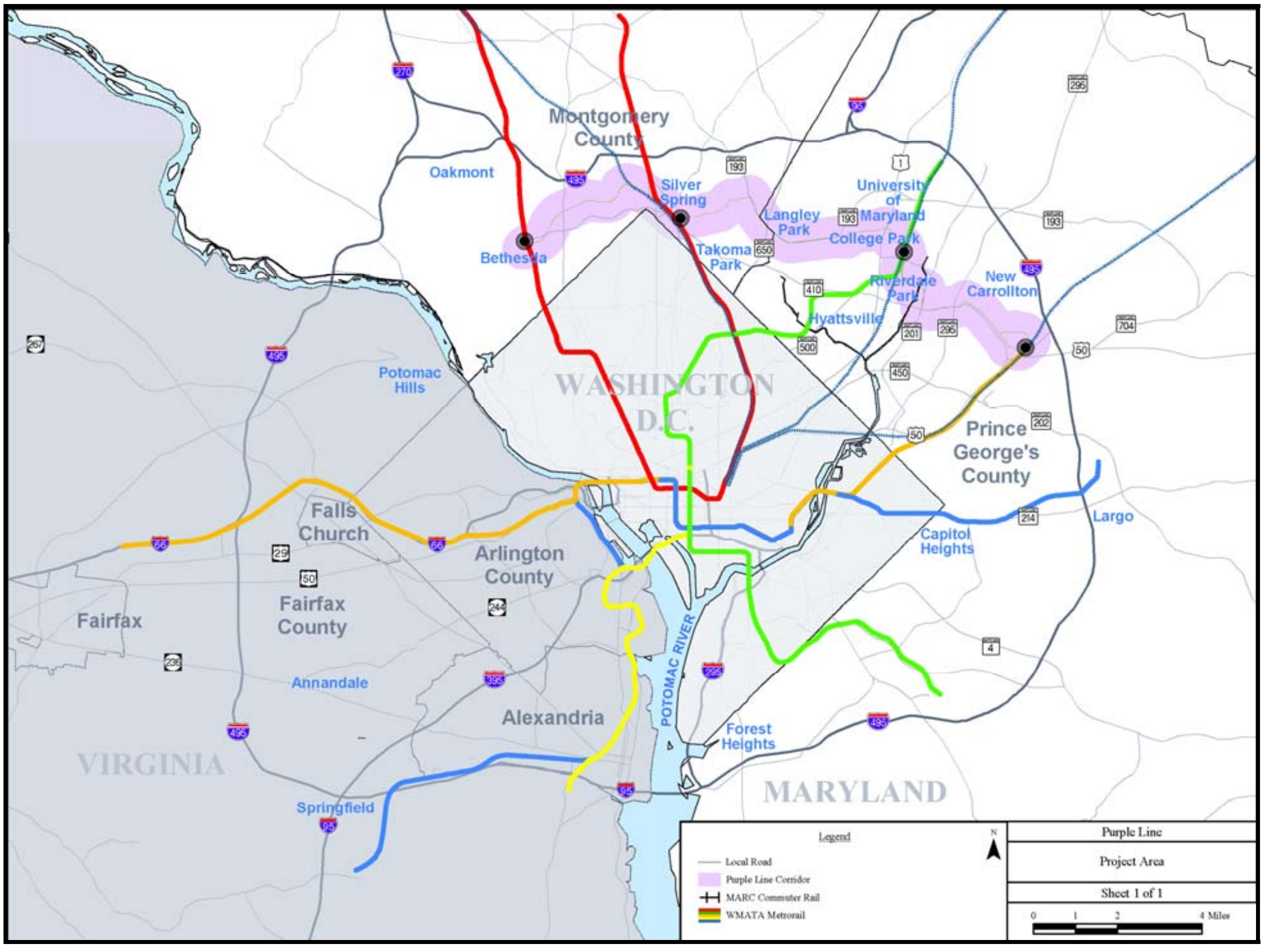


Figure 1-1: Project Location

1.2. Alternatives Retained for Detailed Study

The Purple Line study has identified eight alternatives for detailed study, shown on Figure 1-2. The alternatives include the No Build Alternative, the Transportation System Management (TSM) Alternative, and six Build Alternatives. The Build Alternatives include three using bus rapid transit (BRT) technology and three using light rail transit (LRT) technology.

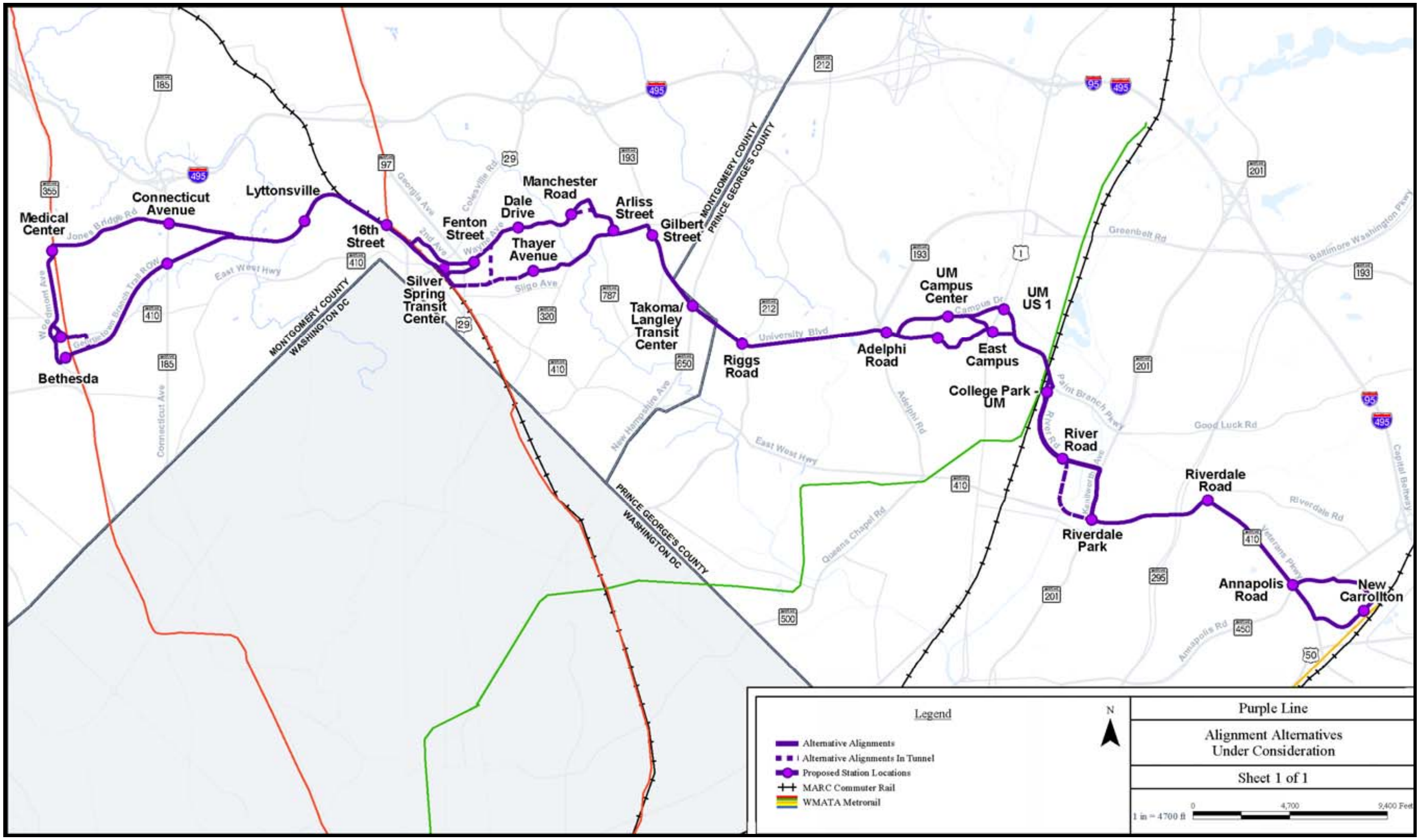


Figure 1-2: Alternative Alignments

All alternatives extend the full length of the Purple Line Corridor between the Bethesda Metro Station in the west and the New Carrollton Metro Station in the east, with variations in alignment, type of running way (shared, dedicated, or exclusive), and amount of grade-separation options (e.g., tunnel segments or aerial). For purposes of evaluation, complete alignments need to be considered. These alternatives were used to examine the general benefits, costs, and impacts for serving major market areas within the corridor.

1.2.1. Alternative 1: No Build Alternative

The No Build Alternative is used as the baseline against which the other alternatives are compared for purposes of environmental and community impacts. The No Build Alternative consists of the transit service levels, highway networks, traffic volumes, and forecasted demographics for horizon year 2030 that are assumed in the local Constrained Long Range Plan of the local metropolitan planning organization (in this case, the Metropolitan Washington Council of Governments).

1.2.2. Alternative 2: TSM Alternative

The TSM Alternative provides an appropriate baseline against which all major investment alternatives are evaluated for the Federal Transit Administration's New Starts funding program. The New Starts rating and evaluation process begins when the project applies to enter preliminary engineering and continues through final design.

The TSM Alternative represents the best that can be done for mobility in the corridor without constructing a new transitway. Generally, the TSM Alternative emphasizes upgrades in transit service through operational and minor physical improvements, plus selected highway upgrades through intersection improvements, minor widening, and other focused traffic engineering actions. A TSM Alternative normally includes such features as bus route restructuring, shortened bus headways, expanded use of articulated buses, reserved bus lanes, express and limited-stop service, signalization improvements, and timed-transfer operations.

1.2.3. Build Alternatives

The six Build Alternatives generally use the same alignments; only a few segments have locations where different roadways would be used. The differences between the alternatives are more often the incorporation of design features, such as grade separation to avoid congested roadways or intersections.

Alternative 3: Low Investment BRT

The Low Investment BRT Alternative would primarily use existing streets to avoid the cost of grade separation and extensive reconstruction of existing streets. It would incorporate signal, signage, and lane improvements in certain places. This alternative would operate mostly in mixed lanes with at-grade crossings of all intersections and queue jump lanes at some intersections. Southbound along Kenilworth Avenue and westbound along Annapolis Road, Low Investment BRT would operate in dedicated lanes. This is the only alternative that would operate on Jones Bridge Road, directly serving the National Institutes of Health and the National

Naval Medical Center near Wisconsin Avenue and Jones Bridge Road. It is also the only alternative that would use the bus portion of the new Silver Spring Transit Center (SSTC). A detailed description of the alternative follows.

From the western terminus in Bethesda, Low Investment BRT would originate at the Bethesda Metro Station bus terminal. The alignment would operate on Woodmont Avenue within the existing curb. At the Bethesda Station, the buses would enter the station via Edgemoor Road and exit onto Old Georgetown Road.

At Wisconsin Avenue, just south of Jones Bridge Road, the transitway would remain on the west side of the road in exclusive lanes. Low Investment BRT would turn onto Jones Bridge Road where the transit would operate in shared lanes with queue jump lanes westbound at the intersection with Wisconsin Avenue and westbound for the intersection at Connecticut Avenue. Some widening would be required at North Chevy Chase Elementary School.

The alignment would continue along Jones Bridge Road to Jones Mill Road where it would turn right (south) onto Jones Mill Road. Eastbound on Jones Bridge Road would be a queue jump lane at the intersection. From Jones Mill Road, the alignment would turn east onto the Georgetown Branch right-of-way, where a new exclusive roadway would be constructed, with an adjacent trail on the south side.

Low Investment BRT would continue on the Georgetown Branch right-of-way, crossing Rock Creek Park on a new bridge, replacing the existing pedestrian bridge. The trail would also be accommodated on the bridge or on an adjacent bridge. A trail connection to the Rock Creek Trail would be provided east of the bridge. The alignment would continue on the Georgetown Branch right-of-way until the CSX corridor at approximately Kansas Avenue.

At this point, the alignment would turn southeast to run parallel and immediately adjacent to the CSX tracks on a new exclusive right-of-way. The trail would parallel the transitway, crossing the transitway and the CSX right-of-way east of Talbot Avenue on a new structure and continuing on the north side of the CSX right-of-way. The transitway would continue on a new roadway between the CSX tracks and Rosemary Hills Elementary School and continue past the school. The transitway would cross 16th Street at -grade, where a station would be located. The transitway would continue parallel to the CSX tracks to Spring Street where it would connect to Spring Street and turn to cross over the CSX tracks on Spring Street. The alignment would continue on Spring Street to 2nd Avenue where it would turn east. Buses would operate in shared lanes on Spring Street and Second Avenue.

Low Investment BRT would cross Colesville Road at-grade and continue up Wayne Avenue to Ramsey Street, where the buses would turn right to enter the SSTC at the second level.

The buses would leave the SSTC and return to Wayne Avenue via Ramsey Street. Low Investment BRT would continue east on Wayne Avenue in shared lanes. After crossing Sligo Creek Parkway, the alignment would operate in shared lanes.

At Flower Avenue, the alignment would turn left (south) onto Arliss Street, operating in shared lanes to Piney Branch Road. At Piney Branch Road, the alignment would turn left to continue in shared lanes to University Boulevard.

Low Investment BRT would follow University Boulevard to Adelphi Road. The lanes on University Boulevard would be shared. At Adelphi Road, the alignment would enter the University of Maryland campus on Campus Drive. The alignment would follow the Union Drive extension, as shown in the University of Maryland Facilities Master Plan (2001-2020), through what are currently parking lots. The alignment would follow Union Drive and then Campus Drive through campus in mixed traffic and the main gate to US 1.

Low Investment BRT would operate on Paint Branch Parkway to the College Park Metro Station in shared lanes. The alignment would then follow River Road to Kenilworth Avenue in shared lanes. Along Kenilworth Avenue, the southbound alignment would be a dedicated lane, but northbound would be in mixed traffic.

The alignment turns east from Kenilworth Avenue on East West Highway (MD 410) and continues in shared lanes on Veterans Parkway. This alignment turns left on Annapolis Road and then right on Harkins Road to the New Carrollton Metro Station. The westbound alignment on Annapolis would be dedicated, but the eastbound lanes would be shared.

Alternative 4: Medium Investment BRT

Alternative 4, the Medium Investment BRT Alternative, is, by definition, an alternative that uses the various options that provide maximum benefit relative to cost. Most of the segments are selected from either the Low or High Investment BRT Alternatives.

This alternative follows a one-way counter-clockwise loop from the Georgetown Branch right-of-way onto Pearl Street, East West Highway, Old Georgetown Road, Edgemoor Lane, and Woodmont Avenue and from there onto the Georgetown Branch right-of-way under the Air Rights Building. The buses stop at both the existing Bethesda Metro Station on Edgemoor Lane and at the new southern entrance to the Metro station under the Air Rights Building.

The alignment continues on the Georgetown Branch right-of-way with an aerial crossing over Connecticut Avenue and a crossing under Jones Mill Road.

This alignment, and all others that use the Georgetown Branch right-of-way, includes construction of a hiker-biker trail between Bethesda and the SSTC.

The alignment would continue on the Georgetown Branch right-of-way until the CSX right-of-way. The alignment would cross Rock Creek Park on a new bridge, replacing the existing pedestrian bridge. The trail would also be accommodated on the bridge or on an adjacent bridge. The alignment would continue on the Georgetown Branch right-of-way until the CSX corridor at approximately Kansas Avenue. This segment of the alignment, from Jones Mill Road to the CSX corridor, would be the same for all the alternatives.

As with Low Investment BRT, this alternative would follow the CSX corridor on the south side of the right-of-way, but it would cross 16th Street and Spring Street below the grade of the streets, at approximately the same grade as the CSX tracks. The station at 16th Street would have elevators and escalators to provide access from 16th Street.

After passing under the Spring Street Bridge, Medium Investment BRT would rise above the level of the existing development south of the CSX right-of-way. East of the Falklands Chase apartments, Medium Investment BRT would cross over the CSX tracks on an aerial structure to enter the SSTC parallel to, but at a higher level than, the existing tracks.

After the SSTC, Medium Investment BRT would leave the CSX right-of-way and follow Bonifant Street at-grade, crossing Georgia Avenue, and just prior to Fenton Street turn north toward Wayne Avenue. The alignment would continue on Wayne Avenue in shared lanes with added left turn lanes to Flower Avenue and then Arliss Street. At Piney Branch Road, the alternative would turn left into dedicated lanes to University Boulevard.

Medium Investment BRT would be in dedicated lanes on University Boulevard with an at-grade crossing of the intersections. The alignment would continue through the University of Maryland campus in dedicated lanes on Campus Drive and then continue at-grade in a new exclusive transitway along the intramural fields to US 1.

Crossing US 1 at-grade, Medium Investment BRT would pass through the East Campus development on Rossborough Lane to Paint Branch Parkway. The alignment would continue on Paint Branch Parkway and River Road in shared lanes, as with Low Investment BRT. At Kenilworth Avenue, both lanes would be dedicated.

Turning left on East West Highway, Medium Investment BRT would be in dedicated lanes. As with Low Investment BRT, this alternative would travel in shared lanes on Veterans Parkway.

Medium Investment BRT would continue on Veterans Parkway to Ellin Road, where it would turn left into dedicated lanes to the New Carrollton Metro Station.

Alternative 5: High Investment BRT via Master Plan Alignment

The High Investment BRT Alternative is intended to provide the most rapid travel time for a BRT alternative. It would make maximum use of vertical grade separation and horizontal traffic separation. Tunnels and aerial structures are proposed at key locations to improve travel time and reduce delay. When operating within or adjacent to existing roads, this alternative would operate primarily in dedicated lanes. Like Medium Investment BRT, this alternative would serve the Bethesda Station both at the existing Bethesda bus terminal at the Metro station and at the new south entrance to the Metro station beneath the Apex Building.

High Investment BRT would follow a one-way loop in Bethesda from the Master Plan alignment onto Pearl Street, then travel west on East West Highway and Old Georgetown Road into the Bethesda Metro Station bus terminal, exit onto Woodmont Avenue southbound, and then continue left under the Air Rights Building to rejoin the Georgetown Branch right-of-way.

Elevators would provide a direct connection to the south end of the Bethesda Metro Station in the tunnel under the Air Rights Building.

High Investment BRT would be the same as Medium Investment BRT until it reaches the CSX corridor. As with the Low and Medium Investment BRT Alternatives, this alternative would follow the CSX corridor on the south side of the right-of-way, but it would cross 16th Street and Spring Street below the grade of the streets, at approximately the same grade as the CSX tracks. The station at 16th Street would have elevators and escalators to provide access from 16th Street.

The crossing of the CSX right-of-way would be the same as for Medium Investment BRT. From the SSTC, High Investment BRT would continue along the CSX tracks until Silver Spring Avenue, where the alignment would turn east entering a tunnel, passing under Georgia Avenue, and turning north to Wayne Avenue. The alignment would return to the surface on Wayne Avenue near Cedar Street. It would continue on Wayne Avenue in dedicated lanes, crossing Sligo Creek Parkway, and entering a tunnel approximately half-way between Sligo Creek and Flower Avenue, then turning east to pass under Plymouth Street, crossing under Flower Avenue, and emerging from the tunnel on Arliss Street.

High Investment BRT would be the same on Piney Branch Road and University Boulevard except that the alignment would have grade-separated crossings over New Hampshire Avenue and Riggs Road.

Approaching University of Maryland, the alignment would cross under Adelphi Road. After Adelphi Road, the alignment would follow Campus Drive and turn onto the proposed Union Drive extended. The alignment would enter a tunnel while on Union Drive, prior to Cole Field House, and pass through the campus under Campus Drive. After emerging from the tunnel east of Regents Drive, the alignment would be the same as Medium Investment BRT, until Paint Branch Parkway.

The alignment would continue east on Paint Branch Parkway in dedicated lanes, except under the CSX overpass, to the College Park Metro Station. The alternative would then follow River Road in dedicated lanes. The alignment would be dedicated on these roadways, except under the CSX Bridge on Paint Branch Parkway.

From River Road (also in dedicated lanes) near Haig Drive, the alignment would turn right and enter a tunnel heading south, roughly parallel to Kenilworth Avenue. Near East West Highway (MD 410), the alignment would turn left and continue in the tunnel under Anacostia River Park. The alignment would transition to a surface alignment west of the Kenilworth Avenue/East West Highway intersection. The alternative would follow East West Highway in dedicated lanes.

High Investment BRT would turn right down Veterans Parkway in dedicated lanes. Unlike Medium Investment BRT, this alignment would cross under Annapolis Road before continuing on to Ellin Road.

Alternative 6: Low Investment LRT

The Low Investment LRT Alternative would operate in shared and dedicated lanes with minimal use of vertical grade separation and horizontal traffic separation. All LRT Alternatives would serve only the south entrance of the Bethesda Station and would operate there in a stub-end platform arrangement.

Low Investment LRT would begin on the Georgetown Branch right-of-way near the Bethesda Metro Station under the Air Rights Building. The hiker-biker trail connection to the Capital Crescent Trail would not be through the tunnel under the Air Rights Building, but rather through Elm Street Park on existing streets. The terminal station would be the Bethesda Metro Station with a connection to the southern end of the existing station platform.

After emerging from under the Air Rights Building, the transitway would follow the Georgetown Branch right-of-way, crossing Connecticut Avenue at-grade and crossing under Jones Mill Road. Between approximately Pearl Street and just west of Jones Mill Road, the trail would be on the north side of the transitway; elsewhere it would be on the south side.

The segment from Jones Mill Road to Spring Street in the CSX corridor would be the same as for Low and Medium Investment BRT.

After crossing Spring Street, Low Investment LRT would be the same as the Medium and High Investment BRT Alternatives.

Low Investment LRT would be the same as Medium Investment BRT from the SSTC to Bonifant Street to Wayne Avenue.

Turning right, Low Investment LRT would continue at-grade on Wayne Avenue in shared lanes, crossing Sligo Creek Parkway and entering a tunnel from Wayne Avenue to pass under Plymouth Street. As with High Investment BRT, the alignment emerges from the tunnel on Arliss Street.

The Low Investment LRT Alternative would then follow Piney Branch Road and University Boulevard at-grade in dedicated lanes. In keeping with the low investment definition of this alternative, the major intersections of New Hampshire Avenue and Riggs Road would not be grade-separated.

As this alternative approaches Adelphi Road, the grade of the existing roadway is too steep for the type of LRT vehicles being considered. For this reason, the transitway would cross the intersection below grade.

At Adelphi Road, the alignment would enter the University of Maryland campus on Campus Drive. The alignment would follow the same alignment to the College Park Metro Station as described for Medium Investment BRT.

From the College Park Metro Station to the terminus at the New Carrollton Metro Station, Low Investment LRT would be in dedicated lanes on River Road. On Kenilworth Avenue, the LRT would be in a dedicated lane southbound, but a shared lane northbound. On East West Highway, the LRT would be in dedicated lanes with shared left turn lanes and in shared lanes under Baltimore-Washington Parkway. On Veterans Parkway, the LRT is in dedicated lanes.

As with Low Investment BRT, this alignment turns left on Annapolis Road from Veterans Parkway and then right on Harkins Road to the New Carrollton Metro Station. The segments on Annapolis Road and Harkins Lane would be dedicated.

Alternative 7: Medium Investment LRT

Medium Investment LRT is the same as Low Investment LRT from Bethesda to the CSX corridor, except that the alignment would cross over Connecticut Avenue.

Along the CSX corridor, the alignment would be the same as High Investment BRT, grade-separated (below) at 16th and Spring Streets. The alignment would be the same as Medium and High Investment BRT and Low Investment LRT from Spring Street through the SSTC.

From the SSTC, the alignment would follow Bonifant Street in dedicated lanes to Wayne Avenue. On Wayne Avenue, this alterative would be in shared lanes with added left turn lanes. The alignment would be the same as Low Investment LRT until Paint Branch Parkway, where it would be in dedicated lanes, except under the CSX/metro tracks at the College Park Metro Station, except for Paint Branch Parkway where it would be in dedicated lanes. The LRT follows River Road, Kenilworth Avenue, East West Highway, and Veterans Parkway in dedicated lanes. At the intersection of Veterans Parkway and Annapolis Road the LRT continues across Annapolis, turning left at Ellin Road still in dedicated lanes.

Alternative 8: High Investment LRT

Alternative 8, High Investment LRT, would be the same as the High Investment BRT Alternative, except for the Bethesda terminus. The alignment would begin just west of the tunnel under the Air Rights Building. The hiker-biker trail would follow the alignment through the tunnel under the Air Rights Building. Because of physical constraints, the trail would be elevated above the westbound tracks. The trail would return to grade as it approaches Woodmont Avenue. The terminal station would be the Bethesda Metro Station with a connection to the southern end of the existing station platform.

1.2.4. Design Options

North Side of CSX

This design option is based on the Georgetown Branch Master Plan. From the eastern end of the Georgetown Branch right-of-way, the alignment would cross under the CSX corridor and then continue down the north side. It would emerge from the tunnel near Lyttonsville Road in Woodside. The alignment would be below the grade of 16th Street, passing under the bridge, but providing a station at that location. It would also pass under the Spring Street Bridge but would begin to rise on an aerial structure over the CSX right-of-way 1,000 feet northwest of Colesville Road due to the location of the Metro Plaza Building. The aerial structure over the CSX right-of-way would provide the required 23-foot clearance from top of rail to bottom of structure. The alternative would enter the SSTC parallel to, but at a higher level than, the existing tracks.

South Side of CSX with a Crossing West of the Falklands Chase Apartments

This option would operate on the south side of the CSX, as described either at or below grade at 16th Street. The alignment would cross the CSX corridor between Spring Street and Fenwick Lane. This option would continue along the north side of the CSX right-of-way on an aerial structure over the CSX right-of-way 1,000 feet northwest of Colesville Road, due to the location of the Metro Plaza Building. The aerial structure over the CSX right-of-way would provide the required 23-foot clearance from top of rail to bottom of structure. The alternative would enter the SSTC parallel to, but at a higher level than, the existing tracks.

Silver Spring/Thayer Tunnel

This design option would begin at the SSTC where the alignment leaves the CSX corridor near Silver Spring Avenue. It would enter a tunnel on Silver Spring Avenue passing under Georgia Avenue and Fenton Street. At approximately Grove Street, the alignment would shift northward to continue under the storm drain easement and backyards of homes on Thayer and Silver Spring Avenues. The transitway would emerge from the tunnel behind the East Silver Spring Elementary School on Thayer Avenue and follow Thayer Avenue across Dale Drive to Piney Branch Road. If the mode selected were LRT, the grade of Piney Branch Road would require an aerial structure from west of Sligo Creek and Sligo Creek Parkway and would return to grade just west of Flower Avenue. This aerial structure requires that the road be widened. For this design option, a station would be located on Thayer Avenue where the alignment would emerge from the tunnel.

University of Maryland Campus via Preinkert Drive

Preinkert Drive is being evaluated as a design option for both BRT and LRT through the campus of University of Maryland. The alignment would run from the west on Campus Drive turning right onto Preinkert Drive where it would head southeast. The transitway would turn left to pass directly between LeFrak Hall and the South Dining Campus Hall and then northeast through the Lot Y parking lot. From there, the alignment would run east along Chapel Drive between Memorial Chapel and Marie Mount Hall and eventually would pass to the south of Lee Building at Chapel Fields. The alignment would continue onto Rossborough Lane, passing directly north of Rossborough Inn to cross US 1, and continues east through the East Campus development.

1.2.5. Stations and Station Facilities

Between 20 and 21 stations are being considered for each of the alternatives. Table 1-1 provides the stations for each of the Build Alternatives.

Table 1-1: Stations by Alternative

Segment Name	Low Invest. BRT	Medium Invest. BRT	High Invest. BRT	Low Invest. LRT	Medium Invest. LRT	High Invest. LRT
Bethesda Metro, North Entrance	Yes	Yes	Yes	**N/A**	**N/A**	**N/A**
Medical Center Metro	Yes	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**
Bethesda Metro, South Entrance	**N/A**	Yes	Yes	Yes	Yes	Yes
Connecticut Avenue	Yes	Yes	Yes	Yes	Yes	Yes
Lyttonsville	Yes	Yes	Yes	Yes	Yes	Yes
Woodside/16th Street	Yes	Yes	Yes	Yes	Yes	Yes
Silver Spring Transit Center	Yes	Yes	Yes	Yes	Yes	Yes
Fenton Street	Yes	Yes	**N/A**	Yes	Yes	**N/A**
Dale Drive	Yes	Yes	Yes	Yes	Yes	Yes
Manchester Place	Yes	Yes	Yes	Yes	Yes	Yes
Arliss Street	Yes	Yes	Yes	Yes	Yes	Yes
Gilbert Street	Yes	Yes	Yes	Yes	Yes	Yes
Takoma/Langley Transit Center	Yes	Yes	Yes	Yes	Yes	Yes
Riggs Road	Yes	Yes	Yes	Yes	Yes	Yes
Adelphi Road	Yes	Yes	Yes	Yes	Yes	Yes
University of Maryland Campus Center	Yes	Yes	Yes	Yes	Yes	Yes
US 1	Yes	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**
East Campus	**N/A**	Yes	Yes	Yes	Yes	Yes
College Park Metro	Yes	Yes	Yes	Yes	Yes	Yes
River Road	Yes	Yes	Yes	Yes	Yes	Yes
Riverdale Park	Yes	Yes	Yes	Yes	Yes	Yes
Riverdale Heights	Yes	Yes	Yes	Yes	Yes	Yes
Annapolis Road	Yes	Yes	Yes	Yes	Yes	Yes
New Carrollton Metro	Yes	Yes	Yes	Yes	Yes	Yes

The design of the Purple Line stations has not been determined at this stage of the project; however, the stations would likely include the following elements: shelters, ticket vending machines, seating, and electronic schedule information. The stations would be located along the transitway and would be on local sidewalks or in the median of the streets, depending on the location of the transitway. Because both the BRT and LRT vehicles under consideration are “low floor,” the platforms would be about 14 inches above the height of the roadway. The platforms would be approximately 200 feet long and between 10 and 15 feet wide, depending on the anticipated level of ridership at each particular station. No new parking facilities would be constructed as part of the Purple Line. Municipal parking garages exist near the Bethesda and Silver Spring Metro Stations, and transit parking facilities exist at the College Park and New Carrollton Metro Stations.

Additional kiss-and-ride facilities would be considered at the stations at Connecticut Avenue on the Georgetown Branch right-of-way and Lyttonsville. The SSTC, College Park Metro Station, and New Carrollton Metro Station already have kiss-and-ride parking facilities available and the Purple Line would not add more. It has been determined that kiss-and-ride facilities are not needed at the Takoma/Langley Transit Center.

1.2.6. *Maintenance and Storage Facilities*

LRT and BRT both require maintenance and storage facilities; however, the requirements in terms of location and size are not the same. LRT requires a facility located along the right-of-way while a BRT facility can be located elsewhere. Depending on the construction phasing and mode chosen, two maintenance facilities (one in Montgomery County and one in Prince George's County) are ideal.

The size of the facility depends on the number of vehicles required. A fleet of 40 to 45 vehicles (including Spares) would require approximately 20 acres. The Purple Line would also require storage for non-revenue vehicles and equipment such as: maintenance, supervisory, and security vehicles.

Activities at the maintenance facility would include:

- Vehicle Storage area (tracks for LRT)
- Inspection/Cleaning
- Running Repairs
- Maintenance/Repair
- Operations/Security
- Parking
- Materials/Equipment Storage

Two sites improve operations by providing services and storage near the ends of the alignment. It is possible to have one site provide the majority of the services and the other function as an auxiliary site.

Five potential sites were identified during the course of the alternatives analysis and were evaluated for environmental impacts. As part of the screening process three were eliminated from further consideration. These five sites are listed below:

- Lyttonsville – This is a maintenance facility on Brookville Road in Lyttonsville, currently used by Montgomery County Ride On buses and school buses. The Purple Line would require the use of some additional adjacent property.
- Haig Court – This site is located on River Road at Haig Court. It would require minimal grading, but is partly wooded, and is very close to the residential neighborhood of Riverdale which is also a historic district.
- North Veterans Parkway – This site is located on the north side of Veterans Parkway. This site is heavily wooded and includes steep grades.
- Glenridge Maintenance Facility – This site is located on the south side of Veterans Parkway near West Lanham Shopping Center. It is currently being used as a maintenance facility for Prince George's County Park vehicles.

- MTA New Carrollton property – This site is a parcel owned but the MTA on the east side of the New Carrollton Metro station. It is not particularly well located for use buy the Purple Line because it would require the Purple Line to pass under or around the New Carrollton Metro Station.

The Lyttonsville site and the Glenridge Maintenance Facility were identified as the two sites most appropriate for maintenance and storage facilities for the project based on potential environmental effects and location. These two sites would provide sufficient capacity for either BRT or LRT operations; and are well located near either end of the alignment.

1.2.7. Traction Power Substations

Light rail’s electric traction power system requires electrical substations approximately every 1.25 miles, depending on the frequency and size of the vehicles. These substations, which are approximately 10 feet by 40 feet, do not need to be immediately adjacent to the tracks. This flexibility means the substations can be located to minimize visual intrusions and can be visually shielded by fencing, landscaping, or walls, or can be incorporated into existing buildings. The number and location of these substations will be determined during the preliminary engineering phase of project development.

2. Environmental Analysis

2.1. Affected Environment

Energy is commonly measured in terms of British thermal units, or Btus. A Btu is defined as the amount of heat required to raise the temperature of one pound of water by one degree Fahrenheit. For transportation projects, energy usage is predominantly influenced by the amount of fuel used. The average Btu content of fuels is the heat value (or energy content) per quantity of fuel as determined from tests of fuel samples.

Transportation accounts for a major portion of the energy consumed in the United States (U.S.). As shown in Figure 2-1, transportation is the second largest source of energy consumption in the U.S. In Maryland, the transportation sector is the largest source of energy consumption. On a per capita basis, Maryland's transportation energy consumption is 75.3 million Btus, which is below the U.S. per capita average of 93.1 million Btus (U.S. Department of Transportation 1993). As shown in Figure 2-2, petroleum (e.g., gasoline, diesel fuel, jet fuel) is the predominant source of energy for transportation in Maryland.

Transportation energy is generally discussed in terms of direct and indirect energy. Direct energy involves all energy consumed by vehicle propulsion. This energy is a function of traffic characteristics such as volume, speed, distance traveled, vehicle mix, and thermal value of the fuel being used. Indirect energy consumption involves the non-recoverable, one-time energy expenditure involved in constructing the physical infrastructure associated with the project.

2.2. Environmental Consequences

This section provides a quantitative assessment of the project's impact on transportation-related energy consumption in the study area. Two methodologies currently used to estimate a project's energy consumption were applied. The first is based on the analysis techniques discussed in the report *Energy and Transportation Systems* (California Department of Transportation (Caltrans) and the U.S. Federal Highway Administration (FHWA), 1983), as well as *Urban Transportation and Energy: The Potential Savings of Different Modes* (Congress of the U.S. 1977). The second methodology is based on factors in the *Transportation Energy Data Book, Edition 26* (U.S. Department of Energy 2007).

The direct energy impacts were calculated for the project using both methods. The analyses produced similar results in that both showed approximately the same percentage reduction in roadway vehicular energy demand. Given the age of the source data for each of the analysis techniques, and the fact that the 1983 data must be brought up to date using a series of correction factors, only the results from the *Transportation Energy Data Book* (U.S. Department of Energy 2007) are presented.

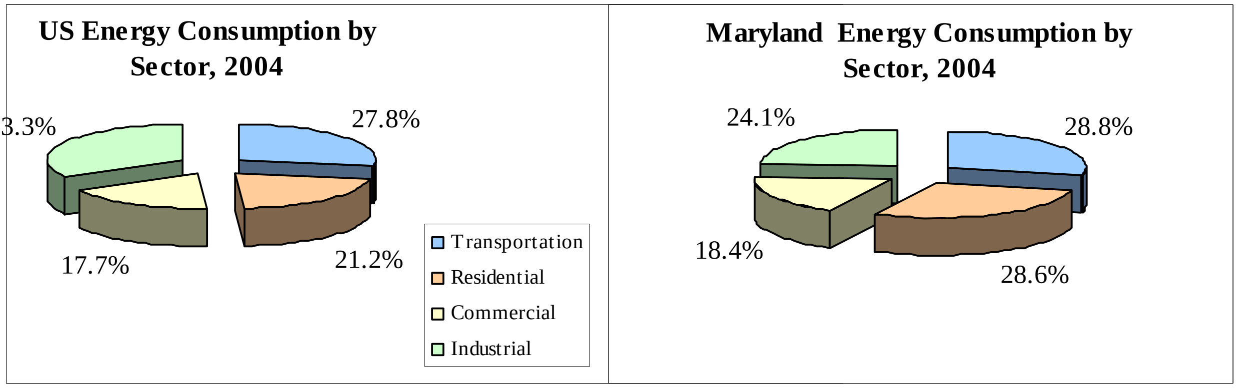
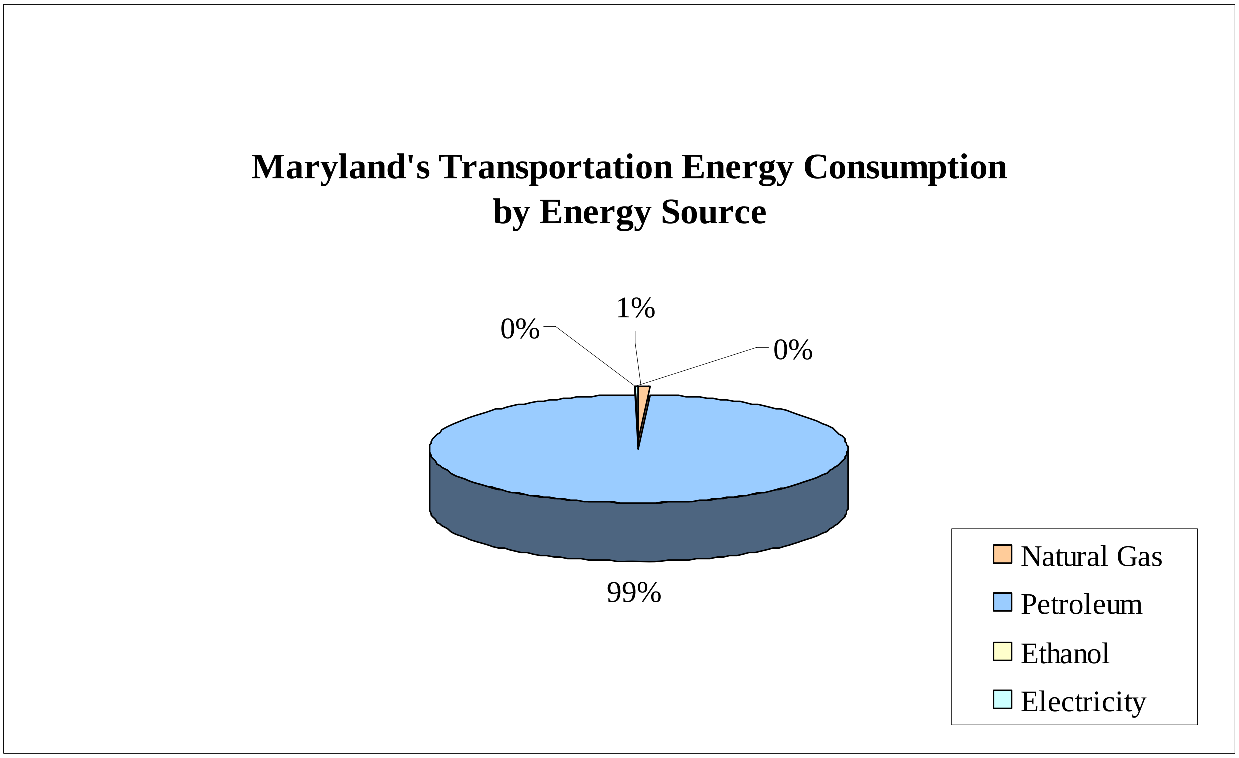


Figure 2-1: Energy Consumption by Sector



Source*:* *U.S. Department of Energy, Energy Information Administration, State Energy Data 2003 Consumption, Washington, DC: 2006. URL http://www.eia.doe.gov/emeu/states/_states.html as of October 26, 2006.*

Figure 2-2: Transportation Energy Consumption by Energy Source

2.2.1. Direct Energy

As shown in Table 2-1, the project is predicted to have little or no effect on overall energy consumption in the project area. Roadway energy is predicted to decrease under all the alternatives with the exception of the TSM Alternative. This is due to the predicted changes in vehicle miles traveled (VMT) under the build alternatives as compared to the No Build Alternative. Overall, total energy levels are predicted to increase under the TSM Alternative (0.04 percent) and decrease under the remaining alternatives. The Medium Investment LRT and BRT Alternatives, as compared to the No Build Alternative, are predicted to demonstrate the largest overall energy reduction (0.07 percent), followed by the High Investment BRT (0.05 percent), Low Investment LRT (0.03 percent), High Investment LRT (0.02 percent), and the Low Investment BRT (0.00 percent).

In terms of energy per passenger mile, the Medium Investment LRT Alternative, as compared to the No Build Alternative, is predicted to demonstrate the largest overall energy reduction (0.09 percent) followed by the Low and High Investment LRT Alternatives (0.07 percent) the High Investment BRT Alternative (0.06 percent) and the Low Investment BRT Alternative (0.02 percent). The TSM Alternative is predicted to increase total energy use in terms of Btus/ passenger mile by 0.02 percent, as compared to the No Build Alternative. This is because, Btu per passenger mile varies by mode, as shown in Figure 2-3. The Btu per passenger miles shown in Figure 2-3 are based on general load factors from the U.S. Department of Energy’s report titled *Transportation Energy Data Book, Edition 26*, dated 2007.

All changes in energy consumption are less than 0.10 percent, making them essentially immeasurable.

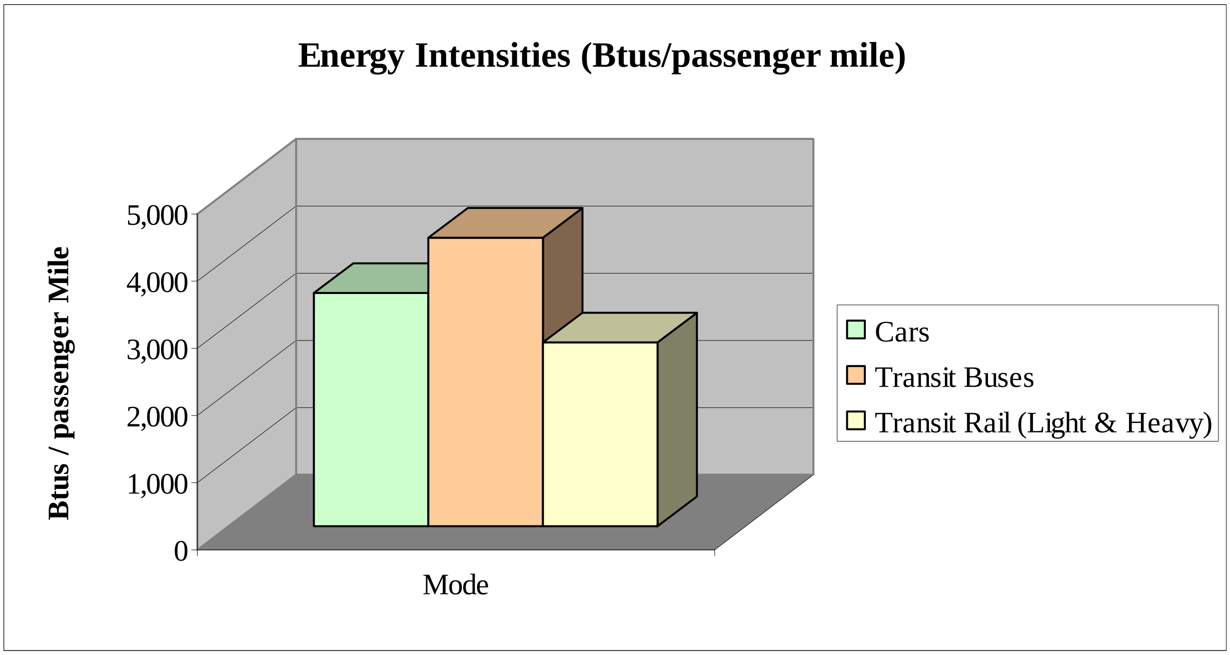


Figure 2-3: Energy Intensities by Mode

Table 2-1: 2030 Direct Energy Consumption

Mode	No Build	TSM	Low Investment BRT	Medium Investment BRT	High Investment BRT	Low Investment LRT	Medium Investment LRT	High Investment LRT
Roadways								
Daily VMT	261,054,000	261,110,000	261,002,000	260,940,000	260,879,000	260,867,000	260,870,000	260,877,000
Average Speed (mph)	24.5	24.5	24.5	24.4	24.4	24.4	24.4	24.4
Energy Intensity								
Auto (Btus)	261,625	261,681	261,573	261,511	261,450	261,438	261,441	261,448
Light Trucks (Btus)	863,033	863,218	862,861	862,656	862,454	862,415	862,424	862,448
Heavy Trucks (Btus)	364,525	364,603	364,452	364,366	364,280	364,264	364,268	364,278
Total Roadway Btus (millions)	1,489,183	1,489,502	1,488,886	1,488,532	1,488,184	1,488,116	1,488,133	1,488,173
Total Roadway Btus Percent Change from Baseline	-	0.02%	-0.02%	-0.07%	-0.07%	-0.07%	-0.09%	-0.07%
Btus Per Passenger Miles(assuming 1.2 passengers/vehicle)	4,754	4,754	4,754	4,754	4,754	4,754	4,754	4,754
Total Btus (million) Per Passenger Mile	1,240,986	1,241,252	1,240,738	1,240,444	1,240,154	1,240,097	1,240,111	1,240,144
LRT								
Daily VMT	0	0	0	0	0	7286	7208	7599
Electric Propulsion Btus (millions)	0.00	0.00	0.00	0	0.00	625	618	652
Btus Per Passenger Miles (assuming 22.4 passengers/vehicle)	0	0	0	0	0	3,828	3,828	3,828
Total Btus (million) Per Passenger Mile	0	0	0	0	0	28	28	29

Table 2-1: 2030 Direct Energy Consumption (continued)

Mode	No Build	TSM	Low Investment BRT	Medium Investment BRT	High Investment BRT	Low Investment LRT	Medium Investment LRT	High Investment LRT
BRT								
Daily VMT	0	7,354	7,354	7,213	7,284	0	0	0
Total BRT Btus (millions)	0.00	314	314	308	311	0	0	0
Btus Per Passenger Miles (Assuming 8.7 passengers/vehicle)	0	4,907	4,907	4,907	4,907	0	0	0
Total Btus (million) Per Passenger Mile	0	36	36	35	36	0	0	0
Total (Roadways, LRT & BRT)								
Daily Direct Energy Btus (millions) Consumed	1,489,183	1,489,816	1,489,200	1,488,840	1,488,495	1,488,741	1,488,751	1,488,825
Percent Change from No Build	-	0.04%	0.00%	-0.07%	-0.05%	-0.03%	-0.07%	-0.02%
Total (Roadways, LRT & BRT) in Terms of Passenger Miles								
Daily Direct Energy Btus (millions) Consumed	1,240,986	1,241,288	1,240,774	1,240,479	1,240,189	1,240,125	1,240,138	1,240,173
Percent Change from No Build	-	0.02%	-0.02%	-0.07%	-0.06%	-0.07%	-0.09%	-0.07%

2.2.2. *Indirect Energy*

Indirect energy is the energy needed to construct the project. Accurate indirect energy costs are extremely difficult to estimate given the uncertainty of field variables at this point in the analysis. The indirect energy values calculated should be considered as an indicator between alternatives, rather than absolute values. Construction energy factors estimate the amount of energy necessary to extract raw materials, manufacture and fabricate construction materials, transport materials to the work site, and complete construction activities.

The analysis is based on the number of lane miles (or track miles) to be constructed for each alternative. Estimates of construction energy reflect at-grade, elevated and below grade construction. As shown in Table 2-2, indirect energy expenditures are predicted to be highest for the LRT Alternatives. This is due to the higher energy requirements estimated for constructing one track mile as compared to one roadway mile.

Table 2-2: 2030 Indirect Energy Consumption

Type of Construction	Number of Track or Lane Feet	Number of Track or Lane Miles	Btus Consumed (millions)
Low Investment BRT			
Track			
Track At-Grade	0.0	0.0	0.0
Track Elevated or Below Grade	0.0	0.0	0.0
Track Total	**0.0**	**0.0**	**0.0**
Roadways			
Surface Roadways	172,162.0c	32.6	195,638.7
Elevated Roadways	6,325.0	1.2	17,120.6
Roadway Total	**178,487.0**	**33.8**	**212,759.3**
System Total	**178,487.0**	**33.8**	**212,759.3**
Medium Investment BRT			
Track			
Track At-Grade	0.0	0.0	0.0
Track Elevated or Below Grade	0.0	0.0	0.0
Track Total	**0.0**	**0.0**	**0.0**
Roadways			
Surface Roadways	159,272.0	30.2	180,991.0
Elevated Roadways	16,845.0	3.2	45,596.4
Roadway Total	**176,117.0**	**33.4**	**226,587.3**
System Total	**176,117.0**	**33.4**	**226,587.3**
High Investment BRT			
Track			
Track At-Grade	0.0	0.0	0.0
Track Elevated or Below Grade	0.0	0.0	0.0
Track Total	**0.0**	**0.0**	**0.0**
Roadways			
Surface Roadways	124,014.0	23.5	140,925.0
Elevated Roadways	52,692.0	10.0	142,627.7
Roadway Total	**176,706.0**	**33.5**	**283,552.8**
System Total	**176,706.0**	**33.5**	**283,552.8**

Table 2-2: 2030 Indirect Energy Consumption (continued)

Type of Construction	Number of Track or Lane Feet	Number of Track or Lane Miles	Btus Consumed (millions)
Low Investment LRT			
Track			
Track At-Grade	143,856.0	27.2	445,226.2
Track Elevated or Below Grade	26,396.0	5.0	277,258.1
Track Total	**170,252.0**	**32.2**	**722,484.3**
Roadways			
Surface Roadways	0.0	0.0	0.0
Elevated Roadways	0.0	0.0	0.0
Roadway Total	**0.0**	**0.0**	**0.0**
System Total	**170,252.0**	**32.2**	**722,484.3**
Medium Investment LRT			
Track			
Track At-Grade	150,016.0	28.4	464,291.0
Track Elevated or Below Grade	21,926.0	4.2	230,306.1
Track Total	**171,942.0**	**32.6**	**694,597.2**
Roadways			
Surface Roadways	0.0	0.0	0.0
Elevated Roadways	0.0	0.0	0.0
Roadway Total	**0.0**	**0.0**	**0.0**
System Total	**171,942.0**	**32.6**	**694,597.2**
High Investment LRT			
Track			
Track At-Grade	119,522.0	22.6	369,913.8
Track Elevated or Below Grade	53,692.0	10.2	563,969.6
Track Total	**173,214.0**	**32.8**	**933,883.4**
Roadways			
Surface Roadways	0.0	0.0	0.0
Elevated Roadways	0.0	0.0	0.0
Roadway Total	**0.0**	**0.0**	**0.0**
System Total	**173,214.0**	**32.8**	**933,883.4**

Notes:

1. U.S. Department of Energy's Assessment of Energy Impacts of Improving Highway-Infrastructure Materials, 1995
2. Minor bridge rehabilitation in urban area (million btus/lane-mile) 14,292 million btus/track mile
3. Surface highway major widening (million btus/lane-mile) 6,000 million btus/track mile
4. Energy and Transportation Systems, Caltrans, 1983; New York State Draft Energy Analysis Guidelines for Project Level Analysis - 2003
5. LRT track construction (million btus/track mile) 16,341 million btus/track mile
6. LRT elevated / tunnel track construction (assumes track and bridge rehabilitation energies) 30,633 million btus/track mile

2.2.3. Measures to Minimize Harm

Conservation of energy could be achieved in facility planning, construction, operation, and maintenance. Conservation could also be applied to recycling pavements, hardware items (guardrails, signals, tires, right-of-way, etc.), using indigenous plants for landscaping, and applying Best Management Practices in roadway maintenance. Other measures that could be applied include using high pressure sodium vapor lamps for light, solar powered lighting, promoting carpools, vanpools, buses, and bicycle projects.

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