Noise and Vibration

Technical Report

September 2008

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1. Introduction to Purple Line

The Maryland Transit Administration (MTA) is preparing an Alternatives Analysis and Draft Environmental Impact Statement (AA/DEIS) 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 *Noise and Vibration Technical Report* presents the analysis of potential noise and vibration impacts that were summarized in the AA/DEIS. It describes the methodology used for the analysis and the results of that analysis.

This Technical Report presents the methodology and data used in the analyses documented in the Purple Line Alternatives Analysis/Draft Environmental Impact Statement. The results presented in this report may be updated as the AA/DEIS is finalized and in subsequent study activities.

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.

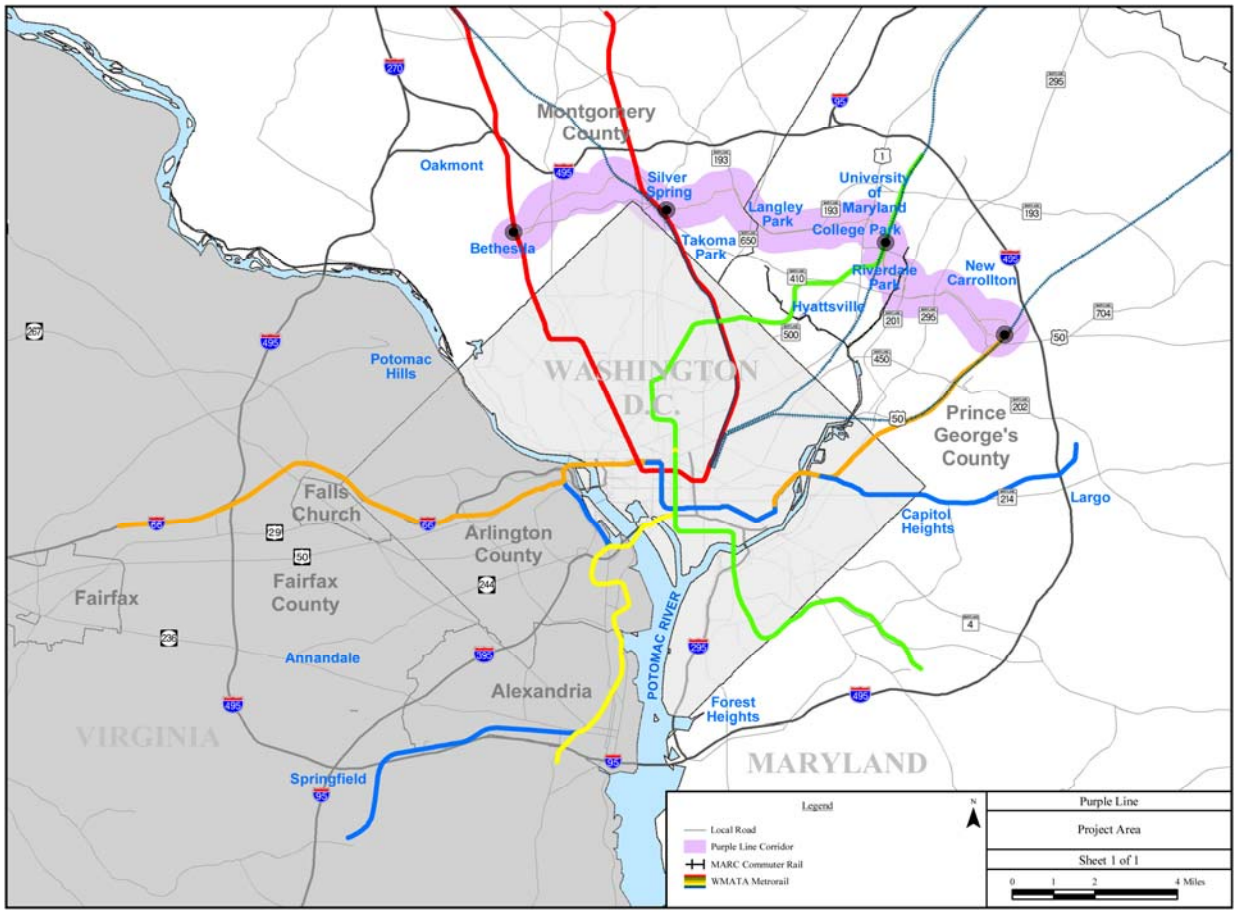
The corridor has a sizeable population that already uses transit and contains some of the busiest transit routes and transfer areas in the Washington, D.C. metropolitan area. Many communities in the corridor have a high percentage of households without a vehicle, and most transit in these communities 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.

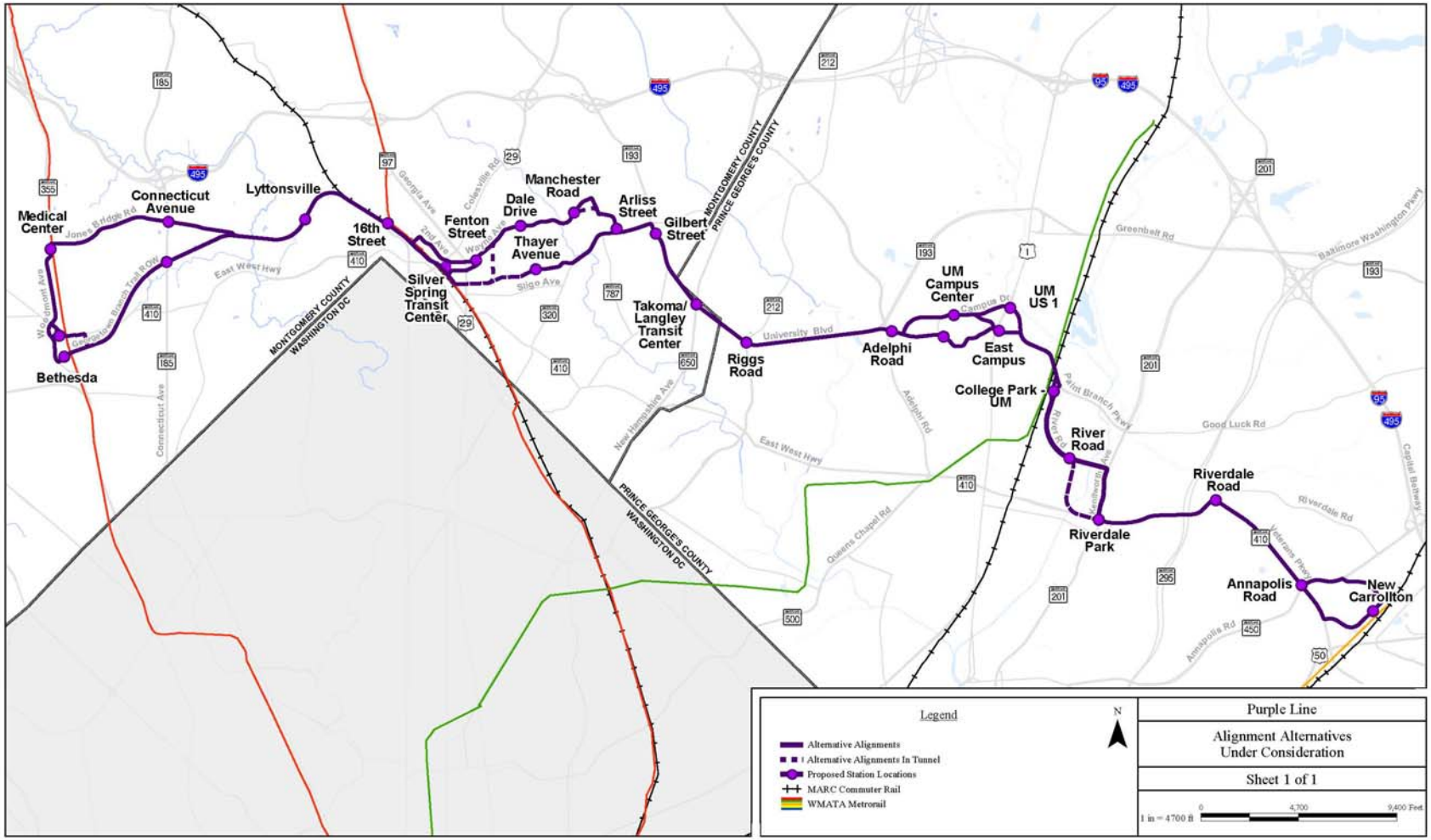
Figure 1-1: Project Area



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 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 through the parking lots adjacent to the Armory and turns on to Rossborough Lane south of the Visitor's Center.

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 shared lanes to the College Park Metro Station. The alternative would then follow River Road in dedicated lanes.

From River Road 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 Annapolis Road. The LRT would follow 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.

Preinkert/Chapel Drive

The Preinkert/Chapel Drive design option is being evaluated 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.

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.

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 Road	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

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 LRT vehicles or 40 to 60 buses (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 by 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. Noise and Vibration Analysis

2.1. Overview of Noise and Vibration Regulations

The construction and operation of the Purple Line has the potential to increase noise and ground-borne vibration levels in adjacent sensitive land uses. Such increases potentially can cause undesirable effects on people, animals, and structures. The principal source of existing noise in the corridor is vehicular traffic. Within the proposed alignments, most adjacent land uses are exposed to low to moderate noise levels. Whether an increase in noise from the construction and operation of the proposed Purple Line is objectionable depends on the relationship between noise generated by the operations of the various proposed BRT and LRT transit systems relative to existing community noise levels.

2.1.1. FTA Noise Criteria

Noise criteria are used by the FTA to identify noise impacts. The basic goals of the noise criteria are to minimize the adverse noise impacts on the community and to provide feasible and reasonable noise control where necessary and appropriate. For this project, the FTA noise impact criteria were used to assess impacts at sensitive sites near the proposed transit operations.

The FTA noise and vibration criteria are defined in the guidance manual *Transit Noise and Vibration Impact Assessment* (FTA-VA-90-1003-06 May 2006). FTA guidelines assess noise impacts for various land use categories using different noise metrics (L_{eq} or L_{dn}). They are presented in Table 2-1. For example, for residential land uses adjoining the transit corridor, the noise descriptor is L_{dn}, which represents the cumulative 24-hour day-night noise level and accounts for the greater sensitivity to noise during the nighttime hours. For land uses involving daytime and evening uses, the noise descriptor is L_{eq} (h), which is defined as the L_{eq} for the noisiest hour of transit–related activity during which human activities occur at noise sensitive locations.

Table 2-1: FTA Land Use Categories and Metrics for Transit Noise

Land Use Category	Noise Metric (dBA)	Description of Land Use Category
1	Outdoor L_{eq}(h)*	Tracts of land where quiet is an essential element in their intended purpose. This category includes lands set aside for serenity and quiet, and such land used as outdoor amphitheaters and concert pavilions, as well as National Historic Landmarks with significant outdoor use.
2	Outdoor L_{dn}	Residences and buildings where people normally sleep. This category includes homes, hospitals, and hotels where a nighttime sensitivity to noise is assumed to be of utmost importance.
3	Outdoor L_{eq}(h)*	Institutional land uses with primary daytime and evening use. This category includes schools, libraries, and churches where it is important to avoid interference with such activities as speech, meditation, and concentration on reading material.

Source: FTA, Transit Noise and Vibration Impact Assessment, Final Report, May 2006.

* L_{eq} for the noisiest hour of transit-related activity during hours of noise sensitivity.

FTA impact assessment based on project noise exposure is presented in Table 2-2. FTA noise impact criteria presented in Table 2-2 determines if potential transit noise impacts will occur by comparing the existing outdoor noise levels (L_{eq} or L_{dn} depending on land use category) with the noise generated solely by the transit noise source. Project impacts are categorized as "No Impact", "Moderate Impact", or "Severe Impact" as determined from the allowable limit in project generated noise exposure over the existing noise exposure.

Table 2-2: FTA Noise Impact Criteria: Noise Levels Defining Impact for Transit Projects

Existing Noise Exposure* L_{eq}(h) or L_{dn} (dBA)	Project Noise Impact Exposure, * L_{eq}(h) or L_{dn} (dBA)					
	Category 1 or 2 Sites			Category 3 Sites		
	No Impact	Moderate Impact	Severe Impact	No Impact	Moderate Impact	Severe Impact
<43	<Ambient+10	Ambient+ 10 to 15	<Ambient+15	<Ambient+15	Ambient+ 10 to 15	>Ambient+20
43	<52	52-58	>58	<57	57-63	>63
44	<52	52-58	>58	<57	57-63	>63
45	<52	52-58	>58	<57	57-63	>63
46	<53	53-59	>59	<58	58-64	>64
47	<53	53-59	>59	<58	58-64	>64
48	<53	53-59	>59	<58	58-64	>64
49	<54	54-59	>59	<59	59-64	>64
50	<54	54-59	>59	<59	59-64	>64
51	<54	54-60	>60	<59	59-65	>65
52	<55	55-60	>60	<60	60-65	>65
53	<55	55-60	>60	<60	60-65	>65
54	<55	55-61	>61	<60	60-66	>66
55	<56	56-61	>61	<61	61-66	>66
56	<56	56-62	>62	<61	61-67	>67
57	<57	57-62	>62	<62	62-67	>67
58	<57	57-62	>62	<62	62-67	>67
59	<58	58-63	>63	<63	63-68	>68
60	<58	58-63	>63	<63	63-68	>68
61	<59	59-64	>64	<64	64-69	>69
62	<59	59-64	>64	<64	64-69	>69
63	<60	60-65	>65	<65	65-70	>70
64	<61	61-65	>65	<66	66-70	>70
65	<61	61-66	>66	<66	66-71	>71
66	<62	62-67	>67	<67	67-72	>72
67	<63	63-67	>67	<68	68-72	>72
68	<63	63-68	>68	<68	68-73	>73
69	<64	64-69	>69	<69	69-74	>74
70	<65	65-69	>69	<70	70-74	>74
71	<66	66-70	>70	<71	71-75	>75
72	<66	66-71	>71	<71	71-76	>76

Table 2-2: FTA Noise Impact Criteria: Noise Levels Defining Impact for Transit Projects

Existing Noise Exposure* $L_{eq}(h)$ or L_{dn} (dBA)	Project Noise Impact Exposure, * $L_{eq}(h)$ or L_{dn} (dBA)					
	Category 1 or 2 Sites			Category 3 Sites		
	No Impact	Moderate Impact	Severe Impact	No Impact	Moderate Impact	Severe Impact
73	<66	66-71	>71	<71	71-76	>76
74	<66	66-72	>72	<71	71-77	>77
75	<66	66-73	>73	<71	71-78	>78
76	<66	66-74	>74	<71	71-79	>79
77	<66	66-74	>74	<71	71-79	>79
>77	<66	66-75	>75	<71	71-80	>80

Source: Transit Noise and Vibration Impact Assessment, FTA May 2006

Note: L_{dn} is used for land use where nighttime sensitivity is a factor; L_{eq} during the hour of maximum transit noise exposure is used for land use involving only daytime activities

2.1.2. FTA Vibration Criteria

Vibration impacts generated by the project are assessed by using FTA vibration prediction procedures. FTA guidelines apply to transit vehicles operating on the transit corridor, near stations and near other supporting transit facilities. FTA published its vibration impact criteria in the FTA manual *Transit Noise and Vibration Impact Assessment* to assess vibration impacts from transit operations. The criteria are based on the maximum vibration level in decibels (vibration decibels or VdB) generated by a single event. The FTA criteria for acceptable ground-borne vibration are expressed in terms of root mean square (rms) vibration velocity and the impact thresholds are specified for three land use categories. Table 2-3 provides FTA's ground-borne vibration criteria for different categories of land use.

Table 2-3: FTA Ground-borne Vibration Impact Criteria[1]

Land Use Category	Vibration Velocity Impact Levels		Ground-Borne Noise Impact Levels	
	Frequent Events[2]	Infrequent Events[3]	Frequent Events[2]	Infrequent Events[3]
Category 1: Buildings where low ambient vibration is essential for interior operations	65 VdB[4]	65 VdB[4]	NA[5]	NA[5]
Category 2: Residences and Buildings where people normally sleep	72 VdB	80 VdB	35 dBA	43 dBA
Category 3: Institutional land uses with primarily daytime use	75 VdB	83 VdB	40 dBA	48 dBA

1. Vibration Levels Expressed in VdB are 1 micro inch/sec and noise levels in dBA.
2. "Frequent Events" is defined as more than 70 vibrations per day. Most rapid transit projects fall into this category.
3. "Infrequent Events" is defined as fewer than 70 vibration events per day. This category includes most commuter rail systems.
4. This criterion limit is based on levels that are acceptable for most moderately sensitive equipment such as optical microscope.
5. Ground-borne noise criteria are generally applicable to vibration generated by wheel-rail interaction in rail projects.

2.2. Existing Noise Conditions

Existing noise levels within the corridor were assessed based on noise measurements collected at representative sites. The communities selected for noise monitoring were chosen based on an extensive review of proposed transit alignments and the location of associated transit facilities such as maintenance and storage facilities. These noise sensitive areas consisted mainly of residential dwellings, and were considered representative properties providing typical ambient noise conditions within the communities bordering the proposed transit alignments.

The overall study area boundaries for the Purple Line noise and vibration assessment covered an area from Bethesda to its extreme westernmost point to New Carrolton at its eastern terminus. Development along the corridor generally is either residential, falling into the FTA Category 2 where nighttime sensitivity to noise is assumed to be of utmost importance and FTA Category 1 land uses where quiet is an essential element of their intended purpose. FTA Category 3 uses are interspersed along the alignments, but are not differentiated from the more-sensitive residential uses. Non-sensitive commercial or industrial land uses are not represented by an FTA land-use category.

Within a given land use category, noise measurements recorded at one site would be representative of existing and future noise conditions at that site and all other sites within that land use category. In addition, some monitoring locations are selected on the basis of site equivalence where the measurement results collected at one site are applied to multiple sites. Physical and operational parameters that would produce the worst-case noise effect—such as train speed, frequency of operation, and distance to track—were accounted for in the determination of representative 24-hour noise measurement sites. In some cases, noise measurement sites could be selected to be representative of a larger cluster of residential dwellings. This occurred when all the properties in a given location shared the following characteristics:

- Proximity to the same noise sources such as BRT roadways and LRT train tracks where maximum exposure to transit noise may potentially occur
- Similar type and density of housing such as single family homes and multi-family housing in apartment complexes
- Properties where the site equivalence criterion can be utilized, so that noise measurement collected at one site are judged to be applicable to multiple sites.

2.2.1. Measured Existing Noise

All of the field measurements were collected in accordance with the procedures described in *Sound Procedures for Measuring Highway Noise* (Report Number FHWA-DP-45-1R May 1996) and in *Transit Noise and Vibration Impact Assessment* (May 2006). A calibrated set of Brüel and Kjær (B & K) noise and vibration measuring equipment was used in the study, including Types 2231, 2238, and 2260 sound level meters fitted with a B & K Type 5155 condenser microphones and windshields for noise monitoring. The B & K 2231 equipment was used for all short-term (30-minute) peak hour noise readings. For collecting long-term noise measurements noise meter instruments suitable for 24-hour noise monitoring were employed These include a 01dB digital

noise analyzer with a calibrated condenser microphone, a Larson Davis 814 Integrated Sound Level Meter and its accessories and several B& K 2238 and B & K 2260 sound level meters fitted with a Type 5155 condenser microphones. Each meter was contained in a weatherproof case, which also contained a large gel cell battery to provide electrical power for an entire 24-hour time period. All noise monitoring were collected under acceptable weather and roadway conditions (rain free days with dry roadway pavements and wind speed less than 12 mph).

Daytime peak hour existing noise levels were recorded at seven FTA Category 1 parks identified within the corridor where quiet is an essential element in their intended use. The short-term noise readings presented in Table 2-4, were recorded during daytime hours for 30-minute durations. The short-term noise readings were further augmented with long-term 24 day-night (Ldn) noise levels determined at 57 representative FTA Category 2 land uses consisting primarily of residential properties identified within close proximity of the proposed Purple Line alignments.

Table 2-4: Existing One Hour Equivalent Noise Levels [Leq (1hr) (dBA)]

Site Number	Description of Noise Measurement Location	Land Use	Date	Time	Leq (1hr) dBA
Park-21	Rock Creek Stream Valley Park	Park	10/04/07	9:10 AM	56
Park-12	Long Branch Park	Park	10/04/07	10:45 AM	51
Park-24A	Sligo Creek Stream Valley Park	Park	10/04/07	9:45 AM	55
Park-24B	Sligo Creek Stream Valley Park	Park	10/04/07	10:15 AM	56
Park-1A	Anacostia River Stream Valley Park	Park	10/02/07	1:30 PM	50
Park-1B	Anacostia River Stream Valley Park	Park	10/03/07	10:00 AM	60
Park-26	West Lanham Hills Park	Park	10/02/07	10:40 AM	63

The MTA requested access to residential properties throughout the corridor to monitor existing noise levels, but received consent from a limited number of property owners. Due to property access restrictions, long-term 24-hour noise measurements were only collected at 23 of the 57 impact assessment sites. Most of the remaining 34 representative sites were determined by the population density method described in the FTA impact assessment manual. However, at a few sites where access was not provided, noise measurements collected at other nearby sites under similar traffic and geographic conditions were averaged to establish ambient levels at these representative properties. Existing noise levels at Sites N-7, N-8 and N-12 along the Interim Georgetown Branch Trail where determined from the noise measurements collected at Sites N-B and N-10A. Similarly, Sites N-4, N-6, N-9, N-11, and N-13 located along Jones Bridge Road were determined by averaging the 24-hour day-night noise levels measured at Sites N-5B and N-10B. The footnotes at the bottom of Table 2-5 identify what representative properties were measured or estimated. The location of each of the representative noise measurement sites are depicted on Figures 2-1A through 2-1D. The noise measurements were collected during the month of October 2007.

Table 2-5: Existing 24 Hour Day-Night (Ldn) Noise Exposure (dBA)

Site Number	Description of Noise Measurement Location	Land Use	2007 Existing Day-Night Noise Levels (Ldn, dBA)
N-1	Woodmont Avenue between Edgemoor Lane and Montgomery Lane, Bethesda	Residential	60[2]
N-2	Woodmont Avenue between Rugby Avenue and Battery Lane, Bethesda	Residential	66[1]
N-3	Commerce Lane between Waverly Street and Pearl Street, Bethesda	Residential	68[1]
N-4	Jones Bridge Road between Maryland Avenue and Gladwyne Court, Bethesda	Residential	68[3]
N-5B	4504 Jones Bridge Road, Bethesda	Residential	64[1]
N-6	North Side Jones Bridge Road between Lancaster Street and Grier Road, Bethesda	Residential	68[3]
N-7	Elm Street between 44th Street and Oakridge Avenue, Bethesda	Residential	60[3]
N-B	4242 East West Highway, Bethesda	Residential	59[1]
N-8	Edgevale Court, Bethesda	Residential	60[3]
N-9	Jones Bridge Road between Hawkins Lane and Platt Ridge Drive, Bethesda	Residential	68[3]
N-10A	Columbia Country Club, adjacent to Georgetown Branch right-of-way, Bethesda	Residential	61[1]
N-10B	Columbia Country Club, adjacent to Jones Bridge Road, Bethesda.	Residential	70[1]
N-11	Jones Bridge Road between Kensington Parkway and Montgomery Avenue, Bethesda	Residential	68[3]
N-12	Manor Road between Connecticut Avenue and Preston Place, Bethesda	Residential	60[3]
N-13	Susanna Lane Just East of Jones Mill Road, Chevy Chase	Residential	68[3]
N-14	Terrace Drive and Freyman Drive, Chevy Chase, adjacent to Georgetown Branch right-of-way,	Residential	55[2]
N-15	Lyttonsville Place, Silver Spring, adjacent to Georgetown Branch right-of-way	Residential	50[2]
N-16	2231 Luzerne Avenue, Silver Spring	Residential	68[1]
N-17	Leonard Drive, Silver Spring	Residential	65[2]
N-18	3rd Avenue between N. Springwood Drive and S. Springwood Drive, Silver Spring	Residential	65[2]
N-19	16th Street between East West Highway and Spring Street, Silver Spring	Residential	65[2]
N-20	Wayne Avenue between Fenwick Lane and Apple Avenue, Silver Spring	Residential	67[1]
N-21	935 Bonifant Street , Silver Spring	Residential	60[1]
N-22	Wayne Avenue between Dartmouth Avenue and Dale Drive, Silver Spring	Residential	55[2]

Table 2-5: Existing 24 Hour Day-Night (Ldn) Noise Exposure (dBA)

Site Number	Description of Noise Measurement Location	Land Use	2007 Existing Day-Night Noise Levels (Ldn, dBA)
N-23	Spring Street between Grove Street and Carroll Lane, Silver Spring	Residential	60[2]
N-24	Wayne Avenue between Cedar Street and Cloverfield Road, Silver Spring	Residential	55[2]
N-25	Wayne Avenue between Mansfield Road and Sligo Creek Parkway, Silver Spring	Residential	55[2]
N-26	Thayer Avenue between Thayer Place and Dale Drive, Silver Spring	Residential	60[2]
N-27	Wayne Avenue between Eton Road and Bradford Road, Silver Spring	Residential	60[2]
N-28	Piney Branch Road at Manchester Road, Silver Spring	Residential	60[2]
N-29	Plymouth Street between Reading Road and Flower Avenue, Silver Spring	Residential	60[2]
N-30	Arliss Street between Flower Avenue and Walden Road, Silver Spring	Residential	60[2]
N-31	Piney Branch Road between Garland Avenue and Baron Street, Silver Spring	Residential	65[2]
N-32	University Boulevard between Bayfield Street and Forston Street, Silver Spring	Residential	65[2]
N-33	University Boulevard between Merrimac Drive and Lebanon Street, Silver Spring	Residential	60[2]
N-34	University Boulevard between 14th Avenue and 15th Avenue, Hyattsville	Residential	65[2]
N-35	University Boulevard between Guilford Road and 23rd Avenue, Hyattsville	Residential	60[2]
N-36	University Boulevard between 24th Avenue and 25th Avenue, Hyattsville	Residential	65[2]
N-37	3322 University Boulevard, Hyattsville	Residential	68[1]
N-38	3416 Tulane Drive, Hyattsville	Residential	59[1]
N-39	UMUC/Inn & Conference Center, University Boulevard, College Park	Residential	53[1]
N-40	Benjamin Hall, Union Drive, College Park	Residential	65[1]
N-40A	Carroll Hall, Preinkert Drive, Collage Park	Residential	64[1]
N-41	Memorial Chapel near Garrett Hall (Dorm), Chapel Drive, Collage Park	Residential	64[1]
N-42	Shriver Lab, Campus Drive, College Park	Residential	66[1]
N-43	Leonardtown Housing, Rossborough Lane, College Park	Residential	67[1]
N-44	6507 Kenilworth Avenue, Riverdale	Residential	68[1]
N-45	Kenilworth Avenue between Rittenhouse Street and Quintana Street, Riverdale	Residential	65[2]
N-46	5442 Powhatan Road, Riverdale	Residential	68[1]

Table 2-5: Existing 24 Hour Day-Night (Ldn) Noise Exposure (dBA)

Site Number	Description of Noise Measurement Location	Land Use	2007 Existing Day-Night Noise Levels (Ldn, dBA)
N-47 (MIHP-8)	6200 Riverdale Road, Riverdale	Church	71[1]
N-48	Riverdale Road between 63rd Avenue and Eastpine Drive, Riverdale	Residential	65[2]
N-49	Riverdale Road between 67th Avenue and 67th Place, Riverdale	Residential	65[2]
N-50	Riverdale Road between Veterans Highway and Auburn Avenue, Riverdale	Residential	64[1]
N-51	6410 Rosalie Lane, Riverdale	Residential	64[1]
N-52	Undeveloped Parcel at end of Patterson Street Residential Neighborhood, Lanham	Residential	63[1]
N-53	Ingraham Street, Hyattsville	Residential	64[1]
N-54	7801 Cross Street, Riverdale	Residential	66[1]
N-55	Decatur Road between Decatur Place and Lanham Drive, Lanham	Residential	50[2]

1. Existing day-night noise levels (Ldn) were determined from 24-hour noise measurements.
2. Existing day-night noise levels (Ldn) were estimated from neighborhood population densities.
3. Existing day-night noise levels (Ldn) were estimated by averaging nearby measured noise levels recorded at properties where access was provided and using these average noise levels as representative of typical ambient noise conditions at monitoring sites exposed to the same roadway conditions where access was not provided.

Figure 2-1A: Noise and Vibration Measurement and Prediction Sites

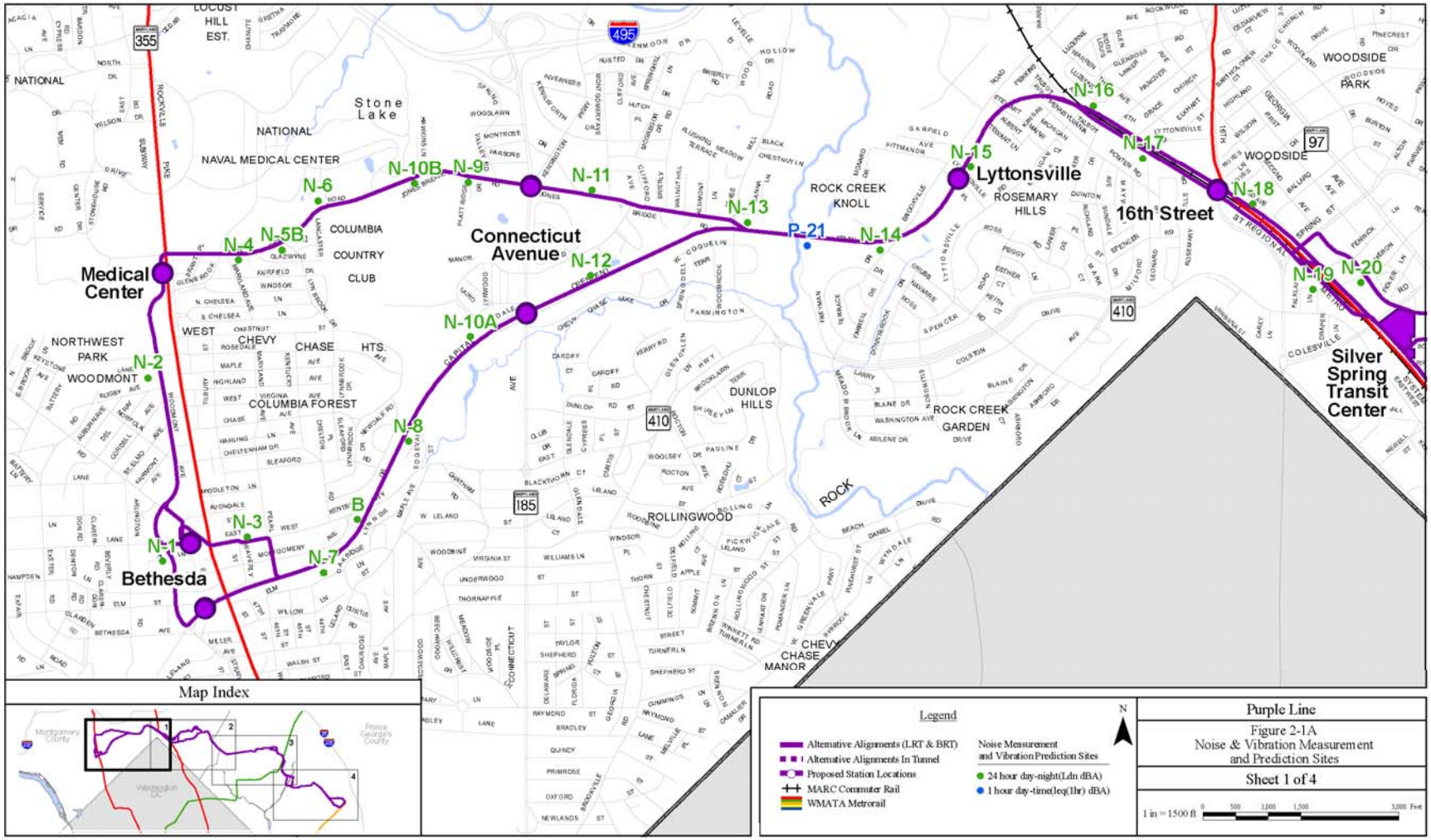


Figure 2-1B: Noise and Vibration Measurement and Prediction Sites

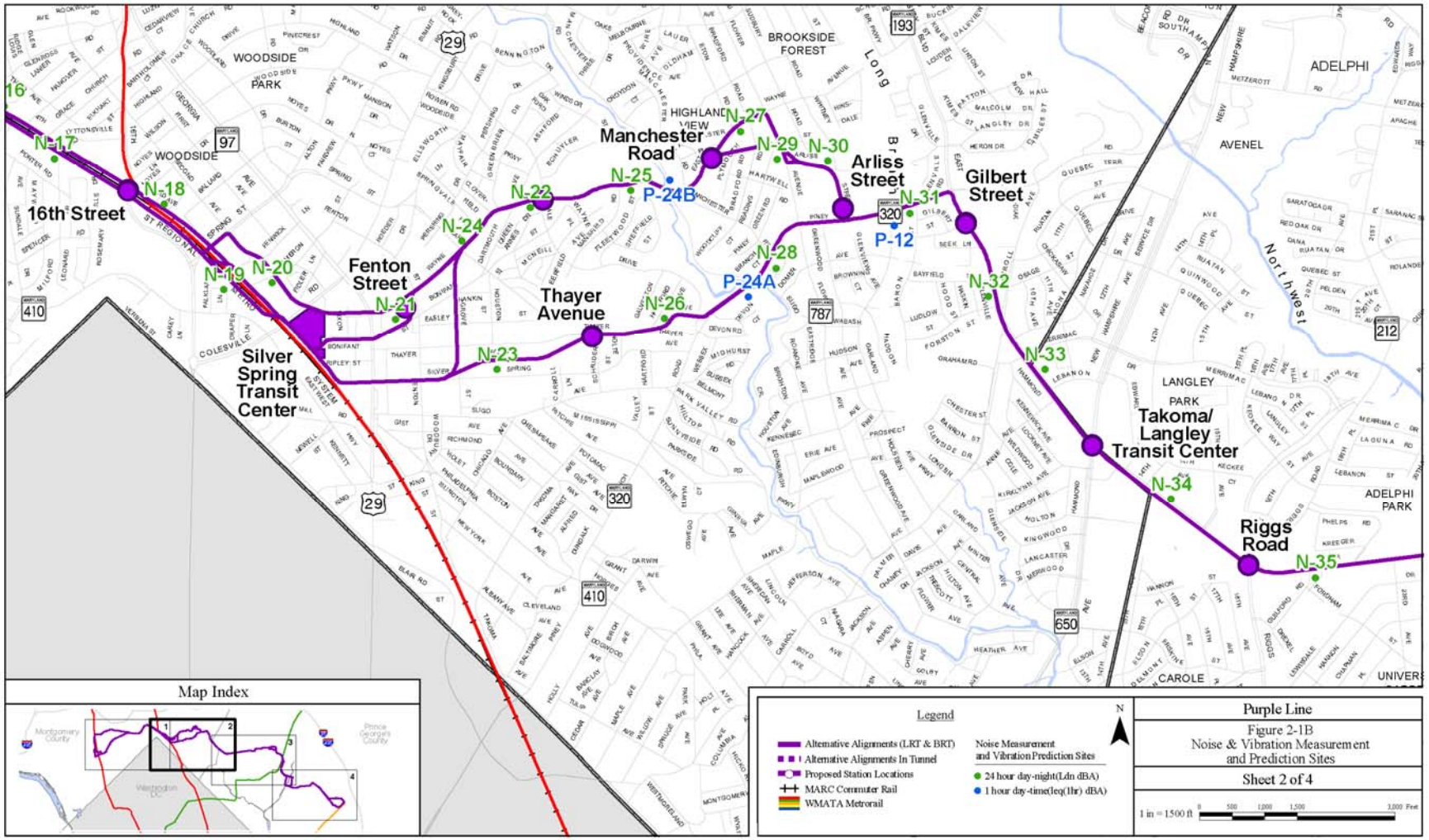


Figure 2-1C: Noise and Vibration Measurement and Prediction Sites

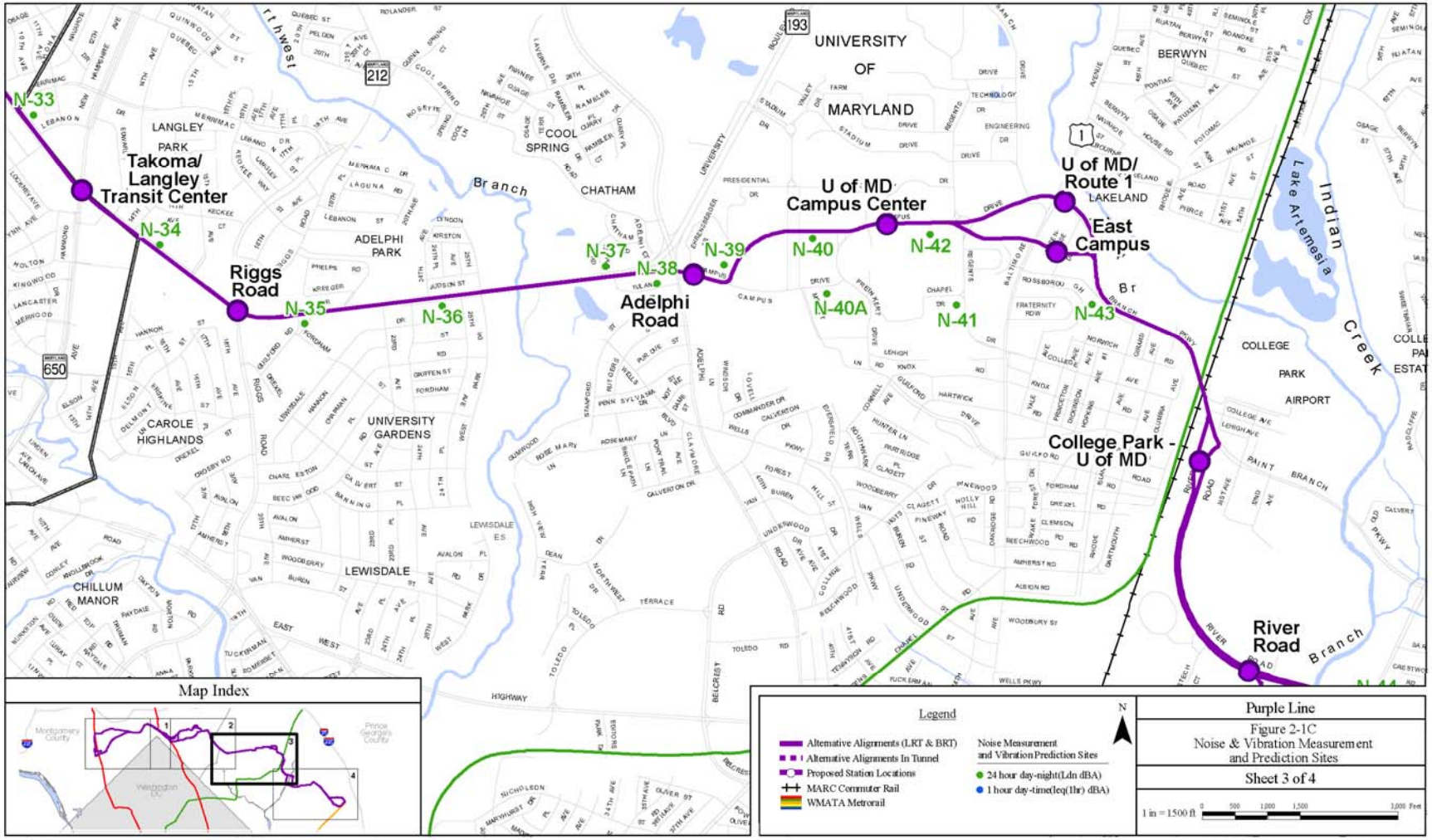
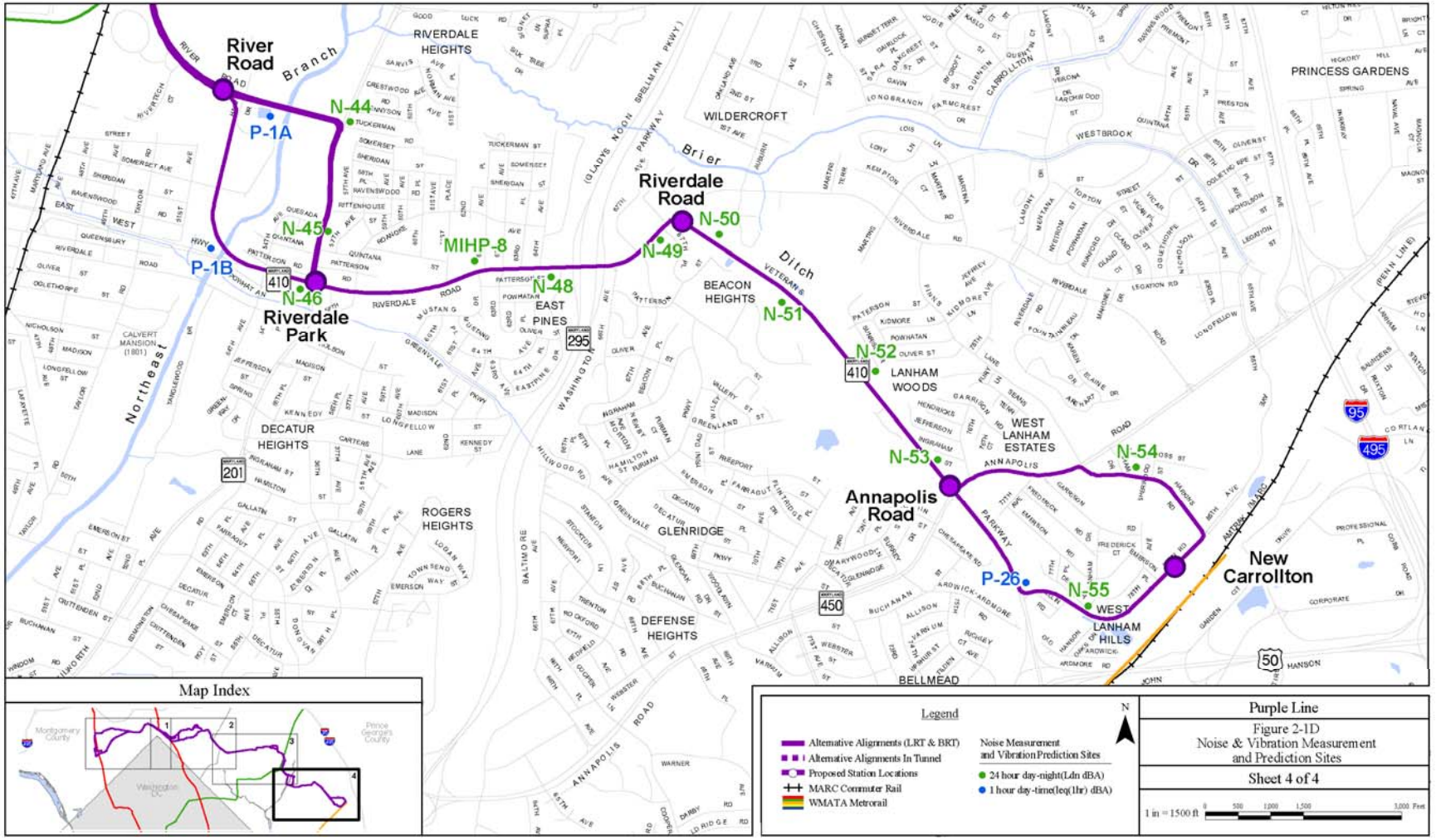


Figure 2-1D: Noise and Vibration Measurement and Prediction Sites



A summary of the 24-hour day-night (Ldn dBA) noise levels at each of the 57 sites along with a brief description of each measurement location and its land use type is provided in Table 2-5. Existing measured day-night (Ldn) noise levels were within typical range for suburban communities varying from 71 dBA at Site N-47 to 53 dBA at Site N-39. Existing day-night Ldn levels estimated using the population density methodology varied from a maximum estimated day-night level of 65 dBA (at Sites N-17, N-18, N-19, N-31, N-32, N-34, N-36, N-45, N-48, and N-49) and a minimum estimated noise level of 50 dBA at site N-15.

2.2.2. Existing Vibration Levels

The FTA impact assessment procedures do not require the measurement of baseline vibration levels to assess potential impacts from project-generated vibration and therefore no existing vibration measurements were recorded. The transit corridors which the proposed BRT and LRT alternatives will transverse are currently exposed to vibrations generated predominately from trucks and buses traveling on existing roadways. Typical vibration levels generated from road traffic movements are generally in the 50 to 60 VdB range, which are below the FTA vibration impact thresholds shown in Table 2-3.

In response to concerns expressed by the University of Maryland, vibration measurements are being taken on the university campus relative to research laboratories in which the equipment is particularly sensitive to vibration.

2.3. Environmental Consequences

This section discusses the potential noise and vibration impacts expected as a result of future construction and operation of the Purple Line as they would be experienced in the immediate vicinity of the right-of-way. Noise and vibration impacts were evaluated for activities associated with Purple Line operations, and maintenance and storage facilities. In addition, locations where wheel squeal noise generated by rail vehicles in tight curves were identified. Project construction noise and vibration are qualitatively evaluated and discussed. Noise exposures and ground-borne vibration were determined and assessed following FTA procedures and criteria.

2.3.1. Expected Noise Exposures: Line Operations

Noise from line operations was estimated following procedures presented in the FTA 2006 *Transit Noise and Vibration Guidance Manual*. The procedure predicts vehicle noise emissions and quantifies the attenuation of sound as it travels from the vehicle to noise-sensitive receptor locations along the right-of-way. The propagation assumptions generally are conservative and tend to result in over-prediction of noise exposure.

Prediction Procedures

Every noise prediction must characterize three elements: the noise source, the sound propagation path, and the affected noise receptor. In this study, residents along the right-of-way are the primary focus. Schools, churches, libraries, medical facilities, and parkland are also of concern.

The Purple Line service would be provided either by buses with either conventional or hybrid-electric drive systems or by light rail vehicles. For a given type of vehicle, noise emissions depend upon the operating conditions. Operating conditions are characterized for buses by vehicle speed and rate of acceleration, and for rail cars by speed and track type—tie-and-ballast or embedded (i.e., with rails encapsulated in the roadway pavement).

Analysis Inputs and Assumptions

Project-generated noise exposures were determined at 57 representative FTA Category 2 properties, predominately single family residential properties, and at seven FTA Category 1 sites comprised of historic parklands. These noise analysis locations are shown in Figures 2-1A thru 2-1D. Projected project-generated BRT and LRT noise exposure was determined based upon the existing ambient levels found at these representative sites. The existing noise levels determined at each of these properties are summarized in Table 2-5.

Transit line operations for the proposed Purple Line LRT service would be provided by two 90-foot long car trains. BRT service would most likely be provided by 60-foot-long, articulated, diesel/electric hybrid buses. Normal service would be provided for 19 hours of the day during weekdays starting from 5 AM in the morning running all day until 12 AM (midnight) except Friday and Saturday night when service would be provided until 3 AM, thereby providing 22 hours of service during these two days. To provide the most conservative approach the noise analysis was completed for a 22-hour service time period.

Expected vehicle speeds along the transit route would vary depending upon distance from passenger stations and other local conditions. The planned maximum vehicle speed between stations was used in the noise impact estimations. Line operation noise exposures first were computed in terms of a source reference Sound Exposure Level (SEL) of 83 dBA for hybrid buses and 82 dBA for rail cars. The cumulative, day-night average sound level metric then was calculated based upon the expected activity as defined by the line operational data (headways and travel speeds) provided for a given alternative. Day-night noise levels (Ldn) were then determined based on the centerline distance between the transit alternative and each representative property. Distance-adjusted hourly noise level estimates at individual noise measurement sites were determined based on the assumption that the transit vehicles (both LRT and BRT) would be operating on the right-of-way centerline and hourly Leq (1hr) noise levels were then determined based on the centerline distance between the transit alternative and each representative property. At each representative property, for all proposed Build Alternatives, using this procedure the cumulative day-night noise levels (Ldn) were computed from these hourly noise level estimates.

Predicted Noise Levels

Summaries of the transit noise impact assessment findings within the proposed Purple Line corridor for each of the BRT alternatives are presented in Tables 2-6 through 2-8. Noise impacts identified under the various BRT alternatives from line operations indicate that predicted BRT noise levels will result in noise impacts limited to the FTA “Moderate Impact” category under all BRT alternatives. The findings indicate that moderate noise impacts are projected to occur at 3

locations (Sites N-17, N-24, and N-25) under the BRT Low Investment Alternative and at 6 locations (Sites N-17, N-19, N-22, N-24, N-25, and N-30) under the proposed BRT Medium and High Investment Alternatives. Estimated BRT levels were determined to be in the lower end of the impact scale averaging 1 to 3 dBA above the FTA Moderate Impact threshold. These Moderate Impacts are clustered in Montgomery County in the general area of Silver Spring along a section of the CSX corridor, and along a portion of Wayne Avenue ending at Arliss Street. Noise levels within the Capital Cresent Trail were reduced by for 4 decibels because of the presence of 4-foot noise walls which MTA has incorporated into the project build design definition.

Noise levels generated from line operations for each of the proposed LRT alternatives are presented in Table 2-9, Table 2-10, and Table 2-11. The noise analysis findings show that noise generated from LRT operations would be below the FTA impact thresholds throughout the Purple Line corridor due largely to the presence of vehicle skirts placed on all Purple Line light rail vehicles. Vehicle skirts are panels that cover the wheels of light rail vehicles. In addition, the proposed Build alternative design within the Georgetown Branch right-of-way includes the construction of a four-foot retaining wall on one side of the transitway and a four foot noise barrier on the other side which will provide additional noise reduction from light rail vehicles. Both the vehicle skirts and the retaining walls are considered an integral part of the Purple Line project definition. An illustration depicting a LRT transit car with and without a vehicle skirts in shown in Figure 2-2. Because most of the noise generated by LRT operations is from the interaction and friction from the wheels pressing down on the rails as the train moves along, vehicle skirt panels are very effective at reducing the noise generated at the wheel/rail interface. The combined effect of both LRT vehicle skirts and incorporation of walls as part of the LRT alternatives will ensure that noise exposure from LRT operations at nearby adjacent residential communities will stay below the FTA impact threshold throughout the limits of operation of the Purple Line.

A conservative 8-decibel noise reduction was assumed to be achieved from LRT vehicle skirts and 4-decibel noise reduction achieved from four-foot tall retaining walls. LRT estimated noise levels were reduced by 12 decibels within the Georgetown Branch right-of-way and 8 decibels for all other sections within the Purple Line corridor.

Table 2-6: Summary of Estimated Noise Levels and Impact Assessment for the Low Investment BRT Alternative

Site #	Description	Approximate Distance to BRT Roadway	2007 Existing Noise	FTA Moderate Impact Thresholds Level	FTA Severe Impact Thresholds Level	Project-Generated Noise Impact Assessment
		feet	Ldn	Ldn	Ldn	Ldn Level
N-2	Woodmont Avenue between Rugby Avenue and Battery Lane, Bethesda	35	66[2]	62	68	54 No Impact
N-4	Jones Bridge Road between Maryland Avenue and Gladwyne Court, Bethesda	80	68[4]	63	69	48 No Impact
N-5B	4504 Jones Bridge Road, Bethesda	90	64[2]	61	66	50 No Impact
N-6	North Side Jones Bridge Road between Lancaster Street and Grier Road, Bethesda	122	68[4]	63	69	48 No Impact
N-9	Jones Bridge Road between Hawkins Lane and Platt Ridge Drive, Bethesda	50	68[4]	63	69	54 No Impact
N-10B	Columbia Country Club, adjacent to Jones Bridge Road, Bethesda.	80	70[2]	65	70	51 No Impact
N-11	Jones Bridge Road between Kensington Parkway and Montgomery Avenue, Bethesda	90	68[4]	63	69	53 No Impact
N-13	Susanna Lane Just East of Jones Mill Road, Chevy Chase	95	68[4]	63	69	48 No Impact
N-14	Terrace Drive and Freyman Drive, Chevy Chase, adjacent to Georgetown Branch right-of-way,	65	55[3]	56	62	51 No Impact
N-15	Lyttonsville Place, Silver Spring, adjacent to Georgetown Branch right-of-way	110	50[3]	54	60	50 No Impact
Park-21	Rock Creek Stream Valley Park	100	56[5]	61[5]	68[5]	47[5] No Impact
N-16	2231 Luzerne Avenue, Silver Spring	135	68[2]	63	69	52 No Impact

Table 2-6: Summary of Estimated Noise Levels and Impact Assessment for the Low Investment BRT Alternative

Site #	Description	Approximate Distance to BRT Roadway	2007 Existing Noise	FTA Moderate Impact Thresholds Level	FTA Severe Impact Thresholds Level	Project-Generated Noise Impact Assessment
		feet	Ldn	Ldn	Ldn	Ldn Level
N-17	Leonard Drive, Silver Spring	30	65[3]	61	67	62 MODERATE IMPACT
N-18	3rd Avenue between N. Springwood Drive and S. Springwood Drive, Silver Spring	165	65[3]	61	67	45 No Impact
N-20	Wayne Avenue between Fenwick Lane and Apple Avenue, Silver Spring	40	67[2]	63	68	59 No Impact
N-24	Wayne Avenue between Cedar Street and Cloverfield Road, Silver Spring	60	55[3]	56	62	56 MODERATE IMPACT
N-22	Wayne Avenue between Dartmouth Avenue and Dale Drive, Silver Spring	70	55[3]	56	62	55 No Impact
N-25	Wayne Avenue between Mansfield Road and Sligo Creek Parkway, Silver Spring	50	55[3]	56	62	58 MODERATE IMPACT
N-27	Wayne Avenue between Eton Road and Bradford Road, Silver Spring	55	60[3]	58	64	54 No Impact
N-29	Plymouth Street between Reading Road and Flower Avenue, Silver Spring	75	60[3]	58	64	52 No Impact
N-30	Arliss Street between Flower Avenue and Walden Road, Silver Spring	65	60[3]	58	64	52 No Impact
N-31	Piney Branch Road between Garland Avenue and Baron Street, Silver Spring	65	65[3]	61	67	52 No Impact
Park-12	Long Branch Park	90	51[5]	59[5]	66[5]	52[5] No Impact

Table 2-6: Summary of Estimated Noise Levels and Impact Assessment for the Low Investment BRT Alternative

Site #	Description	Approximate Distance to BRT Roadway	2007 Existing Noise	FTA Moderate Impact Thresholds Level	FTA Severe Impact Thresholds Level	Project-Generated Noise Impact Assessment
		feet	Ldn	Ldn	Ldn	Ldn Level
Park-24B	Sligo Creek Stream Valley Park	100	56[5]	61[5]	68[5]	50[5] No Impact
N-32	University Boulevard between Bayfield Street and Forston Street, Silver Spring	95	65[3]	61	67	47 No Impact
N-33	University Boulevard between Merrimac Drive and Lebanon Street, Silver Spring	130	60[3]	58	64	49 No Impact
N-34	University Boulevard between 14th Avenue and 15th Avenue, Hyattsville	90	65[3]	61	67	51 No Impact
N-35	University Boulevard between Guilford Road and 23rd Avenue, Hyattsville	113	60[3]	58	64	51 No Impact
N-36	University Boulevard between 24th Avenue and 25th Avenue, Hyattsville	95	65[3]	61	67	52 No Impact
N-37	3322 University Boulevard, Hyattsville	110	68[2]	63	69	51 No Impact
N-38	3416 Tulane Drive, Hyattsville	150	59[2]	58	64	49 No Impact
N-39	UMUC/Inn & Conference Center, University Boulevard, College Park	150	53[2]	55	61	48 No Impact
N-40	Benjamin Hall, Union Drive, College Park	45	65[2]	61	67	56 No Impact
N-42	Shriver Lab, Campus Drive, College Park	40	66[2]	62	68	57 No Impact
N-43	Leonardtown Housing, Rossborough Lane, College Park	40	67[2]	63	68	59 No Impact

Table 2-6: Summary of Estimated Noise Levels and Impact Assessment for the Low Investment BRT Alternative

Site #	Description	Approximate Distance to BRT Roadway	2007 Existing Noise	FTA Moderate Impact Thresholds Level	FTA Severe Impact Thresholds Level	Project-Generated Noise Impact Assessment
		feet	Ldn	Ldn	Ldn	Ldn Level
N-44	6507 Kenilworth Avenue, Riverdale	175	68[2]	63	69	47 No Impact
N-45	Kenilworth Avenue between Rittenhouse Street and Quintana Street, Riverdale	110	65[3]	61	67	50 No Impact
N-46	5442 Powhatan Road, Riverdale	230	68[2]	63	69	45 No Impact
MIHP-8 (N-47)	6200 Riverdale Road, Riverdale	100	71[2]	66	71	51 No Impact
N-48	Riverdale Road between 63rd Avenue and East Pine Drive, Riverdale	65	65[3]	61	67	53 No Impact
N-49	Riverdale Road between 67th Avenue and 67th Place, Riverdale	65	65[3]	61	67	53 No Impact
Park-1A	Anacostia River Stream Valley Park	100	50[5]	59[5]	65[5]	49[5] No Impact
N-50	Riverdale Road between Veterans Highway and Auburn Avenue, Riverdale	125	64[4]	61	66	52 No Impact
N-51	6410 Rosalie Lane, Riverdale	220	64[2]	61	66	48 No Impact
N-52	Undeveloped Parcel at end of Patterson Street Residential Neighborhood, Lanham	205	63[2]	60	66	48 No Impact
N-53	Ingraham Street, Hyattsville	150	64[4]	61	66	50 No Impact
N-54	7801 Cross Street, Riverdale	185	66[2]	62	68	47 No Impact

1. Under the FTA criteria, for land uses not involving sleep (non-residential land use) peak hour Leq was used for assessment purposes.

2. Existing noise levels (Ldn) were estimated from 24-hour noise measurements.
3. Existing noise levels (Ldn) were estimated from neighborhood population densities.
4. Existing day-night noise levels (Ldn) were estimated by averaging nearby measured noise levels recorded at properties where access was provided and using these average noise levels as representative of typical ambient noise conditions at monitoring sites exposed to the same roadway conditions where access was not provided.
5. Existing noise levels (Leq) for Parks were based on 1-hour noise measurements and impact assessment is based on peak hour FTA Category 3 impact criteria.
6. Land use at each site is residential except for Park-21, Park 24B, Park-1A & Park-12.
7. Headways of 6 minutes from 5 AM to 9 AM and 3 PM to 8 PM, 8 minutes from 9 AM to 10 AM, and 12 minutes from 10 AM to 3 PM and 8 PM to midnight, and 15 minutes from midnight to 3 AM were used for the impact assessment.

Table 2-7: Summary of Estimated Noise Levels and Impact Assessment for the Medium Investment BRT Alternative

Site #	Description	Approximate Distance to BRT Roadway	2007 Existing Noise	FTA Moderate Impact Thresholds Level	FTA Severe Impact Thresholds Level	Project-Generated Noise Impact Assessment
		feet	Ldn	Ldn	Ldn	Ldn Level
N-1	Woodmont Avenue between Edgemoor Lane and Montgomery Lane, Bethesda	45	60[3]	58	64	55 No Impact
N-3	Commerce Lane between Waverly Street and Pearl Street, Bethesda	50	68[2]	63	69	53 No Impact
N-7	Elm Street between 44th Street and Oakridge Avenue, Bethesda	105	60[4]	58	64	45 No Impact
N-B	4242 East West Highway, Bethesda	40	59[2]	58	64	53 No Impact
N-8	Edgevale Court, Bethesda	55	60[4]	58	64	51 No Impact
N-10A	Columbia Country Club, adjacent to Georgetown Branch right-of-way, Bethesda.	25	61[2]	59	65	56 No Impact
N-12	Manor Road between Connecticut Avenue and Preston Place, Bethesda	70	60[4]	58	64	53 No Impact
N-14	Terrace Drive and Freyman Drive, Chevy Chase, adjacent to Georgetown Branch right-of-way,	55	55[3]	56	62	55 No Impact
N-15	Lyttonsville Place, Silver Spring, adjacent to Georgetown Branch right-of-way	110	50[3]	54	60	50 No Impact
Park-21	Rock Creek Stream Valley Park	100	56[5]	61[5]	68[5]	47[5] No Impact
N-16	2231 Luzerne Avenue, Silver Spring	135	68[2]	63	69	52 No Impact
N-17	Leonard Drive, Silver Spring	30	65[3]	61	67	62 MODERATE IMPACT

Table 2-7: Summary of Estimated Noise Levels and Impact Assessment for the Medium Investment BRT Alternative

Site #	Description	Approximate Distance to BRT Roadway	2007 Existing Noise	FTA Moderate Impact Thresholds Level	FTA Severe Impact Thresholds Level	Project-Generated Noise Impact Assessment
		feet	Ldn	Ldn	Ldn	Ldn Level
N-18	3rd Avenue between N. Springwood Drive and S. Springwood Drive, Silver Spring	165	65[3]	61	67	45 No Impact
N-19	16th Street between East West Highway and Spring Street, Silver Spring	30	65[3]	61	67	61 MODERATE IMPACT
N-24	Wayne Avenue between Cedar Street and Cloverfield Road, Silver Spring	55	55[3]	56	62	59 MODERATE IMPACT
N-22	Wayne Avenue between Dartmouth Avenue and Dale Drive, Silver Spring	70	55[3]	56	62	57 MODERATE IMPACT
N-25	Wayne Avenue between Mansfield Road and Sligo Creek Parkway, Silver Spring	55	55[3]	56	62	59 MODERATE IMPACT
N-27	Wayne Avenue between Eton Road and Bradford Road, Silver Spring	55	60[3]	58	64	54 No Impact
N-29	Plymouth Street between Reading Road and Flower Avenue, Silver Spring	75	60[3]	58	64	52 No Impact
N-30	Arliss Street between Flower Avenue and Walden Road, Silver Spring	50	60[3]	58	64	59 MODERATE IMPACT
N-31	Piney Branch Road between Garland Avenue and Baron Street, Silver Spring	60	65[3]	61	67	53 No Impact
Park-24B	Sligo Creek Stream Valley Park	100	56[5]	61[5]	68[5]	53[5] No Impact

Table 2-7: Summary of Estimated Noise Levels and Impact Assessment for the Medium Investment BRT Alternative

Site #	Description	Approximate Distance to BRT Roadway	2007 Existing Noise	FTA Moderate Impact Thresholds Level	FTA Severe Impact Thresholds Level	Project-Generated Noise Impact Assessment
		feet	Ldn	Ldn	Ldn	Ldn Level
Park-12	Long Branch Park	90	51[5]	59[5]	66[5]	50[5] No Impact
N-32	University Boulevard between Bayfield Street and Forston Street, Silver Spring	100	65[3]	61	67	47 No Impact
N-33	University Boulevard between Merrimac Drive and Lebanon Street, Silver Spring	130	60[3]	58	64	51 No Impact
N-34	University Boulevard between 14th Avenue and 15th Avenue, Hyattsville	85	65[3]	61	67	54 No Impact
N-35	University Boulevard between Guilford Road and 23rd Avenue, Hyattsville	100	60[3]	58	64	52 No Impact
N-36	University Boulevard between 24th Avenue and 25th Avenue, Hyattsville	95	65[3]	61	67	52 No Impact
N-37	3322 University Boulevard, Hyattsville	100	68[2]	63	69	52 No Impact
N-40A	Carroll Hall, Preinkert Drive, College Park	60	64[2]	61	66	58 No Impact
N-41	Memorial Chapel, Chapel Drive, College Park	60	64[2]	61	66	58 No Impact
N-43	Leonardtown Housing, Rossborough Lane, College Park	40	67[2]	63	68	59 No Impact
N-44	6507 Kenilworth Avenue, Riverdale	175	68[2]	63	69	47 No Impact
N-45	Kenilworth Avenue between Rittenhouse Street and Quintana Street, Riverdale	110	65[3]	61	67	50 No Impact

Table 2-7: Summary of Estimated Noise Levels and Impact Assessment for the Medium Investment BRT Alternative

Site #	Description	Approximate Distance to BRT Roadway	2007 Existing Noise	FTA Moderate Impact Thresholds Level	FTA Severe Impact Thresholds Level	Project-Generated Noise Impact Assessment
		feet	Ldn	Ldn	Ldn	Ldn Level
N-46	5442 Powhatan Road, Riverdale	230	68[2]	63	69	45 No Impact
MIHP-8 (N-47)	6200 Riverdale Road, Riverdale	85	71[2]	66	71	55 No Impact
N-48	Riverdale Road between 63rd Avenue and Eastpine Drive, Riverdale	65	65[3]	61	67	57 No Impact
N-49	Riverdale Road between 67th Avenue and 67th Place, Riverdale	65	65[3]	61	67	57 No Impact
Park-1A	Anacostia River Stream Valley Park	100	50[5]	59[5]	65[5]	49[5] No Impact
N-50	Riverdale Road between Veterans Highway and Auburn Avenue, Riverdale	125	64[4]	61	66	52 No Impact
N-51	6410 Rosalie Lane, Riverdale	220	64[2]	61	66	48 No Impact
N-52	Undeveloped Parcel at end of Patterson Street Residential Neighborhood, Lanham	205	63[2]	60	66	48 No Impact
N-53	Ingraham Street, Hyattsville	150	64[4]	61	66	50 No Impact
N-55	Decatur Road between Decatur Place and Lanham Drive, Lanham	150	50[3]	54	60	48 No Impact
Park-26	West Lanham Hills Park	150	63[5]	65[5]	71[5]	47[5] No Impact

1. Under the FTA criteria, for land uses not involving sleep (non-residential land use) peak hour Leq was used for assessment purposes.
2. Existing noise levels (Ldn) were estimated from 24-hour noise measurements.
3. Existing noise levels (Ldn) were estimated from neighborhood population densities.
4. Existing day-night noise levels (Ldn) were estimated by averaging nearby measured noise levels recorded at properties where access was provided and using these average noise levels as

representative of typical ambient noise conditions at monitoring sites exposed to the same roadway conditions where access was not provided.

5. Existing noise levels (Leq) for Parks were based on 1-hour noise measurements and impact assessment is based on peak hour FTA Category 3 impact criteria.
6. Land use at each site is residential except for Park-21, Park -24B & Park-26.
7. Headways of 6 minutes from 5 AM to 9 AM and 3 PM to 8 PM, 8 minutes from 9 AM to 10 AM, and 12 minutes from 10 AM to 3 PM and 8 PM to midnight, and 15 minutes from midnight to 3 AM were used for the impact assessment.

Table 2-8: Summary of Estimated Noise Levels and Impact Assessment for the High Investment BRT Alternative

Site #	Description	Approximate Distance to BRT Roadway	2007 Existing Noise	FTA Moderate Impact Thresholds Level	FTA Severe Impact Thresholds Level	Project-Generated Noise Impact Assessment
		feet	Ldn	Ldn	Ldn	Ldn Level
N-1	Woodmont Avenue between Edgemoor Lane and Montgomery Lane, Bethesda	45	60[3]	58	64	55 No Impact
N-3	Commerce Lane between Waverly Street and Pearl Street, Bethesda	50	68[2]	63	69	52 No Impact
N-7	Elm Street between 44th Street and Oakridge Avenue, Bethesda	105	60[4]	58	64	45 No Impact
N-B	4242 East West Highway, Bethesda	40	59[2]	58	64	53 No Impact
N-8	Edgevale Court, Bethesda	55	60[4]	58	64	51 No Impact
N-10A	Columbia Country Club, adjacent to Georgetown Branch right-of-way, Bethesda.	25	61[2]	59	65	56 No Impact
N-12	Manor Road between Connecticut Avenue and Preston Place, Bethesda	70	60[4]	58	64	53 No Impact
N-14	Terrace Drive and Freyman Drive, Chevy Chase, adjacent to Georgetown Branch right-of-way,	55	55[3]	56	62	55 No Impact
N-15	Lyttonsville Place, Silver Spring, adjacent to Georgetown Branch right-of-way	110	50[3]	54	60	50 No Impact
Park-21	Rock Creek Stream Valley Park	100	56[5]	61[5]	68[5]	49[5] No Impact
Park-12	Long Branch Park	90	51[5]	59[5]	66[5]	50[5] No Impact
N-16	2231 Luzerne Avenue, Silver Spring	135	68[2]	63	69	52 No Impact

Table 2-8: Summary of Estimated Noise Levels and Impact Assessment for the High Investment BRT Alternative

Site #	Description	Approximate Distance to BRT Roadway	2007 Existing Noise	FTA Moderate Impact Thresholds Level	FTA Severe Impact Thresholds Level	Project-Generated Noise Impact Assessment
		feet	Ldn	Ldn	Ldn	Ldn Level
N-17	Leonard Drive, Silver Spring	25	65[3]	61	67	63 Moderate Impact
N-18	3rd Avenue between N. Springwood Drive and S. Springwood Drive, Silver Spring	165	65[3]	61	67	50 No Impact
N-19	16th Street between East West Highway and Spring Street, Silver Spring	30	65[3]	61	67	61 Moderate Impact
N-24	Wayne Avenue between Cedar Street and Cloverfield Road, Silver Spring	55	55[3]	56	62	59 Moderate Impact
N-22	Wayne Avenue between Dartmouth Avenue and Dale Drive, Silver Spring	70	55[3]	56	62	57 Moderate Impact
N-25	Wayne Avenue between Mansfield Road and Sligo Creek Parkway, Silver Spring	55	55[3]	56	62	59 Moderate Impact
N-30	Arliss Street between Flower Avenue and Walden Road, Silver Spring	50	60[3]	58	64	59 Moderate Impact
N-31	Piney Branch Road between Garland Avenue and Baron Street, Silver Spring	60	65[3]	61	67	54 No Impact
Park-24B	Sligo Creek Stream Valley Park	100	56[5]	61[5]	68[5]	53[5] No Impact

Table 2-8: Summary of Estimated Noise Levels and Impact Assessment for the High Investment BRT Alternative

Site #	Description	Approximate Distance to BRT Roadway	2007 Existing Noise	FTA Moderate Impact Thresholds Level	FTA Severe Impact Thresholds Level	Project-Generated Noise Impact Assessment
		feet	Ldn	Ldn	Ldn	Ldn Level
N-32	University Boulevard between Bayfield Street and Forston Street, Silver Spring	100	65[3]	61	67	47 No Impact
N-33	University Boulevard between Merrimac Drive and Lebanon Street, Silver Spring	130	60[3]	58	64	51 No Impact
N-34	University Boulevard between 14th Avenue and 15th Avenue, Hyattsville	85	65[3]	61	67	54 No Impact
N-35	University Boulevard between Guilford Road and 23rd Avenue, Hyattsville	100	60[3]	58	64	52 No Impact
N-36	University Boulevard between 24th Avenue and 25th Avenue, Hyattsville	95	65[3]	61	67	52 No Impact
N-37	3322 University Boulevard, Hyattsville	100	68[2]	63	69	52 No Impact
N-39	UMUC/Inn & Conference Center, University Boulevard, College Park	150	53[2]	55	61	48 No Impact
N-40	Benjamin Hall, Union Drive, C7llege Park	45	65[2]	61	67	55 No Impact
N-43	Leonardtown Housing, Rossborough Lane, College Park	40	67[2]	63	68	59 No Impact
N-46	5442 Powhatan Road, Riverdale	140	68[2]	63	69	50 No Impact
MIHP-8 (N-47)	6200 Riverdale Road, Riverdale	85	71[2]	66	71	55 No Impact
N-48	Riverdale Road between 63rd Avenue and Eastpine Drive, Riverdale	65	65[3]	61	67	57 No Impact

Table 2-8: Summary of Estimated Noise Levels and Impact Assessment for the High Investment BRT Alternative

Site #	Description	Approximate Distance to BRT Roadway	2007 Existing Noise	FTA Moderate Impact Thresholds Level	FTA Severe Impact Thresholds Level	Project-Generated Noise Impact Assessment
		feet	Ldn	Ldn	Ldn	Ldn Level
N-49	Riverdale Road between 67th Avenue and 67th Place, Riverdale	65	65[3]	61	67	57 No Impact
N-50	Riverdale Road between Veterans Highway and Auburn Avenue, Riverdale	125	64[4]	61	66	51 No Impact
N-51	6410 Rosalie Lane, Riverdale	220	64[2]	61	66	48 No Impact
N-52	Undeveloped Parcel at end of Patterson Street Residential Neighborhood, Lanham	205	63[2]	60	66	48 No Impact
N-53	Ingraham Street, Hyattsville	150	64[4]	61	66	50 No Impact
N-55	Decatur Road between Decatur Place and Lanham Drive, Lanham	150	50[3]	54	60	48 No Impact
Park-26	West Lanham Hills Park	150	63[5]	65[5]	71[5]	47[5] No Impact

1. Under the FTA criteria, for land uses not involving sleep (non-residential land use) peak hour Leq was used for assessment purposes.
2. Existing noise levels (Ldn) were estimated from 24-hour noise measurements.
3. Existing noise levels (Ldn) were estimated from neighborhood population densities.
4. Existing day-night noise levels (Ldn) were estimated by averaging nearby measured noise levels recorded at properties where access was provided and using these average noise levels as representative of typical ambient noise conditions at monitoring sites exposed to the same roadway conditions where access was not provided.
5. Existing noise levels (Leq) for Parks were based on 1-hour noise measurements and impact assessment is based on peak hour FTA Category 3 impact criteria.
6. Land use at each site is residential except for Park-21, Park-24B & Park-26.
7. Headways of 6 minutes from 5 AM to 9 AM and 3 PM to 8 PM, 8 minutes from 9 AM to 10 AM, and 12 minutes from 10 AM to 3 PM and 8 PM to midnight, and 15 minutes from midnight to 3 AM were used for the impact assessment.

Table 2-9: Summary of Estimated Noise Levels and Impact Assessment for the Low Investment LRT Alternative

Site #	Description	Approximate Distance to LRT	2007 Existing Noise	FTA Moderate Impact Thresholds Level	FTA Severe Impact Thresholds Level	Project - Generated Noise Impact Assessment
		feet	Ldn	Ldn	Ldn	Ldn Level
N-7	Elm Street between 44th Street and Oakridge Avenue, Bethesda	105	60[4]	58	64	46 No Impact
N-B	4242 East West Highway, Bethesda	40	59[2]	58	64	52 No Impact
N-8	Edgevale Court, Bethesda	35	60[4]	58	64	54 No Impact
N-10A	Columbia Country Club, adjacent to Georgetown Branch right-of-way, Bethesda.	36	61[2]	59	65	53 No Impact
N-12	Manor Road between Connecticut Avenue and Preston Place, Bethesda	65	60[4]	58	64	52 No Impact
N-14	Terrace Drive and Freyman Drive, Chevy Chase, adjacent to Georgetown Branch right-of-way,	50	55[3]	56	62	48 No Impact
N-15	Lyttonsville Place, Silver Spring, adjacent to Georgetown Branch right-of-way	70	50[3]	54	60	43 No Impact
Park-21	Rock Creek Stream Valley Park	100	56[5]	61[5]	68[5]	49[5] No Impact
N-16	2231 Luzerne Avenue, Silver Spring	90	68[2]	63	69	51 No Impact
N-17	Leonard Drive, Silver Spring	115	65[3]	61	67	49 No Impact
N-18	3rd Avenue between N. Springwood Drive and S. Springwood Drive, Silver Spring	50	65[3]	61	67	50 No Impact
N-19	16th Street between East West Highway and Spring Street, Silver Spring	160	65[3]	61	67	42 No Impact

Table 2-9: Summary of Estimated Noise Levels and Impact Assessment for the Low Investment LRT Alternative

Site #	Description	Approximate Distance to LRT	2007 Existing Noise	FTA Moderate Impact Thresholds Level	FTA Severe Impact Thresholds Level	Project - Generated Noise Impact Assessment
		feet	Ldn	Ldn	Ldn	Ldn Level
N-21	935 Bonifant Street , Silver Spring	35	60[2]	58	64	44 No Impact
N-24	Wayne Avenue between Cedar Street and Cloverfield Road, Silver Spring	60	55[3]	56	62	44 No Impact
N-22	Wayne Avenue between Dartmouth Avenue and Dale Drive, Silver Spring	75	55[3]	56	62	43 No Impact
N-25	Wayne Avenue between Mansfield Road and Sligo Creek Parkway, Silver Spring	50	55[3]	56	62	45 No Impact
N-30	Arliss Street between Flower Avenue and Walden Road, Silver Spring	70	60[3]	58	64	48 No Impact
N-31	Piney Branch Road between Garland Avenue and Baron Street, Silver Spring	65	65[3]	61	67	43 No Impact
Park-24B	Sligo Creek Stream Valley Park	100	56[5]	61[5]	68[5]	47[5] No Impact
Park-12	Long Branch Park	90	51[5]	59[5]	66[5]	48[5] No Impact
N-32	University Boulevard between Bayfield Street and Forston Street, Silver Spring	100	65[3]	61	67	45 No Impact
N-33	University Boulevard between Merrimac Drive and Lebanon Street, Silver Spring	130	60[3]	58	64	45 No Impact
N-34	University Boulevard between 14th Avenue and 15th Avenue, Hyattsville	85	65[3]	61	67	43 No Impact
N-35	University Boulevard between Guilford Road and 23rd Avenue, Hyattsville	100	60[3]	58	64	43 No Impact

Table 2-9: Summary of Estimated Noise Levels and Impact Assessment for the Low Investment LRT Alternative

Site #	Description	Approximate Distance to LRT	2007 Existing Noise	FTA Moderate Impact Thresholds Level	FTA Severe Impact Thresholds Level	Project - Generated Noise Impact Assessment
		feet	Ldn	Ldn	Ldn	Ldn Level
N-36	University Boulevard between 24th Avenue and 25th Avenue, Hyattsville	90	65[3]	61	67	44 No Impact
N-37	3322 University Boulevard, Hyattsville	100	38[2]	63	69	43 No Impact
N-40	Benjamin Hall, Union Drive, College Park	45	65[2]	61	67	46 No Impact
N-42	Shriver Lab, Campus Drive, College Park	40	66[2]	62	68	45 No Impact
N-43	Leonardtown Housing, Rossborough Lane, College Park	120	67[2]	63	68	43 No Impact
N-44	6507 Kenilworth Avenue, Riverdale	130	68[2]	63	69	40 No Impact
N-45	Kenilworth Avenue between Rittenhouse Street and Quintana Street, Riverdale	120	65[3]	61	67	41 No Impact
N-46	5442 Powhatan Road, Riverdale	210	68[2]	63	69	37 No Impact
MIHP-8 (N-47)	6200 Riverdale Road, Riverdale	85	71[2]	66	71	42 No Impact
N-48	Riverdale Road between 63rd Avenue and Eastpine Drive, Riverdale	65	65[3]	61	67	44 No Impact
N-49	Riverdale Road between 67th Avenue and 67th Place, Riverdale	35	65[3]	61	67	48 No Impact
Park-1A	Anacostia River Stream Valley Park	100	50[5]	59[5]	65[5]	40[5] No Impact

Table 2-9: Summary of Estimated Noise Levels and Impact Assessment for the Low Investment LRT Alternative

Site #	Description	Approximate Distance to LRT	2007 Existing Noise	FTA Moderate Impact Thresholds Level	FTA Severe Impact Thresholds Level	Project - Generated Noise Impact Assessment
		feet	Ldn	Ldn	Ldn	Ldn Level
N-50	Riverdale Road between Veterans Highway and Auburn Avenue, Riverdale	125	64[4]	61	66	42 No Impact
N-51	6410 Rosalie Lane, Riverdale	220	64[2]	61	66	39 No Impact
N-52	Undeveloped Parcel at end of Patterson Street Residential Neighborhood, Lanham	200	63[2]	60	66	39 No Impact
N-53	Ingraham Street, Hyattsville	150	64[4]	61	66	45 No Impact
N-54	7801 Cross Street, Riverdale	235	66[2]	62	68	35 No Impact

1. Under the FTA criteria, for land uses not involving sleep (non-residential land use) peak hour Leq was used for assessment purposes.
2. Existing noise levels (Ldn) were estimated from 24-hour noise measurements.
3. Existing noise levels (Ldn) were estimated from neighborhood population densities.
4. Existing day-night noise levels (Ldn) were estimated by averaging nearby measured noise levels recorded at properties where access was provided and using these average noise levels as representative of typical ambient noise conditions at monitoring sites exposed to the same roadway conditions where access was not provided.
5. Existing noise levels (Leq) for Parks were based on 1-hour noise measurements and impact assessment is based on peak hour FTA Category 3 impact criteria.
6. Land use at each site is residential except for Park-21, Park -24B, and Park-1A & Park-12.
7. Headways of 6 minutes from 5 AM to 9 AM and 3 PM to 8 PM, 8 minutes from 9 AM to 10 AM, and 12 minutes from 10 AM to 3 PM and 8 PM to midnight, and 15 minutes from midnight to 3 AM were used for the impact assessment.

Table 2-10: Summary of Estimated Noise Levels and Impact Assessment for the Medium Investment LRT Alternative

Site #	Description	Approximate Distance to LRT	2007 Existing Noise	FTA Moderate Impact Thresholds Level	FTA Severe Impact Thresholds Level	Project - Generated Noise Impact Assessment
		feet	Ldn	Ldn	Ldn	Ldn Level
N-7	Elm Street between 44th Street and Oakridge Avenue, Bethesda	105	60[4]	58	64	46 No Impact
N-B	4242 East West Highway, Bethesda	40	59[2]	58	64	52 No Impact
N-8	Edgevale Court, Bethesda	35	60[4]	58	64	54 No Impact
N-10A	Columbia Country Club, adjacent to Georgetown Branch right-of-way, Bethesda.	36	61[2]	59	65	53 No Impact
N-12	Manor Road between Connecticut Avenue and Preston Place, Bethesda	65	60[4]	58	64	52 No Impact
N-14	Terrace Drive and Freyman Drive, Chevy Chase, adjacent to Georgetown Branch right-of-way,	50	55[3]	56	62	48 No Impact
N-15	Lyttonsville Place, Silver Spring, adjacent to Georgetown Branch right-of-way	70	50[3]	54	60	43 No Impact
Park-21	Rock Creek Stream Valley Park	100	56[5]	61[5]	68[5]	49[5] No Impact
N-16	2231 Luzerne Avenue, Silver Spring	90	68[2]	63	69	47 No Impact
N-17	Leonard Drive, Silver Spring	115	65[3]	61	67	45 No Impact
N-18	3rd Avenue between N. Springwood Drive and S. Springwood Drive, Silver Spring	50	65[3]	61	67	49 No Impact
N-19	16th Street between East West Highway and Spring Street, Silver Spring	160	65[3]	61	67	41 No Impact

Table 2-10: Summary of Estimated Noise Levels and Impact Assessment for the Medium Investment LRT Alternative

Site #	Description	Approximate Distance to LRT	2007 Existing Noise	FTA Moderate Impact Thresholds Level	FTA Severe Impact Thresholds Level	Project - Generated Noise Impact Assessment
		feet	Ldn	Ldn	Ldn	Ldn Level
N-21	935 Bonifant Street , Silver Spring	35	60[2]	58	64	44 No Impact
N-24	Wayne Avenue between Cedar Street and Cloverfield Road, Silver Spring	60	55[3]	56	62	50 No Impact
N-22	Wayne Avenue between Dartmouth Avenue and Dale Drive, Silver Spring	75	55[3]	56	62	49 No Impact
N-25	Wayne Avenue between Mansfield Road and Sligo Creek Parkway, Silver Spring	50	55[3]	56	62	51 No Impact
N-30	Arliss Street between Flower Avenue and Walden Road, Silver Spring	70	60[3]	58	64	48 No Impact
N-31	Piney Branch Road between Garland Avenue and Baron Street, Silver Spring	65	65[3]	61	67	43 No Impact
Park-24B	Sligo Creek Stream Valley Park	100	56[5]	61[5]	68[5]	47[5] No Impact
Park-12	Long Branch Park	90	51[5]	59[5]	67[5]	48[5] No Impact
N-32	University Boulevard between Bayfield Street and Forston Street, Silver Spring	100	65[3]	61	67	35 No Impact
N-33	University Boulevard between Merrimac Drive and Lebanon Street, Silver Spring	130	60[3]	58	64	45 No Impact
N-34	University Boulevard between 14th Avenue and 15th Avenue, Hyattsville	85	65[3]	61	67	43 No Impact
N-35	University Boulevard between Guilford Road and 23rd Avenue, Hyattsville	100	60[3]	58	64	43 No Impact

Table 2-10: Summary of Estimated Noise Levels and Impact Assessment for the Medium Investment LRT Alternative

Site #	Description	Approximate Distance to LRT	2007 Existing Noise	FTA Moderate Impact Thresholds Level	FTA Severe Impact Thresholds Level	Project - Generated Noise Impact Assessment
		feet	Ldn	Ldn	Ldn	Ldn Level
N-36	University Boulevard between 24th Avenue and 25th Avenue, Hyattsville	90	65[3]	61	67	44 No Impact
N-37	3322 University Boulevard, Hyattsville	100	38[2]	63	69	43 No Impact
N-40A	Carroll Hall, Preinkert Drive, College Park	60	64[2]	61	66	50 No Impact
N-41	Memorial Chapel, Chapel Drive, College Park	60	64[2]	61	66	50 No Impact
N-43	Leonardtown Housing, Rossborough Lane, College Park	120	67[2]	63	68	43 No Impact
N-44	6507 Kenilworth Avenue, Riverdale	130	68[2]	63	69	40 No Impact
N-45	Kenilworth Avenue between Rittenhouse Street and Quintana Street, Riverdale	120	65[3]	61	67	41 No Impact
N-46	5442 Powhatan Road, Riverdale	210	68[2]	63	69	37 No Impact
MIHP-8 (N-47)	6200 Riverdale Road, Riverdale	85	71[2]	66	71	42 No Impact
N-48	Riverdale Road between 63rd Avenue and Eastpine Drive, Riverdale	65	65[3]	61	67	44 No Impact
N-49	Riverdale Road between 67th Avenue and 67th Place, Riverdale	35	65[3]	61	67	48 No Impact
Park-1A	Anacostia River Stream Valley Park	100	50[5]	59[5]	65[5]	40[5] No Impact

Table 2-10: Summary of Estimated Noise Levels and Impact Assessment for the Medium Investment LRT Alternative

Site #	Description	Approximate Distance to LRT	2007 Existing Noise	FTA Moderate Impact Thresholds Level	FTA Severe Impact Thresholds Level	Project - Generated Noise Impact Assessment
		feet	Ldn	Ldn	Ldn	Ldn Level
N-50	Riverdale Road between Veterans Highway and Auburn Avenue, Riverdale	125	64[4]	61	66	42 No Impact
N-51	6410 Rosalie Lane, Riverdale	220	64[2]	61	66	39 No Impact
N-52	Undeveloped Parcel at end of Patterson Street Residential Neighborhood, Lanham	200	63[2]	60	66	39 No Impact
N-53	Ingraham Street, Hyattsville	150	64[4]	61	66	44 No Impact
N-55	Decatur Road between Decatur Place and Lanham Drive, Lanham	170	64[2]	61	66	37 No Impact
Park-26	West Lanham Hills Park	150	63[5]	65[5]	71[5]	35[5] No Impact

1. Under the FTA criteria, for land uses not involving sleep (non-residential land use) peak hour Leq was used for assessment purposes.
2. Existing noise levels (Ldn) were estimated from 24-hour noise measurements.
3. Existing noise levels (Ldn) were estimated from neighborhood population densities.
4. Existing day-night noise levels (Ldn) were estimated by averaging nearby measured noise levels recorded at properties where access was provided and using these average noise levels as representative of typical ambient noise conditions at monitoring sites exposed to the same roadway conditions where access was not provided.
5. Existing noise levels (Leq) for Parks were based on 1-hour noise measurements and impact assessment is based on peak hour FTA Category 3 impact criteria.
6. Land use at each site is residential except for Park-21, Park -24B, and Park-1A & Park-12.
7. Headways of 6 minutes from 5 AM to 9 AM and 3 PM to 8 PM, 8 minutes from 9 AM to 10 AM, and 12 minutes from 10 AM to 3 PM and 8 PM to midnight, and 15 minutes from midnight to 3 AM were used for the impact assessment.

Table 2-11: Summary of Estimated Noise Levels and Impact Assessment for the High Investment LRT Alternative

Site #	Description	Approximate Distance to LRT	2007 Existing Noise	FTA Moderate Impact Thresholds Level	FTA Severe Impact Thresholds Level	Project-Generated Noise Impact Assessment
		feet	Ldn	Ldn	Ldn	Ldn Level
N-7	Elm Street between 44th Street and Oakridge Avenue, Bethesda	105	60[4]	58	64	46 No Impact
N-B	4242 East West Highway, Bethesda	40	59[2]	58	64	52 No Impact
N-8	Edgevale Court, Bethesda	35	60[4]	58	64	54 No Impact
N-10A	Columbia Country Club, adjacent to Georgetown Branch right-of-way, Bethesda.	36	61[2]	59	65	53 No Impact
N-12	Manor Road between Connecticut Avenue and Preston Place, Bethesda	65	60[4]	58	64	52 No Impact
N-14	Terrace Drive and Freyman Drive, Chevy Chase, adjacent to Georgetown Branch right-of-way,	50	55[3]	56	62	48 No Impact
N-15	Lyttonsville Place, Silver Spring, adjacent to Georgetown Branch right-of-way	70	50[3]	54	60	43 No Impact
Park-21	Rock Creek Stream Valley Park	100	56[5]	61[5]	68[5]	49[5] No Impact
N-16	2231 Luzerne Avenue, Silver Spring	90	68[2]	63	69	47 No Impact
N-17	Leonard Drive, Silver Spring	115	65[3]	61	67	45 No Impact
N-18	3rd Avenue between N. Springwood Drive and S. Springwood Drive, Silver Spring	50	65[3]	61	67	49 No Impact
N-19	16th Street between East West Highway and Spring Street, Silver Spring	160	65[3]	61	67	41 No Impact

Table 2-11: Summary of Estimated Noise Levels and Impact Assessment for the High Investment LRT Alternative

Site #	Description	Approximate Distance to LRT	2007 Existing Noise	FTA Moderate Impact Thresholds Level	FTA Severe Impact Thresholds Level	Project-Generated Noise Impact Assessment
		feet	Ldn	Ldn	Ldn	Ldn Level
N-24	Wayne Avenue between Cedar Street and Cloverfield Road, Silver Spring	60	55[3]	56	62	50 No Impact
N-22	Wayne Avenue between Dartmouth Avenue and Dale Drive, Silver Spring	75	55[3]	56	62	49 No Impact
N-25	Wayne Avenue between Mansfield Road and Sligo Creek Parkway, Silver Spring	50	55[3]	56	62	51 No Impact
N-30	Arliss Street between Flower Avenue and Walden Road, Silver Spring	70	60[3]	58	64	48 No Impact
N-31	Piney Branch Road between Garland Avenue and Baron Street, Silver Spring	65	65[3]	61	67	43 No Impact
Park-24B	Sligo Creek Stream Valley Park	100	56[5]	61[5]	68[5]	47[5] No Impact
Park-12	Long Branch Park	90	51[5]	59[5]	67[5]	48[5] No Impact
N-32	University Boulevard between Bayfield Street and Forston Street, Silver Spring	100	65[3]	61	67	35 No Impact
N-33	University Boulevard between Merrimac Drive and Lebanon Street, Silver Spring	130	60[3]	58	64	46 No Impact
N-34	University Boulevard between 14th Avenue and 15th Avenue, Hyattsville	85	65[3]	61	67	46 No Impact
N-35	University Boulevard between Guilford Road and 23rd Avenue, Hyattsville	100	60[3]	58	64	42 No Impact
N-36	University Boulevard between 24th Avenue and 25th Avenue, Hyattsville	90	65[3]	61	67	43 No Impact

Table 2-11: Summary of Estimated Noise Levels and Impact Assessment for the High Investment LRT Alternative

Site #	Description	Approximate Distance to LRT	2007 Existing Noise	FTA Moderate Impact Thresholds Level	FTA Severe Impact Thresholds Level	Project-Generated Noise Impact Assessment
		feet	Ldn	Ldn	Ldn	Ldn Level
N-37	3322 University Boulevard, Hyattsville	100	68[2]	63	69	43 No Impact
N-40	Benjamin Hall, Union Drive, College Park	45	65[2]	61	67	45 No Impact
N-43	Leonardtown Housing, Rossborough Lane, College Park	120	67[2]	63	68	43 No Impact
Park-21	Rock Creek Stream Valley Park	100	56[5]	61[5]	68[5]	50[5] No Impact
N-46	5442 Powhatan Road, Riverdale	75	68[2]	63	69	45 No Impact
MIHP-8 (N-47)	6200 Riverdale Road, Riverdale	85	71[2]	66	71	45 No Impact
N-48	Riverdale Road between 63rd Avenue and Eastpine Drive, Riverdale	65	65[3]	61	67	47 No Impact
N-49	Riverdale Road between 67th Avenue and 67th Place, Riverdale	35	65[3]	61	67	51 No Impact
Park-26	West Lanham Hills Park	150	63[5]	65[5]	71[5]	35[5] No Impact
N-50	Riverdale Road between Veterans Highway and Auburn Avenue, Riverdale	125	64[4]	61	66	43 No Impact
N-51	6410 Rosalie Lane, Riverdale	220	64[2]	61	66	39 No Impact
N-52	Undeveloped Parcel at end of Patterson Street Residential Neighborhood, Lanham	200	63[2]	60	66	40 No Impact

Table 2-11: Summary of Estimated Noise Levels and Impact Assessment for the High Investment LRT Alternative

Site #	Description	Approximate Distance to LRT	2007 Existing Noise	FTA Moderate Impact Thresholds Level	FTA Severe Impact Thresholds Level	Project-Generated Noise Impact Assessment
		feet	Ldn	Ldn	Ldn	Ldn Level
N-53	Ingraham Street, Hyattsville	150	64[4]	61	66	46 No Impact
N-55	Decatur Road between Decatur Place and Lanham Drive, Lanham	170	50[3]	54	60	37 No Impact

1. Under the FTA criteria, for land uses not involving sleep (non-residential land use) peak hour Leq was used for assessment purposes.
2. Existing noise levels (Ldn) were estimated from 24-hour noise measurements.
3. Existing noise levels (Ldn) were estimated from neighborhood population densities.
4. Existing day-night noise levels (Ldn) were estimated by averaging nearby measured noise levels recorded at properties where access was provided and using these average noise levels as representative of typical ambient noise conditions at monitoring sites exposed to the same roadway conditions where access was not provided.
5. Existing noise levels (Leq) for Parks were based on 1-hour noise measurements and impact assessment is based on peak hour FTA Category 3 impact criteria.
6. Land use at each site is residential except for Park-21, Park -24B & Park-26.
7. Headways of 6 minutes from 5 AM to 9 AM and 3 PM to 8 PM, 8 minutes from 9 AM to 10 AM, and 12 minutes from 10 AM to 3 PM and 8 PM to midnight, and 15 minutes from midnight to 3 AM were used for the impact assessment.

Light Rail Vehicle with Skirts

Light Rail Vehicle without Skirts

Figure 2-2: Light Rail Vehicles Without and With Vehicle Skirts

2.3.2. Expected Noise Exposures: Wheel Squeal

One noise impact exclusive to LRT is wheel squeal. Wheel squeal occurs when trains make sharp turns; the sharper the turn, the more likely wheel squeal will occur. Railcars are supported on each end and guided through curves by a swiveling truck consisting of two pairs of wheels with parallel axles. Since the axles are held rigidly by the truck frame, they cannot take up radial positions as the car traverses a curve. Consequently, the wheels must slide sideways across the rail top as well as roll along its length. The lateral sliding of the wheel over the rail head creates rubbing forces on the wheel which, if conditions are suitable, will cause its vibration to grow until high stable amplitude is reached. The wheel vibration is radiated as squeal noise characterized by one or more intense, high-pitched tones at the natural vibration frequencies of the wheel.

Tables 2-12, 2-13, and 2-14 summarize areas where potential wheel squeal annoyance may occur under the Low, Medium, and High Investment LRT Alternatives, respectively. Track with curve radius less than 750 feet and near residential or other noise sensitive uses has the potential to generate wheel squeal noise annoyance. Seventeen potential locations of possible wheel squeal noise along the Low Investment LRT alignment were identified. Due to some unique design options being considered under the Medium Investment Alternative, eighteen potential areas of wheel squeal noise annoyance were identified, whereas fourteen potential annoyance zones where identified under the Low and High Investment alternatives.

Table 2-12: Potential Areas of Wheel Squeal Noise Annoyance for the Low Investment LRT Alternative

Location Number	Nearest Receptor Within 300' of Tracks	Curve Location		Curve Length (feet)
		From Station	To Station	
1	N-21	620+50	626+50	600
2	N-25	670+00	677+00	700
4	N-30	698+00	701+00	300
5	N-30, N-31	706+00	708+00	200
6	N-31	722+00	724+00	200
7	N-39	874+00	877+00	300
8	N-43	939+00	947+00	800
9	N-43	955+00	960+00	500
10	N-44	1051+00	1055+00	400
11	N-46	1075+00	1079+00	400
12	N-49, N-50	1135+00	1139+00	400
13	N-53	1196+00	1199+00	300
14	N-54	1228+00	1231+00	300

Table 2-13: Potential Areas of Wheel Squeal Noise Annoyance for the Medium Investment LRT Alternative

Location Number	Nearest Receptor Within 300' of Tracks	Curve Location		Curve Length (feet)
		From Station	To Station	
1	N-21	620+00	622+00	200
2	N-21	624+50	626+50	200
3	N-25	665+00	668+00	300
4	N-25	670+00	677+00	700
5	N-25	677+00	682+00	500
6	N-30	698+00	701+00	300
7	N-30, N-31	706+00	708+00	200
8	N-31	722+50	724+50	200
9	N-40A	264+00	266+00	200
10	N-40A	268+50	270+50	200
11	N-41	272+50	274+50	200
12	N-43	939+00	947+00	800
13	N-43	955+00	960+00	500
14	N44	1051+00	1055+00	400
15	N-46	1075+00	1079+00	400
16	N-49, N-50	1135+00	1139+00	400
17	N-55	1212+50	1214+50	200
18	N-55	1225+00	1232+00	700

Table 2-14: Potential Areas of Wheel Squeal Noise Annoyance for the High Investment LRT Alternative

Location Number	Nearest Receptor Within 300' of Proposed Tracks	Curve Location		Curve Length (feet)
		From Station	To Station	
1	N-25	665+00	668+00	300
2	N-25	670+00	677+00	700
3	N-25	677+00	682+00	400
4	N-30	698+00	701+00	300
5	N-30, N-31	706+00	708+00	200
6	N-31	722+50	724+50	200
7	N-39	874+50	876+50	200
8	N-43	939+00	947+00	800
9	N-43	955+00	960+00	500
11	MIHP-8	1094+00	1096+00	200
12	N-49	1132+50	1134+00	200
13	N-55	1212+50	1214+50	200
14	N-55	1225+00	1232+00	700

2.3.3. Potential LRT and BRT Line Operation Vibration Impacts

Generally, pneumatic tire vehicles which would be operating under the BRT alternatives do not generate vibration levels as high as those from LRT vehicles on either a tie-and-ballast system or rails embedded and encapsulated in the roadway pavement. In the case of BRT systems, when complaints are experienced with these vehicles, they are typically the result of airborne noise from the vehicles rattling windows or items hung on the walls, or of ground-borne vibration caused by potholes, pavement joints, other road surface irregularities, or close proximity to the traffic lane. The vibration levels at the nearest structures are estimated by reading values from the FTA reference vibration curve and applying adjustments to account for factors such as track support system, vehicle speed, and track and wheel conditions. This procedure was followed while estimating vibration velocity levels for each of the BRT and LRT alternatives.

Estimated vibration levels at each of the representative noise and vibration sensitive sites shown by receptor distances from the centerline lane for the proposed BRT systems are presented in Table 2-15 for Low Investment BRT, Table 2-16 for Medium Investment BRT and Table 2-17 for High Investment BRT. Vibration impacts under BRT build design conditions were limited to Site 10A at the edge of the Columbia County Golf Club under the BRT Medium and High Investment options within a 25 foot zone of the alignment centerline. Residences living nearby along Newdale Road would not experience vibration impact because they are located further way.

Potential vibration impacts estimated by receptor distances from the centerline of the transitway for the LRT alternatives are shown in Table 2-18 for Low Investment LRT, Table 2-19 for Medium Investment LRT and Table 2-20 for High Investment LRT.

Because of the narrow rights-of-way within portions of the Georgetown Branch right-of-way, structures located within 40 feet of the proposed LRT centerline coupled with light rail train travel speeds in excess of 35 mph are expected to experience vibration levels at or above the FTA 72 VdB impact threshold for Category 2 land uses (see Table 2-3 for FTA ground borne vibration criteria) for all three LRT alternatives. These impacts occur at Sites N-B, N-8 and N10-A. Within the Georgetown Branch right-of-way section, all vibration sensitive structures located within 40 feet of the centerline of the train tracks, covering a 5,000 foot long section of the tracks from approximately track station 313+00 to 363+00 will experience vibration levels at or above the FTA 72 VdB impact threshold.

Table 2-15: Summary of Vibration Levels & Impact Assessment for Low Investment BRT

Site	Description of Location	Station Location	Land Use	Transit Speed	Distance From Receptor	Estimated Vibration Levels	FTA Vibration Impact Level	FTA Impact Yes/No
				mph	feet	VdB	VdB	
N-2	Woodmont Avenue between Rugby Avenue and Battery Lane, Bethesda	129+70	Residential	13	20	64	72	No
N-4	Jones Bridge Road between Maryland Avenue and Gladwyne Court, Bethesda	157+15	Residential	12	60	54	72	No
N-5B	4504 Jones Bridge Road, Bethesda	163+30	Residential	12	70	52	72	No
N-6	North Side Jones Bridge Road between Lancaster Street and Grier Road, Bethesda	172+25	Residential	12	98	49	72	No
N-10B	Columbia Country Club, adjacent to Jones Bridge Road, Bethesda	188+85	Residential	12	60	54	72	No
N-9	Jones Bridge Road between Hawkins Lane and Platt Ridge Drive, Bethesda	194+90	Residential	12	30	60	72	No
N-11	Jones Bridge Road between Kensington Parkway and Montgomery Avenue, Bethesda	216+80	Residential	17	70	55	72	No
N-13	Susanna Lane just east of Jones Mill Road, Chevy Chase	239+80	Residential	17	90	52	72	No
N-14	Terrace Drive and Freyman Drive, Chevy Chase, adjacent to Georgetown Branch right-of-way	259+00	Residential	17	55	58	72	No
N-15	Lyttonsville Place, Silver Spring, adjacent to Georgetown Branch right-of-way	278+10	Residential	24	100	55	72	No
Park-21	Rock Creek Stream Valley Park	249+00	Park	17	100	42	72	No
N-16	2231 Luzerne Avenue, Silver Spring	304+00	Residential	24	135	52	72	No
N-17	Leonard Drive, Silver Spring	315+60	Residential	24	30	66	72	No
N-18	3rd Avenue between N. Springwood Drive and S. Springwood Drive, Silver Spring	318+85	Residential	10	165	32	72	No
N-20	Wayne Avenue between Fenwick Lane and Apple Avenue, Silver Spring	353+20	Residential	39	40	68	72	No
N-24	Wayne Avenue between Cedar Street and Cloverfield Road, Silver Spring	638+60	Residential	39	60	64	72	No

Table 2-15: Summary of Vibration Levels & Impact Assessment for Low Investment BRT

Site	Description of Location	Station Location	Land Use	Transit Speed	Distance From Receptor	Estimated Vibration Levels	FTA Vibration Impact Level	FTA Impact Yes/No
				mph	feet	VdB	VdB	
N-22	Wayne Avenue between Dartmouth Avenue and Dale Drive, Silver Spring	649+10	Residential	39	70	62	72	No
N-25	Wayne Avenue between Mansfield Road and Sligo Creek Parkway, Silver Spring	664+15	Residential	39	50	66	72	No
N-27	Wayne Avenue between Eton Road and Bradford Road, Silver Spring	686+30	Residential	25	30	66	72	No
N-29	Plymouth Street between Reading Road and Flower Avenue, Silver Spring	697+20	Residential	25	55	62	72	No
N-30	Arliss Street between Flower Avenue and Walden Road, Silver Spring	705+15	Residential	12	50	56	72	No
N-31	Piney Branch Road between Garland Avenue and Baron Street, Silver Spring	717+10	Residential	12	30	60	72	No
Park-12	West Lanham Hills Park	716+00	Park	12	60	54	72	No
Park-24B	Sligo Creek Stream Valley Park	671+00	Park	25	100	55	72	No
N-32	University Boulevard between Bayfield Street and Forston Street, Silver Spring	739+70	Residential	8	45	52	72	No
N-33	University Boulevard between Merrimac Drive and Lebanon Street, Silver Spring	755+50	Residential	15	85	52	72	No
N-34	University Boulevard between 14th Avenue and 15th Avenue, Hyattsville	784+25	Residential	13	40	58	72	No
N-35	University Boulevard between Guilford Road and 23rd Avenue, Hyattsville	811+55	Residential	16	65	55	72	No
N-36	University Boulevard between 24th Avenue and 25th Avenue, Hyattsville	830+50	Residential	16	50	58	72	No
N-37	3322 University Boulevard, Hyattsville	854+85	Residential	16	70	54	72	No
N-38	3416 Tulane Drive, Hyattsville	863+00	Residential	16	100	51	72	No
N-39	UMUC/Inn & Conference Center, University Boulevard, College Park	872+80	Residential	15	120	49	72	No
N-40	Benjamin Hall, Union Drive, College Park	894+30	Residential	25	45	58	72	No

Table 2-15: Summary of Vibration Levels & Impact Assessment for Low Investment BRT

Site	Description of Location	Station Location	Land Use	Transit Speed	Distance From Receptor	Estimated Vibration Levels	FTA Vibration Impact Level	FTA Impact Yes/No
				mph	feet	VdB	VdB	
N-42	Shriver Lab, Campus Drive, College Park	912+50	Residential	25	40	64	72	No
N-43	Leonardtown Housing, Rossborough Lane, College Park	943+00	Residential	28	120	55	72	No
N-44	6507 Kenilworth Avenue, Riverdale	846+50	Residential	14	175	46	72	No
N-45	Kenilworth Avenue between Rittenhouse Street and Quintana Street, Riverdale	862+25	Residential	14	110	51	72	No
N-46	5442 Powhatan Road, Riverdale	871+20	Residential	14	190	45	72	No
MIHP-8	6200 Riverdale Road, Riverdale	897+45	Residential	14	55	57	72	No
N-48	Riverdale Road between 63rd Avenue and Eastpine Drive, Riverdale	909+40	Residential	14	40	59	72	No
N-49	Riverdale Road between 67th Avenue and 67th Place, Riverdale	927+70	Residential	14	40	59	72	No
Park 1A	Anacostia River Stream Valley Park	837+25	Park	14	100	50	72	No
N-50	Riverdale Road between Veterans Highway and Auburn Avenue, Riverdale	935+30	Residential	21	125	51	72	No
N-51	6410 Rosalie Lane, Riverdale	948+00	Residential	21	220	47	72	No
N-52	Undeveloped Parcel at end of Patterson Street Residential Neighborhood, Lanham	962+40	Residential	21	205	47	72	No
N-53	Ingraham Street, Hyattsville	986+35	Residential	21	150	49	72	No
N-54	Hawkins Road between Lanham Drive W and Sherwood Street, Lanham	1023+50	Residential	15	140	47	72	No

Table 2-16: Summary of Estimated Vibration Levels & Impact Assessment for Medium Investment BRT

Site	Description of Location	Station Location	Land Use	Transit Speed	Distance From Receptor	Estimated Vibration Levels	FTA Vibration Impact Level	FTA Impact Yes/No
				mph	feet	VdB	VdB	
N-1	Woodmont Avenue between Edgemoor Lane and Montgomery Lane, Bethesda	104+80	Residential	10	45	54	72	No
N-3	Commerce Lane between Waverly Street and Pearl Street, Bethesda	112+50	Residential	13	50	56	72	No
N-7	Elm Street between 44th Street and Oakridge Avenue, Bethesda	140+10	Residential	40	105	59	72	No
N-B	4242 East West Highway, Bethesda	149+40	Residential	40	40	68	72	No
N-8	Edgevale Court, Bethesda	161+50	Residential	43	55	66	72	No
N-10A	Columbia Country Club, adjacent to Georgetown Branch right-of-way, Bethesda.	180+10	Residential	40	25	72	72	Yes
N-12	Manor Road between Connecticut Avenue and Preston Place, Bethesda	202+20	Residential	35	70	51	72	No
N-13	Susanna Lane Just East of Jones Mill Road, Bethesda	226+70	Residential	45	100	60	72	No
N-14	Terrace Drive and Freyman Drive, Chevy Chase, adjacent to Georgetown Branch right-of-way,	245+70	Residential	30	55	63	72	No
N-15	Lyttonsville Place, Silver Spring, adjacent to Georgetown Branch right-of-way,	264+80	Residential	21	110	53	72	No
Park-21	Rock Creek Stream Valley Park	235+90	Park	36	100	48	72	No
N-16	2231 Luzerne Avenue, Silver Spring	304+00	Residential	24	135	52	72	No
N-17	Leonard Drive, Silver Spring	315+60	Residential	24	30	66	72	No
N-18	3rd Avenue between N. Springwood Drive and S. Springwood Drive, Silver Spring	318+85	Residential	10	165	32	72	No
N-19	16th Street between East West Highway and Spring Street, Silver Spring	334+35	Residential	19	30	54	72	No
N-21	935 Bonifant Street, Silver Spring	621+60	Residential	20	45	56	72	No

Table 2-16: Summary of Estimated Vibration Levels & Impact Assessment for Medium Investment BRT

Site	Description of Location	Station Location	Land Use	Transit Speed	Distance From Receptor	Estimated Vibration Levels	FTA Vibration Impact Level	FTA Impact Yes/No
				mph	feet	VdB	VdB	
N-24	Wayne Avenue between Cedar Street and Cloverfield Road, Silver Spring	638+50	Residential	27	55	62	72	No
N-22	Wayne Avenue between Dartmouth Avenue and Dale Drive, Silver Spring	649+00	Residential	27	70	62	72	No
N-25	Wayne Avenue between Mansfield Road and Sligo Creek Parkway, Silver Spring	664+20	Residential	27	55	64	72	No
N-27	Wayne Avenue between Eton Road and Bradford Road, Silver Spring	686+30	Residential	25	55	61	72	No
N-29	Plymouth Street between Reading Road and Flower Avenue, Silver Spring	690+75	Residential	36	60	65	72	No
N-30	Arliss Street between Flower Avenue and Walden Road, Silver Spring	698+70	Residential	36	19	65	72	No
N-31	Piney Branch Road between Garland Avenue and Baron Street, Silver Spring	717+10	Residential	18	60	58	72	No
Park-24B	Sligo Creek Stream Valley Park	671+00	Park	36	100	58	72	No
Park-12	Long Branch Park	716+00	Residential	18	90	53	72	No
N-32	University Boulevard between Bayfield Street and Forston Street, Silver Spring	740+00	Residential	8	60	45	72	No
N-33	University Boulevard between Merrimac Drive and Lebanon Street, Silver Spring	755+80	Residential	18	130	40	72	No
N-34	University Boulevard between 14th Avenue and 15th Avenue, Hyattsville	784+50	Residential	20	85	55	72	No
N-35	University Boulevard between Guilford Road and 23rd Avenue, Hyattsville	811+35	Residential	17	100	51	72	No

Table 2-16: Summary of Estimated Vibration Levels & Impact Assessment for Medium Investment BRT

Site	Description of Location	Station Location	Land Use	Transit Speed	Distance From Receptor	Estimated Vibration Levels	FTA Vibration Impact Level	FTA Impact Yes/No
				mph	feet	VdB	VdB	
N-36	University Boulevard between 24th Avenue and 25th Avenue, Hyattsville	830+30	Residential	17	95	52	72	No
N-37	3322 University Boulevard, Hyattsville	854+70	Residential	17	100	52	72	No
N-38	3416 Tulane Drive	862+80	Residential	17	150	47	72	No
N-39	UMUC/Inn & Conference Center, University Boulevard, College Park	872+70	Residential	12	150	45	72	No
N-40A	Carroll Hall, Preinkert Drive, College Park	261+00	Residential	25	60	60	72	No
N-41	Memorial Chapel, Chapel Drive, College Park	267+70	Residential	25	60	60	72	No
N-43	Leonardtown Housing, Rossborough Lane, College Park	943+00	Residential	28	120	55	72	No
N-44	6507 Kenilworth Avenue, Riverdale	846+50	Residential	14	175	46	72	No
N-45	Kenilworth Avenue between Rittenhouse Street and Quintana Street, Riverdale	862+25	Residential	14	110	51	72	No
N-46	5442 Powhatan Road, Riverdale	871+20	Residential	14	190	45	72	No
MIHP-8	6200 Riverdale Road, Riverdale	895+50	Residential	23	45	62	72	No
N-48	Riverdale Road between 63rd Avenue and Eastpine Drive, Riverdale	906+15	Residential	23	40	63	72	No
N-49	Riverdale Road between 67th Avenue and 67th Place, Riverdale	921+90	Residential	23	40	63	72	No
Park-1A	Anacostia River Stream Valley Park	837+25	Park	14	100	50	72	No
N-50	Riverdale Road between Veterans Highway and Auburn Avenue, Riverdale	935+30	Residential	21	125	51	72	No
N-51	6410 Rosalie Lane, Riverdale	948+00	Residential	21	220	47	72	No
N-52	Undeveloped Parcel at end of Patterson Street Residential Neighborhood, Lanham	962+40	Residential	21	205	47	72	No
N-53	Ingraham Street, Hyattsville	986+35	Residential	21	150	49	72	No

Table 2-16: Summary of Estimated Vibration Levels & Impact Assessment for Medium Investment BRT

Site	Description of Location	Station Location	Land Use	Transit Speed	Distance From Receptor	Estimated Vibration Levels	FTA Vibration Impact Level	FTA Impact Yes/No
				mph	feet	VdB	VdB	
N-55	Decatur Road between Decatur Place and Lanham Drive, Lanham	1017+00	Residential	14	90	50	72	No
Park-26	West Lanham Hills Park	1001+00	Park	14	150	46	72	No

Table 2-17: Summary of Estimated Vibration Levels & Impact Assessment for High Investment BRT

Site	Description of Location	Station Location	Land Use	Transit Speed	Distance From Receptor	Estimated Vibration Levels	FTA Vibration Impact Level	FTA Impact Yes/No
				mph	feet	VdB	VdB	
N-1	Woodmont Avenue between Edgemoor Lane and Montgomery Lane, Bethesda	104+80	Residential	10	45	54	72	No
N-3	Commerce Lane between Waverly Street and Pearl Street, Bethesda	112+50	Residential	13	50	56	72	No
N-7	Elm Street between 44th Street and Oakridge Avenue, Bethesda	140+10	Residential	40	105	59	72	No
N-B	4242 East West Highway, Bethesda	149+40	Residential	43	40	68	72	No
N-8	Edgevale Court, Bethesda	161+50	Residential	40	55	66	72	No
N-10A	Columbia Country Club, adjacent to Georgetown Branch right-of-way, Bethesda.	180+10	Residential	35	25	72	72	Yes
N-12	Manor Road between Connecticut Avenue and Preston Place, Bethesda	202+20	Residential	45	70	51	72	No
N-13	Susanna Lane Just East of Jones Mill Road, Bethesda	226+70	Residential	30	100	60	72	No
N-14	Terrace Drive and Freyman Drive, Chevy Chase, adjacent to Georgetown Branch right-of-way,	245+70	Residential	21	55	63	72	No
N-15	Lyttonsville Place, Silver Spring, adjacent to Georgetown Branch right-of-way	264+80	Residential	36	110	53	72	No
Park-21	Rock Creek Stream Valley Park	235+90	Park	26	100	48	72	No
N-16	2231 Luzerne Avenue, Silver Spring	290+60	Residential	24	135	52	72	No
N-17	Leonard Drive, Silver Spring	302+20	Residential	24	25	67	72	No
N-18	3rd Avenue between N. Springwood Drive and S. Springwood Drive, Silver Spring	318+85	Residential	19	165	48	72	No
N-19	16th Street between East West Highway and Spring Street, Silver Spring	334+35	Residential	19	30	54	72	No
N-24	Wayne Avenue between Cedar Street and Cloverfield Road, Silver Spring	638+50	Residential	27	55	62	72	No

Table 2-17: Summary of Estimated Vibration Levels & Impact Assessment for High Investment BRT

Site	Description of Location	Station Location	Land Use	Transit Speed	Distance From Receptor	Estimated Vibration Levels	FTA Vibration Impact Level	FTA Impact Yes/No
				mph	feet	VdB	VdB	
N-22	Wayne Avenue between Dartmouth Avenue and Dale Drive, Silver Spring	649+00	Residential	27	70	62	72	No
N-25	Wayne Avenue between Mansfield Road and Sligo Creek Parkway, Silver Spring	664+20	Residential	27	55	64	72	No
N-29	Plymouth Street between Reading Road and Flower Avenue, Silver Spring	690+75	Residential	36	60	65	72	No
N-30	Arliss Street between Flower Avenue and Walden Road, Silver Spring	698+70	Residential	36	19	65	72	No
N-31	Piney Branch Road between Garland Avenue and Baron Street, Silver Spring	717+10	Residential	18	60	58	72	No
Park-24B	Sligo Creek Stream Valley Park	671+00	Park	36	100	58	72	No
Park-12	Long Branch Park	716+00	Residential	18	90	53	72	No
N-32	University Boulevard between Bayfield Street and Forston Street, Silver Spring	740+00	Residential	8	60	45	72	No
N-33	University Boulevard between Merrimac Drive and Lebanon Street, Silver Spring	755+80	Residential	18	130	40	72	No
N-34	University Boulevard between 14th Avenue and 15th Avenue, Hyattsville	784+50	Residential	20	85	55	72	No
N-35	University Boulevard between Guilford Road and 23rd Avenue, Hyattsville	811+35	Residential	17	100	51	72	No
N-36	University Boulevard between 24th Avenue and 25th Avenue, Hyattsville	830+30	Residential	17	95	52	72	No
N-37	3322 University Boulevard, Hyattsville	854+70	Residential	17	100	52	72	No
N-38	3416 Tulane Drive	862+80	Residential	17	150	47	72	No
N-39	UMUC/Inn & Conference Center, University Drive, College Park	872+70	Residential	12	150	45	72	No

Table 2-17: Summary of Estimated Vibration Levels & Impact Assessment for High Investment BRT

Site	Description of Location	Station Location	Land Use	Transit Speed	Distance From Receptor	Estimated Vibration Levels	FTA Vibration Impact Level	FTA Impact Yes/No
				mph	feet	VdB	VdB	
N-40	Benjamin Hall, Union Drive, College Park	894+35	Residential	25	45	56	72	No
N-42	Shriver Lab, Campus Drive, College Park	912+50	Residential	25	40	64	72	No
N-43	Leonardtown Housing, Rossborough Lane, College Park	943+00	Residential	21	40	62	72	No
N-46	5442 Powhatan Road, Riverdale	866+75	Residential	18	140	49	72	No
MIHP-8	6200 Riverdale Road, Riverdale	895+50	Residential	23	45	62	72	No
N-48	Riverdale Road between 63rd Avenue and Eastpine Drive, Riverdale	906+15	Residential	23	40	63	72	No
N-49	Riverdale Road between 67th Avenue and 67th Place, Riverdale	921+90	Residential	23	40	63	72	No
Park-1B	Anacostia River Stream Valley Park	1059+00	Park	18	100	52	72	No
N-50	Riverdale Road between Veterans Highway and Auburn Avenue, Riverdale	932+20	Residential	23	130	52	72	No
N-51	6410 Rosalie Lane, Riverdale	944+85	Residential	19	215	46	72	No
N-52	Undeveloped Parcel at end of Patterson Street Residential Neighborhood, Lanham	959+00	Residential	19	205	46	72	No
N-53	Ingraham Street, Hyattsville	983+00	Residential	19	150	49	72	No
N-55	Decatur Road between Decatur Place and Lanham Drive, Lanham	1017+00	Residential	14	90	50	72	No
Park-26	West Lanham Hills Park	1001+00	Park	14	150	46	72	No

Table 2-18: Summary of Estimated Vibration Levels & Impact Assessment for Low Investment LRT

Site	Description of Location	Station Location	Land Use	Transit Speed	Distance From Receptor	Estimated Vibration Levels	FTA Vibration Impact Level	FTA Impact Yes/No
				mph	feet	VdB	VdB	
N-7	Elm Street between 44th Street and Oakridge Avenue, Bethesda	323+20	Residential	40	105	66	72	No
N-B	4242 East West Highway, Bethesda	332+50	Residential	40	40	73	72	Yes
N-8	Edgevale Court, Bethesda	343+70	Residential	43	35	74	72	Yes
N-10A	Columbia Country Club, adjacent to Georgetown Branch right-of-way, Bethesda.	363+00	Residential	40	36	73	72	Yes
N-12	Manor Road between Connecticut Avenue and Preston Place, Bethesda	385+00	Residential	35	65	58	72	No
N-13	Susanna Lane just east of Jones Mill Road, Chevy Chase	409+50	Residential	45	120	65	72	No
N-14	Terrace Drive and Freyman Drive, Chevy Chase, (adjacent to Georgetown Branch right-of-way)	428+80	Residential	30	50	69	72	No
N-15	Lyttonsville Place, Silver Spring, (adjacent to Georgetown Branch right-of-way)	448+50	Residential	21	70	63	72	No
Park-21	Rock Creek Stream Valley Park	419+00	Park	36	100	54	72	No
N-16	2231 Luzerne Avenue, Silver Spring	474+00	Residential	25	90	52	72	No
N-17	Leonard Drive, Silver Spring	485+50	Residential	25	115	51	72	No
N-18	3rd Avenue between N. Springwood Drive and S. Springwood Drive, Silver Spring	502+25	Residential	15	50	52	72	No
N-19	16th Street between East West Highway and Spring Street, Silver Spring	518+20	Residential	21	160	42	72	No
N-21	Bonifant Street between Georgia Avenue and Fenton Street, Silver Spring	621+70	Residential	10	35	61	72	No
N-24	Wayne Avenue between Cedar Street and Cloverfield Road, Silver Spring	639+00	Residential	15	60	62	72	No
N-22	Wayne Avenue between Dartmouth Avenue and Dale Drive, Silver Spring	649+00	Residential	15	75	60	72	No

Table 2-18: Summary of Estimated Vibration Levels & Impact Assessment for Low Investment LRT

Site	Description of Location	Station Location	Land Use	Transit Speed	Distance From Receptor	Estimated Vibration Levels	FTA Vibration Impact Level	FTA Impact Yes/No
				mph	feet	VdB	VdB	
N-25	Wayne Avenue between Mansfield Road and Sligo Creek Parkway, Silver Spring	664+25	Residential	15	50	63	72	No
N-30	Arliss Street between Flower Avenue and Walden Road, Silver Spring	698+80	Residential	49	70	70	72	No
N-31	Piney Branch Road between Garland Avenue and Baron Street, Silver Spring	717+00	Residential	24	65	64	72	No
Park-12	Long Branch Park	716+00	Park	24	90	61	72	No
Park-24B	Sligo Creek Stream Valley Park	671+00	Park	49	100	67	72	No
N-32	University Boulevard between Bayfield Street and Forston Street, Silver Spring	740+00	Residential	8	100	50	72	No
N-33	University Boulevard between Merrimac Drive and Lebanon Street, Silver Spring	755+80	Residential	18	130	46	72	No
N-34	University Boulevard between 14th Avenue and 15th Avenue, Hyattsville	784+50	Residential	17	85	59	72	No
N-35	University Boulevard between Guilford Road and 23rd Avenue, Hyattsville	811+35	Residential	20	100	59	72	No
N-36	University Boulevard between 24th Avenue and 25th Avenue, Hyattsville	830+25	Residential	20	90	60	72	No
N-37	3322 University Boulevard, Hyattsville	854+60	Residential	20	100	59	72	No
N-38	3416 Tulane Drive, Hyattsville	862+80	Residential	20	150	55	72	No
N-39	UMUC/Inn & Conference Center, University Boulevard, College Park	872+75	Residential	14	160	52	72	No
N-40	Benjamin Hall, Union Drive, College Park	894+30	Residential	14	45	63	72	No
N-42	Shriver Lab, Campus Drive, College Park	912+50	Residential	11	40	62	72	No
N-43	Leonardtown Housing, Rossborough Lane, College Park	943+00	Residential	21	120	58	72	No

Table 2-18: Summary of Estimated Vibration Levels & Impact Assessment for Low Investment LRT

Site	Description of Location	Station Location	Land Use	Transit Speed	Distance From Receptor	Estimated Vibration Levels	FTA Vibration Impact Level	FTA Impact Yes/No
				mph	feet	VdB	VdB	
N-44	6507 Kenilworth Avenue, Riverdale	1055+75	Residential	16	130	55	72	No
N-45	Kenilworth Avenue between Rittenhouse Street and Quintana Street, Riverdale	1067+50	Residential	16	120	56	72	No
N-46	5442 Powhatan Road, Riverdale	1073+10	Residential	16	210	50	72	No
MIHP-8	6200 Riverdale Road, Riverdale	1100+90	Residential	15	85	58	72	No
N-48	Riverdale Road between 63rd Avenue and Eastpine Drive, Riverdale	1112+75	Residential	15	65	60	72	No
N-49	Riverdale Road between 67th Avenue and 67th Place, Riverdale	1128+70	Residential	15	35	65	72	No
Park-1A	Anacostia River Stream Valley Park	1043+00	Park	16	100	57	72	No
N-50	Riverdale Road between Veterans Highway and Auburn Avenue, Riverdale	1138+50	Residential	21	130	57	72	No
N-51	6410 Rosalie Lane, Riverdale	1151+30	Residential	21	220	53	72	No
N-52	Undeveloped Parcel at end of Patterson Street Residential Neighborhood, Lanham	1165+75	Residential	21	200	53	72	No
N-53	Ingraham Street, Hyattsville	1189+50	Residential	21	150	46	72	No
N-54	Hawkins Road between Lanham Drive W and Sherwood Street, Lanham	1223+10	Residential	15	235	50	72	No

Table 2-19: Summary of Estimated Vibration Levels & Impact Assessment for Medium Investment LRT

Site	Description of Location	Station Location	Land Use	Transit Speed	Distance From Receptor	Estimated Vibration Levels	FTA Vibration Impact Level	FTA Impact Yes/No
				mph	feet	VdB	VdB	
N-7	Elm Street between 44th Street and Oakridge Avenue, Bethesda	323+20	Residential	40	105	66	72	No
N-B	4242 East West Highway, Bethesda	332+50	Residential	40	40	73	72	Yes
N-8	Edgevale Court, Bethesda	343+70	Residential	43	35	74	72	Yes
N-10A	Columbia Country Club, adjacent to Georgetown Branch right-of-way, Bethesda.	363+00	Residential	40	36	73	72	Yes
N-12	Manor Road between Connecticut Avenue and Preston Place, Bethesda	385+00	Residential	35	65	58	72	No
N-13	Susanna Lane just east of Jones Mill Road, Chevy Chase	409+50	Residential	45	120	65	72	No
N-14	Terrace Drive and Freyman Drive, Chevy Chase, (adjacent to Georgetown Branch right-of-way)	428+80	Residential	30	50	69	72	No
N-15	Lyttonsville Place, Silver Spring, (adjacent to Georgetown Branch right-of-way)	448+50	Residential	21	70	63	72	No
Park-21	Rock Creek Stream Valley Park	419+00	Park	36	100	54	72	No
N-16	2231 Luzerne Avenue, Silver Spring	474+00	Residential	25	90	62	72	No
N-17	Leonard Drive, Silver Spring	485+50	Residential	25	115	61	72	No
N-18	3rd Avenue between N. Springwood Drive and S. Springwood Drive, Silver Spring	502+25	Residential	21	50	65	72	No
N-19	16th Street between East West Highway and Spring Street, Silver Spring	518+20	Residential	21	160	55	72	No
N-21	Bonifant Street between Georgia Avenue and Fenton Street, Silver Spring	621+70	Residential	10	35	61	72	No
N-24	Wayne Avenue between Cedar Street and Cloverfield Road, Silver Spring	639+00	Residential	28	60	67	72	No
N-22	Wayne Avenue between Dartmouth Avenue and Dale Drive, Silver Spring	649+00	Residential	28	75	65	72	No

Table 2-19: Summary of Estimated Vibration Levels & Impact Assessment for Medium Investment LRT

Site	Description of Location	Station Location	Land Use	Transit Speed	Distance From Receptor	Estimated Vibration Levels	FTA Vibration Impact Level	FTA Impact Yes/No
				mph	feet	VdB	VdB	
N-25	Wayne Avenue between Mansfield Road and Sligo Creek Parkway, Silver Spring	664+25	Residential	28	50	68	72	No
N-30	Arliss Street between Flower Avenue and Walden Road, Silver Spring	698+80	Residential	49	70	70	72	No
N-31	Piney Branch Road between Garland Avenue and Baron Street, Silver Spring	717+00	Residential	24	65	64	72	No
Park-24B	Sligo Creek Stream Valley Park	671+00	Park	49	100	67	72	No
Park-12	Long Branch Park	716+00	Park	24	90	61	72	No
N-32	University Boulevard between Bayfield Street and Forston Street, Silver Spring	740+00	Residential	8	100	51	72	No
N-33	University Boulevard between Merrinac Drive and Lebanon Street, Silver Spring	755+80	Residential	19	130	47	72	No
N-34	University Boulevard between 14th Avenue and 15th Avenue, Hyattsville	784+50	Residential	35	85	61	72	No
N-35	University Boulevard between Guilford Road and 23rd Avenue, Hyattsville	811+35	Residential	31	100	58	72	No
N-36	University Boulevard between 24th Avenue and 25th Avenue, Hyattsville	830+25	Residential	28	90	59	72	No
N-37	3322 University Boulevard, Hyattsville	854+60	Residential	28	100	58	72	No
N-38	3416 Tulane Drive, Hyattsville	862+80	Residential	13	150	55	72	No
N-39	UMUC/Inn & Conference Center, University Boulevard, Collage Park	872+70	Residential	12	160	50	72	No
N-40A	Carroll Hall, Preinkert Drive, Collage Park	261+00	Residential	28	60	67	72	No
N-41	Memorial Chapel, Chapel Drive, Collage Park	267+70	Residential	28	60	67	72	No
N-43	Leonardtown Housing, Rossborough Lane, Collage Park	943+00	Residential	21	120	58	72	No

Table 2-19: Summary of Estimated Vibration Levels & Impact Assessment for Medium Investment LRT

Site	Description of Location	Station Location	Land Use	Transit Speed	Distance From Receptor	Estimated Vibration Levels	FTA Vibration Impact Level	FTA Impact Yes/No
				mph	feet	VdB	VdB	
N-44	6507 Kenilworth Avenue, Riverdale	1055+75	Residential	16	130	55	72	No
N-45	Kenilworth Avenue between Rittenhouse Street and Quintana Street, Riverdale	1067+50	Residential	16	120	56	72	No
N-46	5442 Powhatan Road, Riverdale	1073+10	Residential	16	210	50	72	No
MIHP-8	6200 Riverdale Road, Riverdale	1100+90	Residential	15	85	58	72	No
N-48	Riverdale Road between 63rd Avenue and Eastpine Drive, Riverdale	1112+75	Residential	15	65	60	72	No
N-49	Riverdale Road between 67th Avenue and 67th Place, Riverdale	1128+70	Residential	15	35	65	72	No
Park-1A	Anacostia River Stream Valley Park	1043+00	Park	16	100	57	72	No
N-50	Riverdale Road between Veterans Highway and Auburn Avenue, Riverdale	1138+50	Residential	21	130	57	72	No
N-51	6410 Rosalie Lane, Riverdale	1151+30	Residential	21	220	53	72	No
N-52	Undeveloped Parcel at end of Patterson Street Residential Neighborhood, Lanham	1165+75	Residential	21	200	53	72	No
N-53	Ingrahm Street, Hyattsville	1189+50	Residential	21	150	46	72	No
N-55	Decatur Road between Decatur Place and Lanham Drive, Lanham	1223+10	Residential	13	170	50	72	No
Parl-26	West Lanham Hills Park	1001+00	Park	13	150	52	72	No

Table 2-20: Summary of Estimated Vibration Levels & Impact Assessment for High Investment LRT

Site	Description of Location	Station Location	Land Use	Transit Speed	Distance From Receptor	Estimated Vibration Levels	FTA Vibration Impact Level	FTA Impact Yes/No
				mph	feet	VdB	VdB	
N-7	Elm Street between 44th Street and Oakridge Avenue, Bethesda	323+20	Residential	40	105	66	72	No
N-B	4242 East West Highway, Bethesda	332+50	Residential	40	40	73	72	Yes
N-8	Edgevale Court, Bethesda	343+70	Residential	43	35	74	72	Yes
N-10A	Columbia Country Club, adjacent to Georgetown Branch right-of-way, Bethesda.	363+00	Residential	40	36	73	72	Yes
N-12	Manor Road between Connecticut Avenue and Preston Place, Bethesda	385+00	Residential	35	65	58	72	No
N-13	Susanna Lane just east of Jones Mill Road, Chevy Chase	409+50	Residential	45	120	65	72	No
N-14	Terrace Drive and Freyman Drive, Chevy Chase, (adjacent to Georgetown Branch right-of-way)	428+80	Residential	30	50	69	72	No
N-15	Lyttonsville Place, Silver Spring, (adjacent to Georgetown Branch right-of-way)	448+50	Residential	21	70	63	72	No
Park-21	Rock Creek Stream Valley Park	419+00	Park	36	100	54	72	No
N-16	2231 Luzerne Avenue, Silver Spring	474+00	Residential	25	90	62	72	No
N-17	Leonard Drive, Silver Spring	485+50	Residential	25	115	61	72	No
N-18	3rd Avenue between N. Springwood Drive and S. Springwood Drive, Silver Spring	502+25	Residential	21	50	65	72	No
N-19	16th Street between East West Highway and Spring Street, Silver Spring	518+20	Residential	21	160	55	72	No
N-24	Wayne Avenue between Cedar Street and Cloverfield Road, Silver Spring	639+00	Residential	28	60	67	72	No
N-22	Wayne Avenue between Dartmouth Avenue and Dale Drive, Silver Spring	649+00	Residential	28	75	65	72	No

Table 2-20: Summary of Estimated Vibration Levels & Impact Assessment for High Investment LRT

Site	Description of Location	Station Location	Land Use	Transit Speed	Distance From Receptor	Estimated Vibration Levels	FTA Vibration Impact Level	FTA Impact Yes/No
				mph	feet	VdB	VdB	
N-25	Wayne Avenue between Mansfield Road and Sligo Creek Parkway, Silver Spring	664+25	Residential	28	50	68	72	No
N-30	Arliss Street between Flower Avenue and Walden Road, Silver Spring	698+80	Residential	49	70	70	72	No
N-31	Piney Branch Road between Garland Avenue and Baron Street, Silver Spring	717+00	Residential	24	65	64	72	No
Park-24B	Sligo Creek Stream Valley Park	671+00	Park	49	100	67	72	No
N-32	University Boulevard between Bayfield Street and Forston Street, Silver Spring	740+00	Residential	8	100	51	72	No
N-33	University Boulevard between Merrimac Drive and Lebanon Street, Silver Spring	755+80	Residential	19	130	47	72	No
N-34	University Boulevard between 14th Avenue and 15th Avenue, Hyattsville	784+50	Residential	35	85	61	72	No
N-35	University Boulevard between Guilford Road and 23rd Avenue, Hyattsville	811+35	Residential	31	100	58	72	No
N-36	University Boulevard between 24th Avenue and 25th Avenue, Hyattsville	830+25	Residential	28	90	59	72	No
N-37	3322 University Boulevard, Hyattsville	854+60	Residential	28	100	58	72	No
N-38	3416 Tulane Drive, Hyattsville	862+80	Residential	13	150	55	72	No
N-39	UMUC/Inn & Conference Center, University Boulevard, College Park	872+75	Residential	23	160	50	72	No
N-40	Benjamin Hall, Union Drive, College Park	894+30	Residential	12	45	61	72	No
N-42	Shriver Lab, Campus Drive, College Park	912+50	Residential	28	40	70	72	No
N-43	Leonardtown Housing, Rossborough Lane, College Park	943+00	Residential	21	120	58	72	No
N-46	5442 Powhatan Road, Riverdale	1073+10	Residential	19	75	62	72	No

Table 2-20: Summary of Estimated Vibration Levels & Impact Assessment for High Investment LRT

Site	Description of Location	Station Location	Land Use	Transit Speed	Distance From Receptor	Estimated Vibration Levels	FTA Vibration Impact Level	FTA Impact Yes/No
				mph	feet	VdB	VdB	
MIHP-8	6200 Riverdale Road, Riverdale	1100+90	Residential	21	85	61	72	No
N-48	Riverdale Road between 63rd Avenue and Eastpine Drive, Riverdale	1112+75	Residential	21	65	64	72	No
N-49	Riverdale Road between 67th Avenue and 67th Place, Riverdale	1128+70	Residential	21	35	68	72	No
Park-1B	Anacostia River Stream Valley Park	1059+00	Park	19	100	59	72	No
N-50	Riverdale Road between Veterans Highway and Auburn Avenue, Riverdale	1138+50	Residential	22	130	58	72	No
N-51	6410 Rosalie Lane, Riverdale	1151+30	Residential	22	220	53	72	No
N-52	Undeveloped Parcel at end of Patterson Street Residential Neighborhood, Lanham	1165+75	Residential	22	200	53	72	No
N-53	Ingraham Street, Hyattsville	1189+50	Residential	22	150	46	72	No
N-55	Decatur Road between Decatur Place and Lanham Drive, Lanham	1223+10	Residential	13	170	50	72	No
Park-26	West Lanham Hills Park	1001+00	Park	13	150	52	72	No

2.3.4. Expected Noise Exposures: Operations, and Maintenance and Storage Facilities

Within the corridor there are two proposed maintenance and storage facilities. One facility, the Lyttonsville facility, is located on Brookville Road in Montgomery County near the Lyttonsville community, adjacent to noise monitoring Sites N-14 and N-15. The other facility, the Glenridge facility is located in Prince George's County off the southwest side of Veterans Parkway near the West Lanham Shopping Center, adjacent to noise monitoring Site N-53. Noise level estimates of maintenance and storage operations were determined for the LRT and BRT alternatives following FTA impact assessment procedures.

It is anticipated that noise generated from BRT maintenance and storage related activites at the proposed Lyttonsville facility would result in no impact to nearby residential communities. Results of the noise impact analysis completed at nearby representative Sites N-14 and N-15 were found to be below the FTA Impact threshold. Similarly, noise generated from BRT maintenance and storage activitie adjacent to the proposed Glenridge facility, evaluated at representative Site N-53, yield noise levels which are below the FTA impact threshold. Therefore at all proposed BRT maintenance and storage facilities no noise impacts from these types of activities are anticipated at any noise sensitive property within the study area. A summary of these findings is contained in Table 2-21.

Noise estimated at the LRT maintenance and storge facilities were determined assuming each train car was fitted with vehicle skirts providing 8 decibels of noise reduction. As indicated by the findings at representative Sites N-14 and N-15, it is anticipated that noise generated from LRT maintenance and storage activites at the proposed Lyttonsville facility would result in no impact to the surrounding residential communities. At the proposed Glenridge facility noise generated from LRT maintenance and storage activities would result in noise levels reaching the FTA Severe Impact threshold. At the proposed Glenridge facility, the dominate noise contribution is from wheel squeal generated from the numerous curved tracks scattered throughout the facility which provide access to and from the facility. A summary of these findings are contained in Table 2-22.

Table 2-21: Summary of Estimated Noise Levels and FTA Based Impact Assessment at Noise Sensitive Sites Adjacent to Proposed BRT Maintenance and Storage Facilities

Site #	Description	Approximate Distance to BRT Roadway	2007 Existing Noise	FTA Moderate Impact Thresholds Level	FTA Severe Impact Thresholds Level	Low Investment BRT Project-Generated Noise	Medium Investment BRT Project-Generated Noise	High Investment BRT Project-Generated Noise
		feet	Ldn	Ldn	Ldn	Ldn Level Impact Category	Ldn Level Impact Category	Ldn Level Impact Category
N-14	Terrace Drive and Freyman Drive, Chevy Chase, adjacent to Georgetown Branch right-of-way,	55	55[1]	56	62	55 No Impact	55 No Impact	55 No Impact
N-15	Lyttonsville Place, Silver Spring, adjacent to Georgetown Branch right-of-way	110	50[1]	54	60	50 No Impact	50 No Impact	50 No Impact
N-53	Ingraham Street, Hyattsville	45	64[2]	61	66	51 No Impact	51 No Impact	58 No Impact

1. Existing noise levels (Ldn) were estimated from neighborhood population densities.
2. Existing day-night noise levels (Ldn) were estimated by averaging nearby measured noise levels recorded at properties where access was provided and using these average noise levels as representative of typical ambient noise conditions at monitoring sites exposed to the same roadway conditions where access was not provided.

Table 2-22: Summary of Estimated Noise Levels and FTA Based Impact Assessment at Noise Sensitive Sites Adjacent to Proposed LRT Maintenance and Storage Facilities

Site #	Description	Approximate Distance to BRT Roadway	2007 Existing Noise	FTA Moderate Impact Thresholds Level	FTA Severe Impact Thresholds Level	Low Investment LRT Project-Generated Noise	Medium Investment LRT Project-Generated Noise	High Investment LRT Project-Generated Noise
		feet	Ldn	Ldn	Ldn	Ldn Level Impact Category	Ldn Level Impact Category	Ldn Level Impact Category
N-14	Terrace Drive and Freyman Drive, Chevy Chase, adjacent to Georgetown Branch right-of-way,	50	55[1]	56	62	50 No Impact	50 No Impact	50 No Impact
N-15	Lyttonsville Place, Silver Spring, adjacent to Georgetown Branch right-of-way	70	50[1]	54	60	53 No Impact	53 No Impact	53 No Impact
N-53	Ingraham Street, Hyattsville	310	64[2]	61	66	66 Severe Impact	66 Severe Impact	66 Severe Impact

1. Existing noise levels (Ldn) were estimated from neighborhood population densities.
2. Existing day-night noise levels (Ldn) were estimated by averaging nearby measured noise levels recorded at properties where access was provided and using these average noise levels as representative of typical ambient noise conditions at monitoring sites exposed to the same roadway conditions where access was not provided.

2.4. Noise and Vibration Mitigation Measures

As part of the project definition vehicle skirts would be placed on all light rail vehicles. Noise generated from LRT line operations would be below the FTA impact thresholds throughout the Purple Line system due largely to the presence of vehicle skirts placed on all Purple Line light rail vehicles. Vehicle skirts are panels that cover the wheels of light rail vehicles. Illustrations depicting LRT vehicles with and without vehicle skirts are in shown in Figure 2-2. In addition, the proposed build design within the Georgetown Branch right-of-way includes the construction of a four-foot retaining wall on one side of the transitway and a four foot noise wall on the other side. These noise walls will provide additional noise reduction from light rail vehicles traveling within the narrow confines of the right-of-way. Both the vehicle skirts and the retaining walls are considered part of the project definition and therefore are considered an integral part of the Purple Line build design.

Among the most effective noise mitigation measures are noise control at the outset, during the specification and design of the transit vehicle. By developing and enforcing stringent but achievable noise specifications, the transit authority takes a major step in controlling noise everywhere on the system. Along these lines, the MTA has decided to use vehicle skirts on all LRT vehicles resulting in a "built-in" noise reduction of 8 decibels. An additional noise reduction of approximately 4 decibels will be achieved, within the Georgetown Branch right-of-way by the construction of noise barriers and retaining walls as part of the build design. By implymenting these mitigation measures as part of the project build design, the transit authority provides a means to ensure that noise exposure from line operations at nearby residential communities will stay below the FTA impact threshold throughout the limits of operation of the Purple Line system. As indicated in Table 2-23 noise reduction levels assumed to be achieved by vehicle skirts and noise barriers within the Purple Line corridor were on the very conservative range of noise reduction levels achievable. For example, noise reduction from vehicle skirts could be as great as 10 decibels. In addition to noise barriers and vehicle skirts, Table 2-23 describes other potential noise control mitigation measures which can be applied to abate transit noise. Moreover, as the project moves from the preliminary environmental impact assessmenet stage to the FEIS stage the recommended noise abatement measures will be refined and fine tuned to match the selected build design condtion.

Ground-borne vibration generated from LRT and BRT systems is not as common a problem as environmental noise, and as a result mitigation measures are not as well defined. When buses cause annoying ground-borne vibration the source of the problem is usually roadway roughness or discontinuities in the roadway. In the case of LRT systems, proper maintenance of wheels and rails is essential in controlling ground-borne vibration. Improperly maintained wheels or rails can increase vibration levels over time up to 20 VdB. Rail grinding and wheel truing on a regular basis will provide reductions of 10 to 15 VdB. In the case of the Purple Line, the ground-borne vibration exceedances reported at properties within the Capital Crescent Trail (Sites N-B, N-8 and N-10A) are slightly above the FTA impact threshold and with proper track and wheel maintenance these impacts will cease to exist.

Table 2-23: Transit Noise Mitigation Measures

Application	Mitigation Measure		Effectiveness
Source	Stringent Vehicle & Equipment Noise Specifications		Varied
	Operational Restrictions		Varied
	Resilient or Damped Wheels*	For Rolling Noise on Tangent Track:	2 dB
		For Wheel Squeal on Curved Track:	10-20 dB
	Vehicle Skirts		* 6-10 dB
	Under Car Absorption*		5 dB
	Spin-slide Control (prevents flats)*		**
	Wheel Truing (eliminates wheel flats)*		**
	Rail Grinding (eliminates corrugations)*		**
	Turn Radii greater than 1,000 feet*		(Avoids Squeal)
	Rail Lubrication on Sharp Curves*		(Reduces Squeal)
	Movable-Point Frogs (reduce rail gaps at crossovers)*		(Reduces Impact Noise)
	Engine Compartment Treatments (Buses)		6-10 dB
Path	Sound Barriers close to Vehicles		6-15 dB
	Sound Barriers at ROW Line		3-10 dB
	Alteration of Horizontal & Vertical. Alignments		Varied
	Acquisition of Buffer Zones		Varied
	Ballast on At-Grade Guideway*		3 dB
	Ballast on Aerial Guideway*		5 dB
	Resilient Track Support on Aerial Guideway		Varied
Receiver	Acquisition of Property Rights for Construction of Sound Barriers		5-10 dB
	Building Noise Insulation		5-20 dB

Source: Transit Noise and Vibration Impact Assessment, FTA, May 2006.

* Applies to rail projects only

** These mitigation measures work to maintain a rail system in its as-new condition. Without incorporating them into the system, noise levels could increase up to 10 dB.

3. Construction Noise & Vibration

While noise impact and abatement criteria have been established for the operation of transit facilities in the United States, standardized criteria have not yet been established related to noise associated with the construction of such facilities. FTA's *Transit Noise and Vibration Impact Assessment Manual* present guidelines that "can be considered reasonable criteria for assessment" of construction noise impacts. In addition, the State of Maryland and a number of agencies including FHWA, WMATA, and other entities have developed procedures for determining and addressing construction noise impacts and implementing related noise mitigation for their areas of jurisdiction or on a project-specific basis.

Noise impacts from construction activities are a function of:

- Noise generated by construction equipment that would be used under different construction methods.
- The proximity of construction activities to sensitive land uses.
- The duration of construction activity.

3.1. FTA Construction Noise Guidelines

FTA guidelines identify a set of threshold L_{eq} and L_{dn} levels for various construction activities. In urban areas with very high ambient noise levels (L_{dn} > 65 dB), L_{dn} from construction operations should not exceed existing ambient by 10 dB or more. The noise criteria and the descriptors used to evaluate construction noise are dependent on the type of land use in the vicinity of the proposed project.

Table 3-1 shows the FTA construction noise criteria for noise assessment conducted in accordance with FTA methodologies. Using FTA guidelines, an airborne noise impact would occur if noise levels during construction exceed the FTA recommended values shown in Table 3-1. The criteria do not identify park, recreation, museum, church or properties, which are the types of land uses that would be most affected by the proposed action. It should be noted that the existing noise levels at sensitive receptors in the corridor are relatively high reflecting their urban/commercial environment.

Table 3-1: FTA Construction Noise Criteria

Land Use	8-hour L_{eq} (dBA)		L_{dn} (dBA) 30-day Average
	Day	Night	
Residential	80	70	75(a)
Commercial	85	85	80(b)
Industrial	90	90	85(b)

Source: Transit Noise and Vibration Impact Assessment, FTA 2006.

(a) In urban areas with very high ambient noise levels (L_{dn} > 65 dB), L_{dn} from construction operations should not exceed existing ambient + 10 dB.

(b) 24-hour L_{eq} not L_{dn}

3.2. FHWA Construction Noise Regulations

FHWA requirements mandate that certain classifications of construction equipment and motor vehicles meet specified noise emission standards; that, except under very special circumstances, construction activities be limited to weekdays between the hours of 7 AM and 6 PM; and that construction material be handled and transported in a manner as to not create unnecessary noise. Typical noise levels from representative pieces of construction equipment are listed in Table 3-7. Using the FHWA "Roadway Construction Noise Model" (RCNM) noise levels generated from construction activities can be determined at nearby noise sensitive sites assuming the type, number, placement and percentage of the time each equipment is in use (usage factor) of each equipment is known. If a Build Alternative is selected for preliminary design, potential noise impacts generated from construction activity can be determined at noise sensitive properties within the corridor.

In general, when feasible, quieter pile driving alternatives (e.g., drilled piles or sonic piles) should be used. These methods would be recommended where geological conditions permit their use. When working outside state-owned rights-of-way, hours of construction would be limited, as specified in local municipal ordinances.

FHWA regulates construction noise through the following process:

- Identify land uses and activities that may be affected during construction.
- Determine the measures, needed to minimize or eliminate adverse construction-noise effects on the community.
- Prior to the start of construction, incorporate needed abatement measures in project plans and specifications.

3.3. Maryland Statutes

The following Maryland Noise Statutes are contained in Title 26: Department of the Environment, Subtitle 02: Occupational, Industrial, and Residential Hazards, Chapter 03: Control of Noise Pollution. The environmental noise standards set forth here represent goals expressed in terms of equivalent A-weighted sound levels, which are protective of the public health and welfare. The ambient noise levels shall be achieved through application, under provisions of laws or regulations or otherwise, of means for reducing noise levels including, but not limited to, isolation of noise-producing equipment, dampening of sound waves by insulation, equipment modification and redesign, and land use management.

3.4. Standards for Environmental Noise - General

The goals for the attainment of an adequate environment are set out in Regulation Chapter 03. The following sound levels contained in Table 3-2 present the standards for the State of

Maryland by general zoning district. Table 3-3 presents maximum allowable noise level in dBA for receiver land use categories.

Table 3-2: Environmental Noise Standards

Zoning District	Level	Measure
Industrial	70 dBA	$L_{eq}(24)$
Commercial	64 dBA	L_{dn}
Residential	55 dBA	L_{dn}

Table 3-3: Maximum Allowable Noise Level (dBA) for Receiving Land Use Categories

Effective Date	Day/Night	Industrial	Commercial	Residential
Upon Adoption	Day	75	67	65
	Night	75	62	55

(1) A person may not cause or permit noise levels which exceed those specified in **Table 2-24** except as provided in §A(2) or (3), or §B, below.
(2) A person may not cause or permit noise levels emanating from construction or demolition site activities which exceed:
(a) 90 dBA during daytime hours.
(b) The levels specified in **Table 2-24** during nighttime hours.
(3) A person may not cause or permit the emission of prominent discrete tones and periodic noises which exceed a level which is 5 dBA lower than the applicable level listed in **Table 2-24**.
(4) A person may not cause or permit, beyond the property line of a source, vibration of such direct intensity to cause another person to be aware of the vibration by such direct means as sensation of touch or visual observation of moving objects. The observer shall be located at or within the property line of the receiving property when vibration determinations are made.

B. Exemptions

(1) The provisions of this regulation may not apply to devices used solely for the purpose of warning, protecting, or alerting the public, or some segment thereof, of the existence of an emergency situation.
(2) The provisions of this regulation do not apply to the following:
(a) Household tools and portable appliances in normal usage.
(b) Lawn care and snow removal equipment (daytime only) when used and maintained in accordance with the manufacturer's specifications.
(c) Agricultural field machinery when used and maintained in accordance with manufacturer's specifications.
(d) Blasting operations for demolition, construction, and mining or quarrying (daytime only).
(e) Motor vehicles on, public roads.
(f) Aircraft and related airport operations at airports licensed by the State Aviation Administration.
(g) Boats on State waters or motor vehicles on State lands under the jurisdiction of the Department of Natural Resources.
(h) Emergency operations.
(i) Pile driving equipment during the daytime hours of 8 AM to 5 PM.
(j) Sound not electronically amplified created by sporting, amusement, and entertainment events and other public gatherings operating according to terms and conditions of the appropriate local jurisdictional body. This includes, but is not limited to, athletic contests, amusement parks, carnivals, fairground, and sanctioned auto racing facilities,

3.5. WMATA Construction Noise Specifications

WMATA specifications establish different limits for continuous and intermittent construction noise at the affected structure or area. The WMATA construction noise specifications appear in Table 3-4. For stationary sources, parked mobile sources or any sources or combination of sources producing repetitive or long-term noise lasting more than two hours the maximum allowable noise levels are shown in Table 3-4.

Table 3-4: WMATA Construction Noise Specifications

Affected Structure or Area	Maximum Allowable Continuous Noise Level (dBA)	
	Daytime	Nighttime
Single Family Residential	60	50
Multifamily residential including hospitals or residential along an arterial	65	55
In semi-residential/commercial areas including hotels	70	60
In semi-residential/commercial areas including schools	70	65
In commercial areas with no nighttime residency	75	70
Industrial – All locations	80	80

3.5.1. Intermittent Noise

Limits shown in the Table 3-5 are applicable to noise from non-stationary mobile equipment operated by a driver or from any source of non-scheduled, intermittent, and non-repetitive, short-term noises not lasting more than two hours.

Table 3-5: Intermittent Noise

Affected Structure or Area	Maximum Allowable Continuous Noise Level (dBA)	
	Daytime	Nighttime
Single Family Residential	75	60
Multifamily residential including hospitals or residential along an arterial	75	65
In semi-residential/commercial areas including hotels	80	70
In semi-residential/commercial areas including schools	80	60
In commercial areas with no nighttime residency	85	85
Industrial – All locations	90	90

3.5.2. Special Zones or Special Construction Site

In areas outside of Construction Limits but for which the Contractor has obtained designation as a Special Zone or Special Construction Site from the agency having jurisdiction, the noise limitations for buildings in industrial areas apply. In zones designated by the local agency having jurisdiction as a special zone or special premise or special facilities, such as hospital zones, the noise level and working time restrictions imposed by the agency shall apply. The Contractor shall obtain these zones and work hour restrictions from the local agency.

3.5.3. Construction Equipment Noise Emission Limits

Use only equipment meeting the allowed maximum noise emission limits as indicated in Table 3-6 as measured at a distance of 50 ft from the equipment in substantial conformity with the provisions of the latest revisions of SAEJ366b, SAEJ88, and SAE J952b or in accordance with the measurement procedures specified herein.

Table 3-6: Noise Emission Limits on Construction Noise

	Maximum Noise Limit Date Equipment Acquired	
Type of Equipment	Before 1/1/90	On or after 1/1/90
All equipment other than highway trucks, including hand tools and heavy equipment	90 dBA	85 dBA
Highway trucks in any operating mode or location	83 dBA	80 dBA

Note: Peak levels due to impact pile drivers may exceed the above noise emission limits by 10 dBA.

3.5.4. Construction Methods

Stations, shafts, cut-and-cover tunnels and portals require very similar construction techniques. Noise from excavation associated with the cut and cover construction would include noise from construction equipment such as backhoes, bull dozers, cranes, concrete mixers, concrete delivery trucks, dump trucks, delivery trucks, front-end loaders, pile drivers and jack hammers. A general discussion of noise associated with the major construction elements for the new tunnels, cut and cover construction, and work at various yards is presented below.

3.5.5. Tunneling Activities

Airborne noise from tunneling activity including noise from tunnel boring machines (TBMs) is not anticipated to be discernable in outdoor areas, as most noise would be contained underground and would be masked by existing noise levels. However, noise impacts are anticipated during hauling of excavated materials from the muck shafts and the shipping of liner segments, concrete and other materials to the shafts. Ground-borne noise from tunneling activities is discussed under vibration.

3.5.6. Construction Noise Sources

Construction noise sources at construction sites comprise both mobile and stationary sources. Mobile equipment such as dozers, scrapers, graders, etc., may operate in a cyclic fashion in which a period of full power is followed by a period of reduced power. Mobile equipment such as trucks produce steady noise and are generally associated with supply of materials to the construction sites and disposal of waste materials from construction sites. Stationary equipment consists of equipment that generates noise from one general area and includes items such as pumps, generators, compressors, etc. These types of equipment operate at a constant noise level under normal operation and are classified as non-impact equipment. Other types of stationary equipment such as pile drivers, jackhammers, pavement breakers, blasting operations, etc., produce variable and sporadic noise levels and produce impact-type noises. Typical noise emission levels from construction equipment are shown in Table 3-7. Equipment such as compressors, although generally considered to be stationary when operating, can be readily

relocated to another location for the next operation. If the proposed action would cause construction equipment to be operating within 500 feet of a sensitive receptor for an extended period of time, a more detailed analysis should be performed. Blasting operations are not expected during the project construction.

Table 3-7: Construction Equipment Noise Emission Levels

Equipment	Typical Noise Level (dBA) 50 ft From Source	Equipment	Typical Noise Level (dBA) 50 ft From Source
Air Compressor	81	Pile Driver (Impact)	101
Backhoe	80	Sonic	96
Ballast Equalizer	82	Pneumatic Tool	85
Ballast Tamper	83	Pump	76
Compactor	82	Rail Saw	90
Concrete Mixer	85	Rock Drill	98
Concrete Pump	82	Roller	74
Concrete Vibrator	76	Saw	76
Crane, Derrick	88	Scarifier	83
Crane, Mobile	83	Scraper	89
Dozer	85	Shovel	82
Generator	81	Spike Driver	77
Grader	85	Tie Cutter	84
Impact Wrench	85	Tie Handler	80
Jack Hammer	88	Tie Inserter	85
Loader	85	Truck	88
Paver	89		

Source: FTA Guidance Manual for Transit Noise and Vibration Impact Assessment May 2006.

3.6. Purple Line Construction Noise Criteria

Maryland and WMATA's residential limits for continuous construction noise levels are the same and both limit daytime noise level to 65 dBA and night time noise level to 55 dBA. These limits are applicable for the Purple Line Construction. For commercial areas, the applicable daytime and nighttime limits are 67 dBA and 62 dBA and for industrial areas, the limit is 75 dBA for both daytime and nighttime. Maryland's maximum daytime construction noise level shall not exceed 90 dBA in all areas and maximum nighttime noise level shall be limited to 55 dBA in residential areas, 62 dBA in commercial areas, and 75 dBA in industrial areas.

3.6.1. Purple Line Construction Noise

Purple Line construction noise and associated impact during station construction would be similar for all of the Build alternatives. Construction noise impacts from alternatives involving the construction of tunnels will be different for each alternative depending on the length of the proposed tunnels. In general, construction of alternatives with tunnel segments would generally result in more noise impacts than the construction of surface alternatives

3.6.2. Noise Control Requirements

To reduce noise associated with the construction methods performance standards would be established by the MTA and would be included with contract documents that must be met by all contractors during construction. A variety of measures would be employed to meet these standards, which could include using buckets and vertical conveyors to move spoils to the street level, lining hoppers and trucks with vibration-cushioning materials such as rubber to minimize the effects of spoils being deposited into hoppers and trucks and using drive through street-level truck enclosures for truck loading.

Notwithstanding the specific noise levels specified herein, utilize the noise control measures listed below to minimize to the greatest extent feasible the noise levels in all areas outside the construction limits. Project-specific construction noise abatement that can be utilized to minimize, the noise impact in areas outside the construction site boundary, should include the following:

- Utilize shields, impervious fences or other physical sound barriers to inhibit transmission of noise.
- Utilize sound retardant housings or enclosures around noise producing equipment.
- Utilize effective intake and exhaust mufflers on internal combustion engines and compressors.
- Line or cover hoppers, storage bins and chutes with sound absorbing material.
- Do not use air or gasoline driven saws.
- Conduct truck loading, unloading and hauling operations so that noise is kept to a minimum.
- Route construction equipment and other vehicles carrying spill, concrete or other materials over streets and routes that will cause the least disturbance to residents in the vicinity of the activity. Advise the Engineer in writing of the proposed haul routes prior to securing a permit from the local government.
- Subject to the approval of the Engineer, and to the extent physically feasible site stationary equipment away from residential areas to minimize noise impact on the community.

3.7. Vibration Generated During Construction

Construction activities have the potential for producing high vibration levels that may be perceptible. Some construction activities have the potential to generate vibration levels enough to cause architectural and structural damage. Even where vibration levels are lower or imperceptible, vibrations can nonetheless produce ground-borne noise. Construction activities typically producing the highest vibration and ground-borne noise levels are those involving the use of impact equipment or blasting. The effects of ground-borne vibration may include discernable rattling of windows, and shaking of items on shelves or hanging on walls. In extreme cases, the vibration can cause damage to buildings. The vibration of floors and walls may cause perceptible vibration, rattling of such items as windows or dishes on shelves. The vibration of building surfaces and objects within the building can also result in a low-frequency rumble noise. The rumble is the noise radiated from the vibration of the room surfaces, even when the vibration itself cannot be felt. This is called ground-borne noise.

3.7.1. Vibration Prediction Methodology

The FTA guidance manual provides some simple screening methodologies for determining where there is a significant potential for impact from construction activities. Such activities include pile driving, demolition, drilling, excavation, or blasting in close proximity to sensitive structure. The procedure includes: (1) selecting the equipment and determining the vibratory levels at a reference distance of 25 feet; (2) determining peak particle velocity at a receptor location using a formula that accounts for the peak particle velocity of the equipment and the distance from the receptor; and (3) if consideration of annoyance or interference with vibration-sensitive activities is of concern, estimate the vibration level and apply the vibration impact.

3.7.2. Source Vibration Levels for Construction Equipment

Listed in Table 3-8 are vibration source levels from heavy construction equipment. These levels are average source levels under a wide variety of construction activities. This information can be used while predicting vibration levels at various receptor distances from the operation of construction equipment. Damage and annoyance assessment will follow the FTA procedures.

Table 3-8: Source Levels for Construction Equipment Vibration

Equipment	PPV* at 25 ft (in/sec)	Approximate L_v at 25 ft ** (VdB re 10^{-6} in/sec)
Pile Driver (impact, upper range)	1.518	112
Pile Driver (impact, typical)	0.644	104
Pile Driver (sonic, upper range)	0.734	105
Pile Driver (sonic, typical)	0.170	93
Clam shovel drop (slurry wall)	0.202	94
Large bulldozer	0.089	87
Caisson drilling	0.089	87
Loaded trucks	0.076	86
Jackhammer	0.035	79
Small bulldozer	0.003	58

Source: Guidance Manual for Transit Noise and Vibration Impact Assessment, April 1995

* Peak Particle Velocity ** RMS (Root Mean Square) Velocity in decibels (VdB)

3.7.3. Purple Line Construction Vibration Criteria

To avoid physical damage to buildings, the contractor shall conduct construction activities in such a manner that the maximum ground-borne vibration at all times does not exceed 0.2 in/sec (PPV) in any direction for buildings which are in generally sound condition. For historical monuments, the contractor shall conduct construction activities in such a manner that the ground vibration magnitude at all times does not exceed 0.12 in/sec (PPV) in any direction.

3.7.4. Purple Line Construction Vibration

Purple Line construction vibration and associated impact during station construction would be the same for all of the Build Alternatives. Construction vibration impacts from alternatives involving the construction of tunnels will be different for each alternative depending on the length of the proposed tunnels. In general, construction of alternatives with tunnel segments, such as the LRT and High Investment BRT Alternatives would generally result in more construction vibration impacts than the construction of surface alternatives.

3.7.5. Vibration Control Requirements

Notwithstanding the specific vibration levels specified herein, utilize vibration control measures listed below to minimize to the greatest extent feasible the vibration levels in all areas outside the construction limits:

- Use vibratory pile drivers or auguring for setting piles in lieu of impact pile drivers.
- If impact pile drivers must be used, their use is restricted to the hours from 8 AM to 5 PM weekdays in residential and in semi-residential/commercial areas.

Specify realistic vibration limits in contract documents.

- Develop a monitoring program during construction. Monitor vibrations at nearest sensitive locations throughout the construction period.

- Inform people living and working in the vicinity about construction method, possible effects, quality control measures and precautions to be used and the channels of communication available to them.

Additional vibration control plans and practices would include routing truck traffic and heavy equipment to avoid impacts to sensitive receptors, properly securing street decking over cut-and-cover excavations, scheduling work to limit nighttime impacts in residential areas, and minimizing the duration of vibration impacts

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