Los Angeles County
Metropolitan Transportation Authority

Appendix L Noise and Vibration Impacts Report

EASTSIDE TRANSIT CORRIDOR PHASE 2

Metro

May 2026

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Acronyms

2024 RTP	Connect SoCal 2024-2050 Regional Transportation Plan
ADA	Americans with Disabilities Act
ANSI	American National Standards Institute
Am	Ante Meridiem
API	area of potential impact
BMP	Best Management Practices
CIDH	cast-in-drilled-hole
CWR	continuous welded rail
dB	decibels
dBA	A-weighted decibel
EA	Environmental Assessment
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
FLM	First/Last Mile
FTA	Federal Transit Administration
GBN	ground-borne noise
GBV	ground-borne vibration
HVAC	heating, ventilation, and air conditioning
I	Interstate
ID No.	Identification Number
ips	inches per second
LACMTA	Los Angeles County Metropolitan Transportation Authority
Ldn	average day-night noise level
Leq(h)	average hourly equivalent noise level
Lmax	Maximum noise level
LRT	light rail transit

LRTP	Long Range Transportation Plan
LRV	light rail vehicles
Metro	Los Angeles County Metropolitan Transportation Authority
MOW	Maintenance of Way
mph	miles per hour
MRDC	Metro Rail Design Criteria
MSF	maintenance and storage facility
N/A	Not Applicable
NEPA	National Environmental Policy Act
NMM	National Environmental Policy Act mitigation measure
NPM	National Environmental Policy Act project measure
OCS	overhead catenary system
pm	Post Meridiem
Project	Eastside Transit Corridor Phase 2 Project
RMS	root mean squared
ROW	Right-of-way
SCAG	Southern California Association of Governments
SEL	sound level exposure
SFR	Single-Family Residence
SR	State Route
TBM	tunnel boring machine
TPSS	traction power substation
VdB	vibration decibels
VMT	vehicle miles traveled

1.0 INTRODUCTION

This impacts report discusses the Eastside Transit Corridor Phase 2 Project setting in relation to noise and vibration. It briefly summarizes the Project (Atlantic to Greenwood Alternative [Build Alternative] and the No Build Alternative), describes the regulatory setting and affected environment, and evaluates the environmental consequences of the alternatives.

The Build Alternative consists of 4.7 miles of reconfigured and new light rail transit (LRT) guideway to extend the Los Angeles County Metropolitan Transportation Authority (LACMTA/Metro) E Line east from the current terminus at Atlantic Boulevard in East Los Angeles to an at-grade terminal station at the Greenwood station in the City of Montebello.

The area of analysis (Study Area) is in eastern Los Angeles County and includes portions of the unincorporated community of East Los Angeles and the Cities of Commerce and Montebello. It has a diverse mix of land uses, including single- and multi-family residences, commercial and retail uses, industrial development, parks and recreational, health and medical uses, educational institutions, and vacant land. The Build Alternative would traverse densely populated, low-income, and heavily transit dependent communities with major activity centers within the Gateway Cities subregion of Los Angeles County.

2.0 PROJECT ALTERNATIVES

2.1 Project Setting

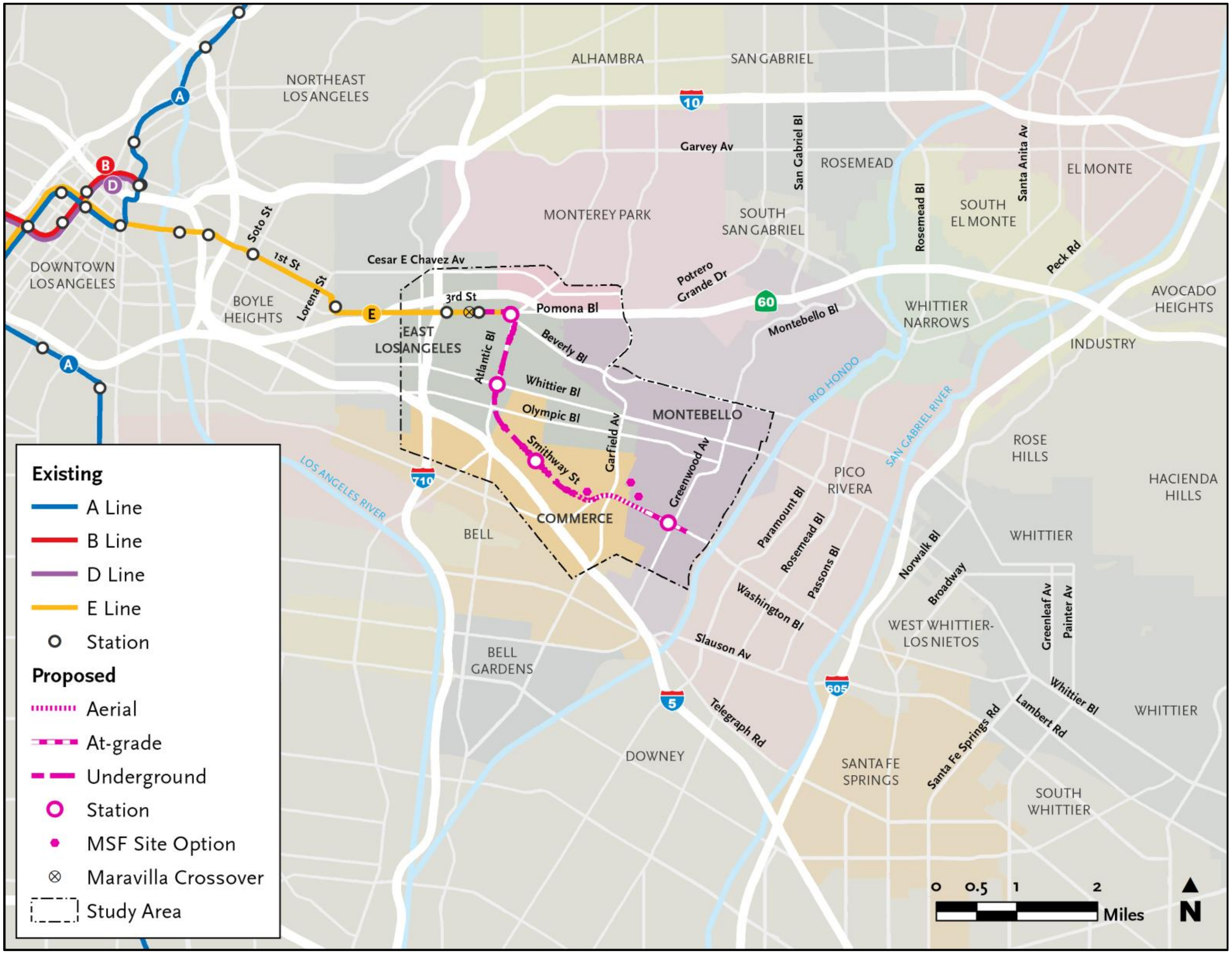
This Impacts Report evaluates potential environmental effects of the Build Alternative and No Build Alternative. The Study Area for the Build Alternative generally includes the area within a 0.5-mile to 2-mile radius from the Build Alternative's guideway's centerline.[1] The Study Area varies in distance from the alignment to encompass the area of localized effects and also include nearby boundaries of Cities and census tracts that are considered in the evaluation of topics such as land use and growth. It primarily encompasses a portion of the communities located along the Build Alternative alignment: the Cities of Commerce and Montebello and unincorporated East Los Angeles. A small portion of Monterey Park is located on the northwestern edge. **Figure 2.1** shows the Study Area boundaries.

As discussed in **Section 1.0**, the Study Area and surrounding region serve a diverse mix of uses. Major activity centers include East Los Angeles Community College, recreation areas, major retail and commercial centers (e.g., Citadel Outlets and the Historic Whittier Boulevard Shopping District), and medical centers. The Study Area is densely populated with low-income and transit dependent communities. In addition, many industrial and commercial properties utilize the arterials and freeways within the region for logistical freight activities.

2.2 Project Description

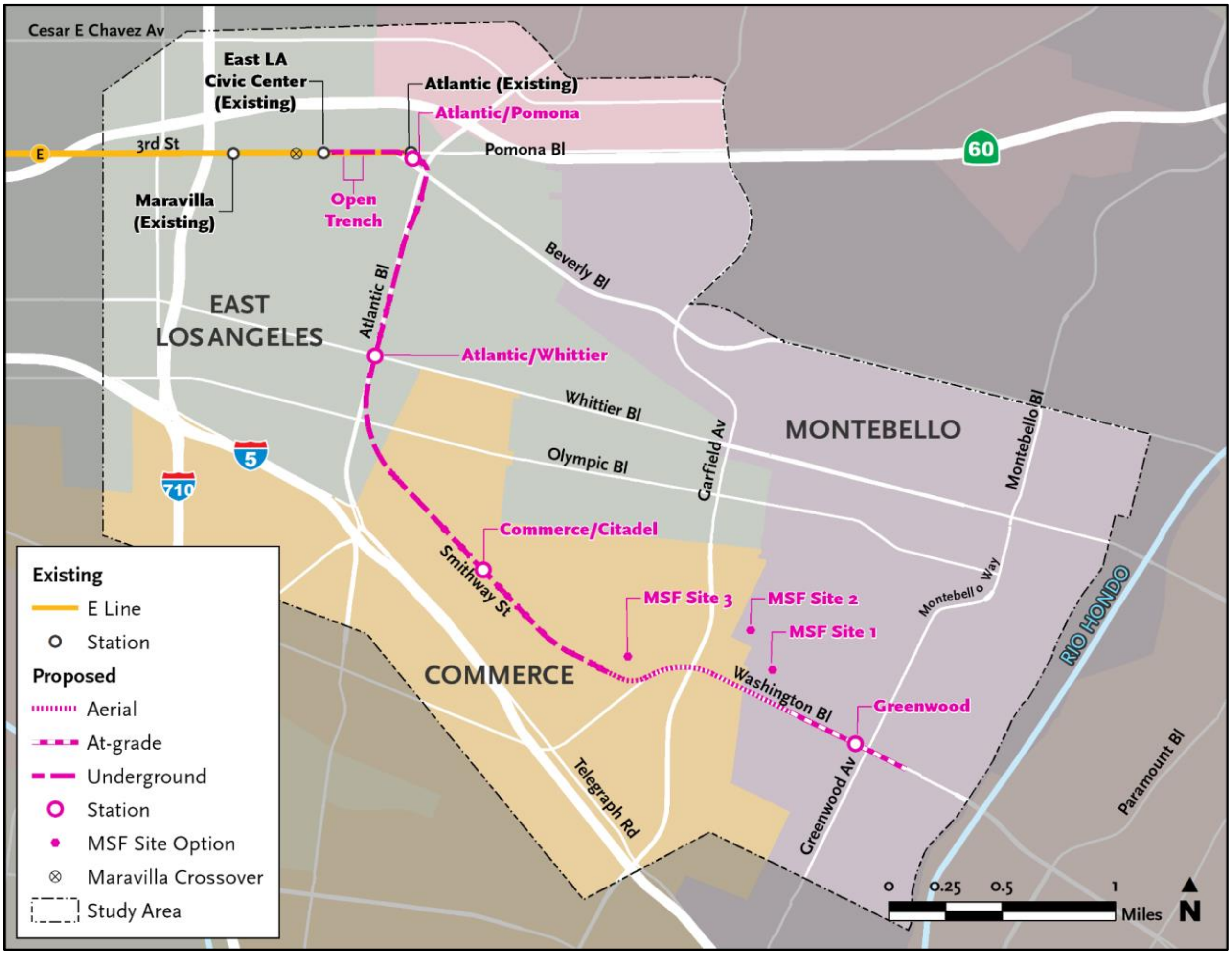
The Build Alternative is an electric-powered LRT service extension in eastern Los Angeles County. The Build Alternative would consist of 4.7 miles of reconfigured and new LRT guideway to extend the Metro E Line east from the current terminus at Atlantic Boulevard to an at-grade terminal station at the Greenwood station in the City of Montebello. The 4.7 miles would include reconfiguration of 0.4 miles of existing track for a transition to a new 4.3-mile extension. The configuration includes an approximately 3.1-mile underground guideway, 0.9-mile aerial guideway, and 0.7-mile at-grade guideway. It also includes a relocated underground Atlantic/Pomona station and three new stations. As discussed in greater detail below, the Build Alternative also includes guideway and system facilities to support vehicle operations, such as overhead catenary systems (OCS), radio communications, and train control houses that would be constructed along the alignment, a modification to existing tracks west of the proposed alignment extension (Maravilla Crossover); and a maintenance and storage facility (MSF). Three site options for the MSF are being evaluated based on project requirements, constructability, environmental impacts, operational efficiency, and compatibility with surrounding land uses, but only one would be selected. Of the evaluated MSF sites, two are in the City of Montebello (MSF Sites 1 and 2) and one is in the City of Commerce (MSF Site 3). **Figure 2.2** shows a close-up of the Study Area and the alignment with the proposed stations and MSF site options.

[1] According to the Federal Transit Administration (FTA), a guideway refers to a public transportation facility using and occupying a separate right-of-way (ROW) or rail line for the exclusive use of public transportation (FTA 2025). The Build Alternative guideway is the proposed rail line, including the underground, aerial, and at-grade configurations. The centerline refers to the center line between the guideway LRT tracks or structures that supports, contains, and physically guides the LRT vehicles.



Source: Metro; CDM Smith/AECOM JV 2026.

Figure 2.1. Study Area



Source: Metro; CDM Smith/AECOM JV 2026.

Figure 2.2. Study Area Close-up

2.2.1 Guideway Alignment

The Build Alternative includes revisions to the existing Metro E Line tracks west of the existing East Los Angeles Civic Center Station and a new guideway extension that begins east of the station in East Los Angeles (unincorporated Los Angeles County).

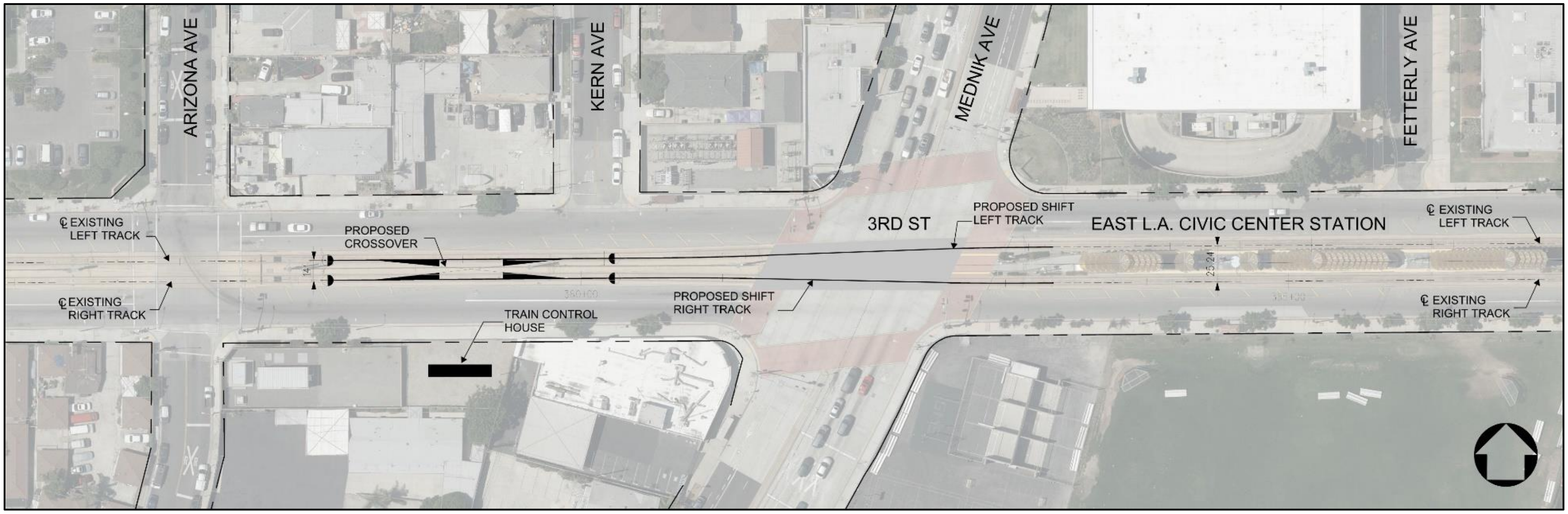
The existing tracks would be reconfigured to install a new at-grade double crossover[2] on 3rd Street between Arizona Avenue and Kern Avenue as shown in **Figure 2.3**. The new crossover, referred to as the Maravilla Crossover, is required to meet operational requirements of the guideway extension. Construction of the Maravilla Crossover would involve a minor shift of the existing track to the east and roadway resurfacing within the existing right-of-way (ROW). A train control house with electric power switches and auxiliary power room would be constructed at the vacant lot owned by Metro on the south side of 3rd Street between South Arizona Avenue and South Mednik Avenue (see **Figure 2.3**). This site is adjacent to an existing traction power substation (TPSS) that is surrounded by a block wall. The block wall would be extended to include the train control house site.

The new guideway would begin with a transition from the existing at-grade guideway to an underground guideway within an open trench extending from east of Civic Center Way to east of La Verne Avenue as shown in **Figure 2.4.** The trench would eliminate vehicle and pedestrian crossings of 3rd Street at La Verne Avenue and therefore, left turns to and from La Verne Avenue would be prohibited during construction and operation of the Build Alternative. Left turns would also be eliminated at Civic Center Way; however, the pedestrian crosswalk at this location would remain. To facilitate traffic movement to and from La Verne Avenue and Civic Center Way, eastbound traffic on 3rd Street would be allowed to make a U-turn on Wood Avenue to reverse direction. Westbound traffic would continue to be allowed to make a U-turn at Mednick Avenue to reverse direction. Additionally, a new access road would be constructed to allow Sheriff's Department vehicles to turn left from the Sheriff's Department driveway onto 3rd Street. A new high-visibility crosswalk would provide pedestrian access across 3rd Street between the existing pedestrian access at Civic Center Way and Woods Avenue.

Once underground, the guideway would follow 3rd Street to the proposed relocated underground Atlantic/Pomona station east of Beverly Boulevard. The underground guideway would then turn south, running east of Atlantic Boulevard until south of 4th Street and then underneath Atlantic Boulevard to approximately Verona Street and Olympic Boulevard. Then the underground guideway would curve southeast, running under Smithway Street near the Citadel Outlets in the City of Commerce.

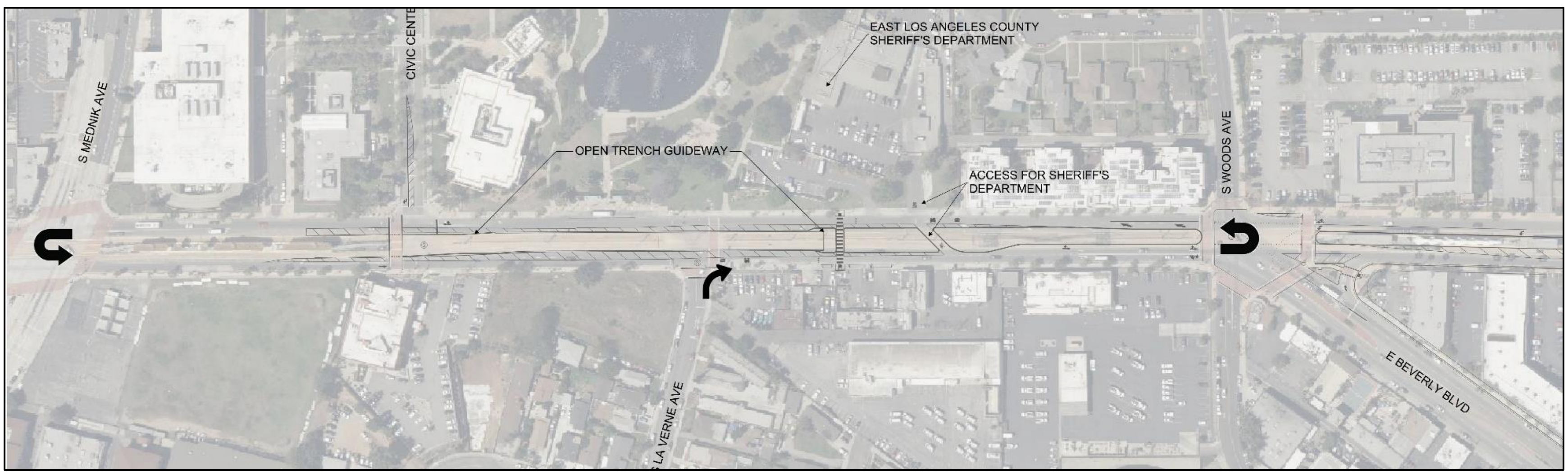
After crossing Saybrook Avenue, the guideway would transition from underground to an aerial configuration. If MSF Site 1 or 3 is selected, the aerial guideway would continue east and merge into the center of Washington Boulevard at Gayhart Street. However, if MSF Site 2 is selected, the aerial guideway would continue east immediately to the north of Washington Boulevard then merge into the center of Washington Boulevard east of Garfield Avenue.

[2] Track crossovers allow a train to reverse direction and use adjacent track to continue operation. The Build Alternative includes the Maravilla Crossover and crossovers along the alignment extension.



Source: Metro; HNTB/Cordoba 2026.

Figure 2.3. Maravilla Crossover Exhibit



Source: HNTB/Cordoba 2026.

Figure 2.4. Conceptual 3rd Street Modifications

Under all three MSF site options, the aerial tracks would transition to an at-grade configuration between Vail Avenue and Maple Avenue. The alignment would remain at-grade in the center of Washington Boulevard until the intersection of Washington Boulevard and Greenwood Avenue in the City of Montebello, where it would shift slightly south of the center of Washington Boulevard. Revenue service would terminate at Greenwood station to the west of Greenwood Avenue and tail tracks would continue further east to Montebello Boulevard to allow for the LRT to reverse direction. The guideway and trackwork design would comply with the Metro Rail Design Criteria (MRDC).

2.2.1.1 Traffic Circulation Changes

Left turns would be eliminated at the intersection of Washington Boulevard and Maple Avenue where the at-grade alignment begins just west of the intersection. At the intersection of Washington Boulevard and Montebello Boulevard, two options for the guideway are being considered:

- Montebello Boulevard Option 1 (no left turn) – This option would remove left-turn pockets on Washington Boulevard and eliminate left turns onto Montebello Boulevard from both directions. Only through traffic movement and right turns would be allowed from Washington Boulevard at this intersection.
- Montebello Boulevard Option 2 (left-turn pocket) – This option would retain left-turn pockets on Washington Boulevard for traffic in both directions. This option would require widening Washington Boulevard and involves additional property acquisitions.

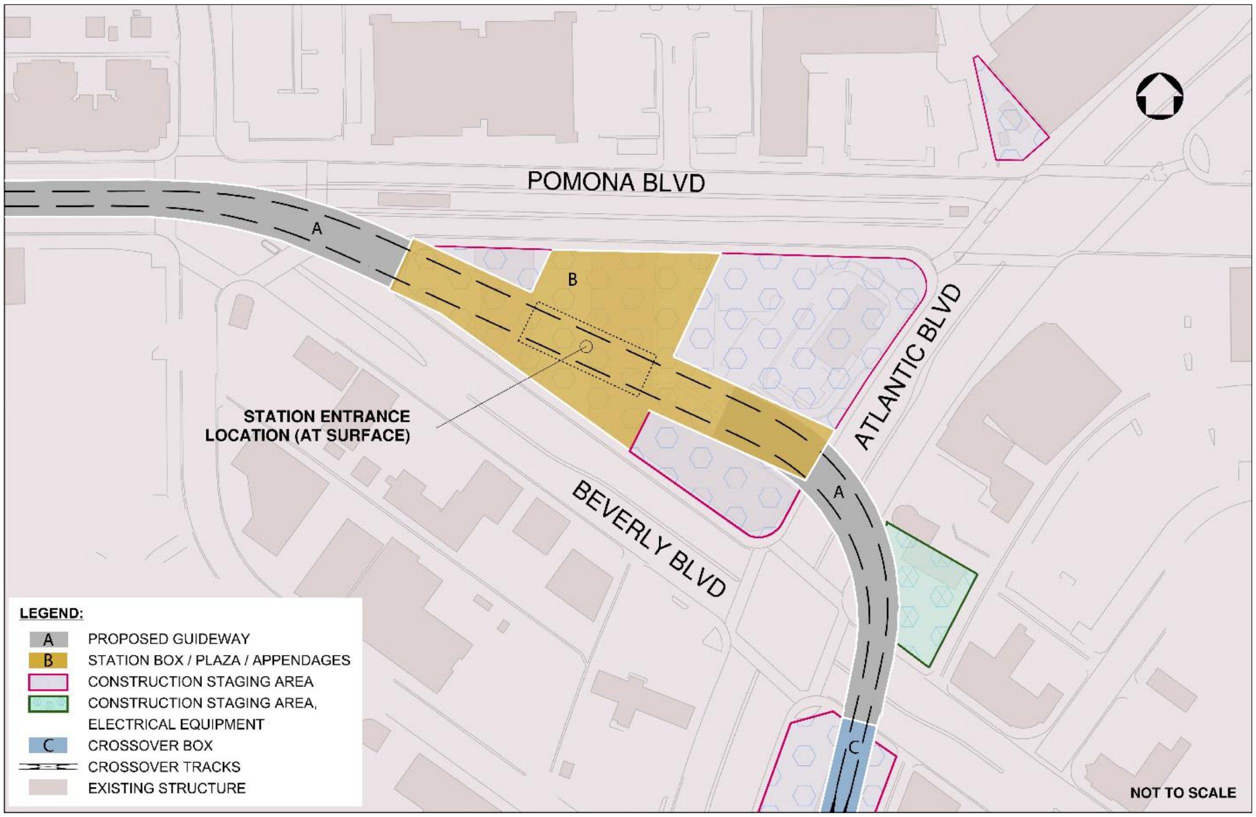
Additional changes to traffic circulation include a reduction in the number of traffic lanes on eastbound 3rd Street from two lanes to one between Civic Center Way and the new Sheriff's Department access road to accommodate the open trench and on Washington Boulevard between Saybrook Avenue and the eastern terminus from three lanes to two lanes to allow for the placement of columns to support the aerial guideway and for the right-of-way needs of the at-grade guideway. Unsignalized left-turns along the at-grade guideway would be prohibited. Minor changes to lane configurations at intersections may be required to accommodate new or modified traffic circulation patterns, such as along Washington Boulevard and near the intersection of 3rd Street and Atlantic Boulevard to accommodate the trench for the transition. There may also be new traffic signals or modifications to existing traffic signals to accommodate light rail movements and traffic circulation patterns at intersections and grade crossings and to facilitate pedestrian access to and from stations. Additional changes may include access changes at selected cross streets due to at-grade or aerial crossings and driveway widening at some industrial properties along Washington Boulevard.

2.2.2 Proposed Stations

The following stations would be constructed under the Build Alternative:

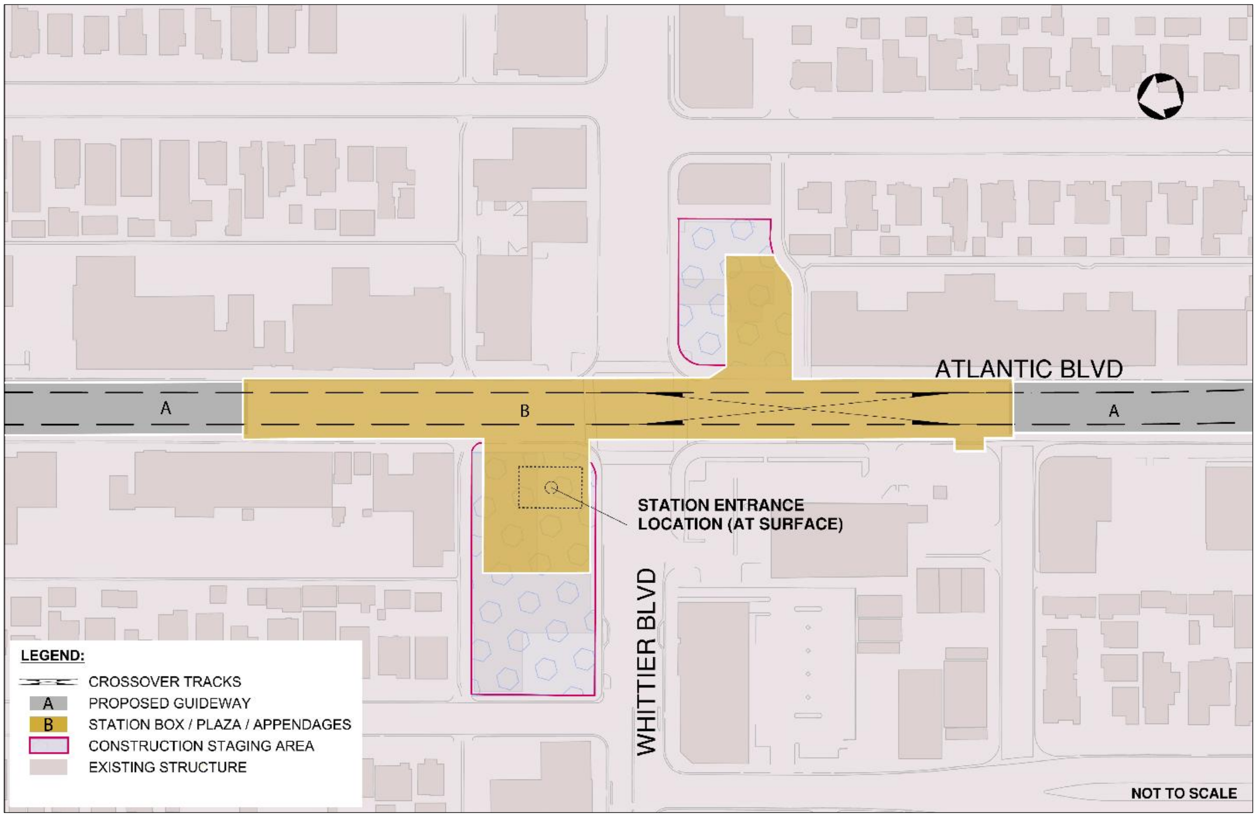
- Atlantic/Pomona – The Atlantic/Pomona station would relocate the existing at-grade Atlantic Station to an underground station with a center platform layout. This station would be located beneath the triangular parcel bounded by Atlantic Boulevard, Pomona Boulevard, and Beverly Boulevard. The existing parking structure with 280 parking spaces is located north of the 3rd Street and Atlantic Boulevard intersection would continue to serve this station. In coordination with Metro Art, efforts would be made, as feasible, to relocate the artwork from the existing Atlantic Station to the new Atlantic/Pomona station.
- Atlantic/Whittier – This station would be underground with a center platform located beneath the intersection of Atlantic and Whittier Boulevards in East Los Angeles. Parking would not be provided at this station. Access to the station would be provided via an entrance located on the northwest corner of the Whittier Boulevard and Atlantic Boulevard intersection.
- Commerce/Citadel – This station would be underground with a center platform located beneath Smithway Street near the Citadel Outlets in the City of Commerce. Parking would not be provided at this station. Access to the station would be provided via an entrance located south of Smithway Street west of Gaspar Avenue.
- Greenwood – This station would be at-grade with a center platform on Washington Boulevard located just west of Greenwood Avenue in the City of Montebello. This station would provide a surface parking facility with 270 to 370 proposed new surface parking spaces near the intersection of Greenwood Avenue and Washington Boulevard.

Conceptual station site plans are shown in **Figure 2.5** through **Figure 2.8**. Station public area designs and amenities would comply with the Systemwide Station Design Standards, Metro Art Program Policy, MRDC, and Architectural Standard and Directive Drawings. Design elements would include, but would not be limited to, station signs, entrance portal canopies at the underground stations, platform canopies at the at-grade station, plaza paving and landscaping, interior architectural finishes and furnishings, lighting, passenger telephones, sound attenuation features, customer information panels, real-time information digital screens, fare gates, fare vending machines, integrated public art, security cameras, and bike racks and lockers. Station entry portals with escalators and elevators would provide access to underground stations. Access to all stations would be compliant with the Americans with Disabilities Act (ADA) and would also have bicycle and pedestrian connections. Bicycle and pedestrian connections to the stations would comply with the Metro First/Last Mile (FLM) Guidelines and the MRDC. Details, including station area planning and urban design, would be determined during the Build Alternative's final design phase in compliance with Metro design standards and policies for Metro rail stations.



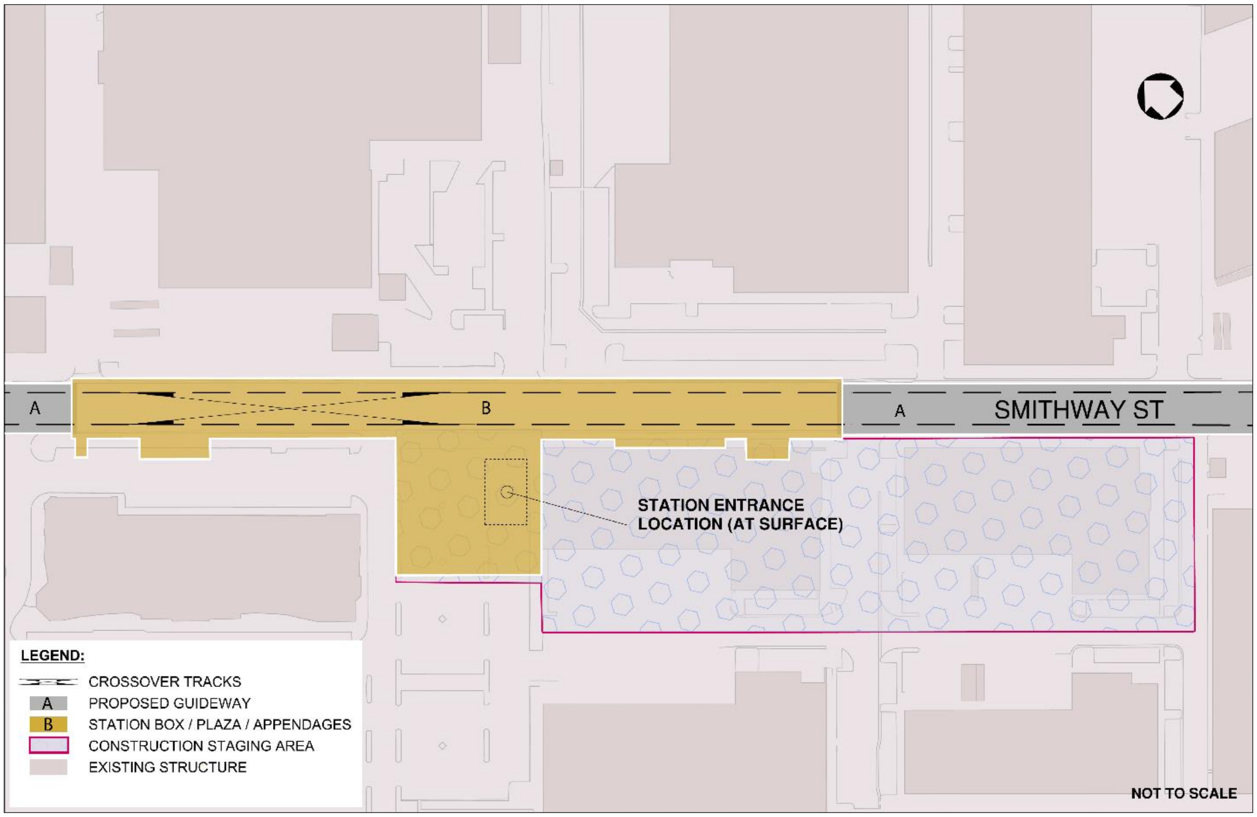
Source: Metro; HNTB/Cordoba 2026.

Figure 2.5. Atlantic/Pomona Station Conceptual Site Plan



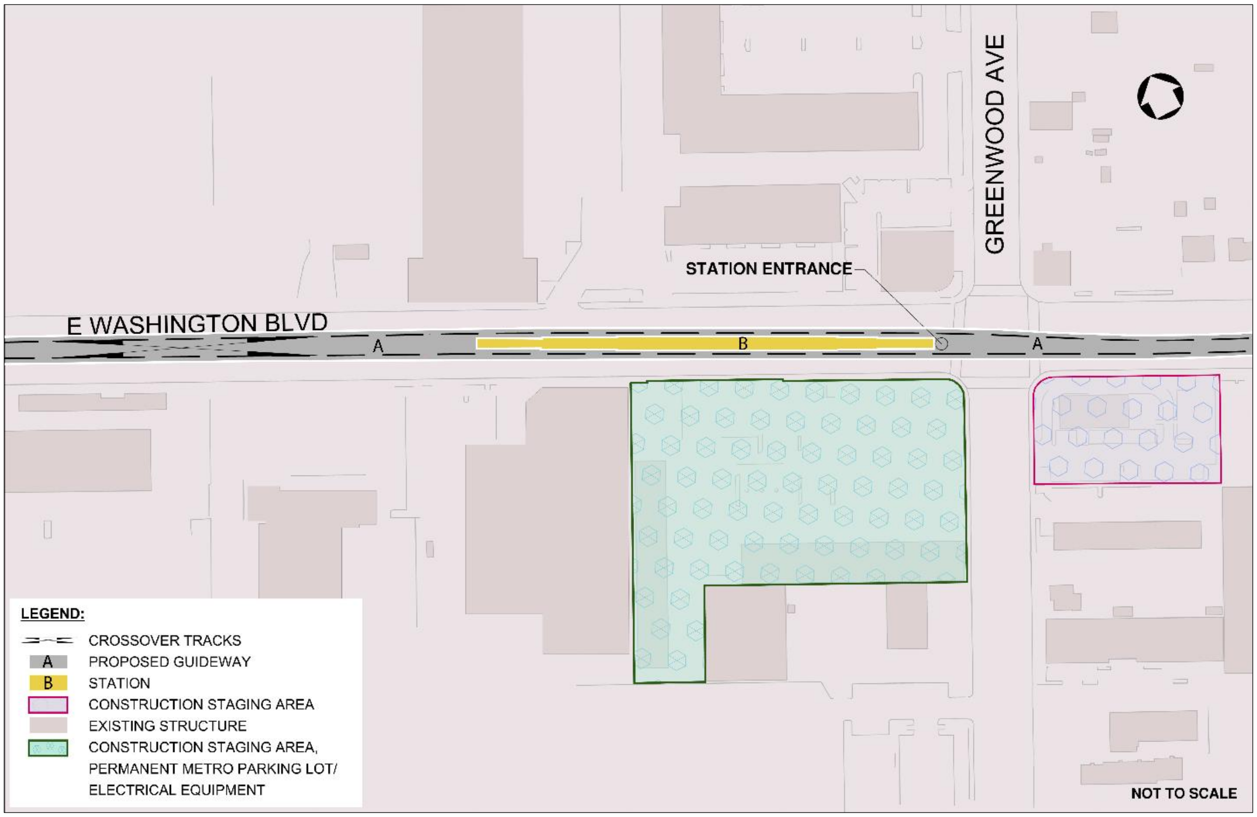
Source: Metro; HNTB/Cordoba 2026.

Figure 2.6. Atlantic/Whittier Station Conceptual Site Plan



Source: Metro; HNTB/Cordoba 2026.

Figure 2.7. Commerce/Citadel Station Conceptual Site Plan



Source: Metro; HNTB/Cordoba J2026.

Figure 2.8. Greenwood Station Conceptual Site Plan

2.2.3 Guideway and System Facilities

The Build Alternative would include additional elements to support vehicle operations, including but not limited to the OCS, tracks, crossovers, cross passages, ventilation structures, emergency fire exits, TPSS, train control houses with electric power switches and auxiliary power rooms, radio communications, an emergency generator, and the MSF. The Build Alternative would have an underground alignment of approximately 3.1 miles in length between La Verne and Saybrook Avenue. Ventilation shafts and emergency fire exits would be installed along the underground portion of the alignment as required by the current version of Metro's Fire Life Safety Criteria. These would be located at the underground stations and adjacent to the crossover following the Atlantic/Pomona station. The Build Alternative alignment would travel along the median of the roadway for most of the route. The precise location of railroad system facilities would be determined in a subsequent design phase.

2.2.4 Maintenance and Storage

2.2.4.1 Maintenance and Storage Facility (Sites 1, 2, and 3)

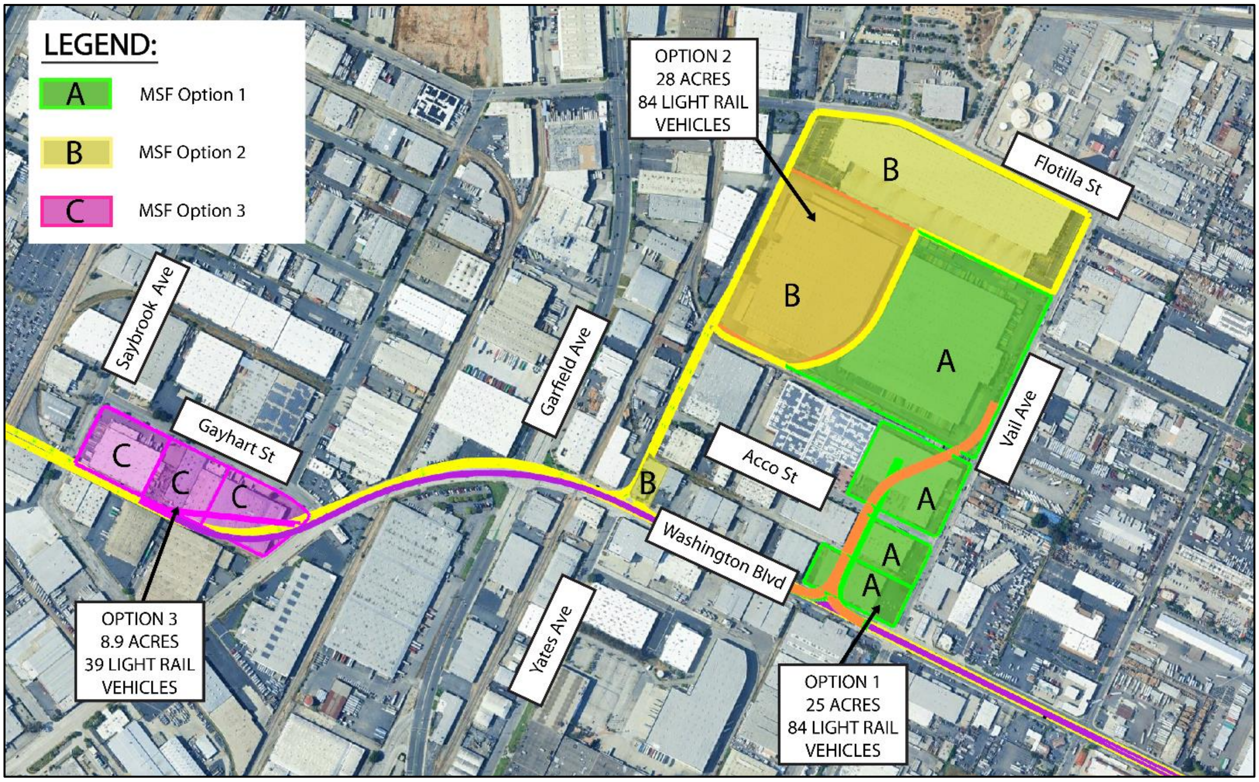
The Build Alternative would include equipment and facilities for cleaning and maintenance of rail cars and to store vehicles that are not in service. This would be supported by a new MSF that would be constructed in an industrial zone in the City of Montebello or in the City of Commerce.

Three site options for the MSF are evaluated in this report: MSF Sites 1 and 2 (25 acres and 28 acres in size, respectively) are in the City of Montebello and MSF Site 3 (9 acres in size) is in the City of Commerce. Only one of the three sites would be selected and constructed. The MSF would include equipment and facilities to clean and maintain rail cars, tracks, and other system components. The MSF would enable storage of light rail vehicles that are not in service and Metro's hi-rail service vehicles, and it would also provide office space for operation and administrative staff. MSF Sites 1 and 2 would have repair facilities and larger storage capacity as compared to MSF Site 3.

MSF Sites 1 and 2 would be north of Washington Boulevard and south of Flotilla Street. Specifically, MSF Site 1 would be west of Vail Avenue with mid-block yard lead tracks and MSF Site 2 would be west of MSF Site 1 with yard lead tracks on Yates Avenue. MSF Sites 1 and 2 would require yard lead tracks that connect to the main line at a wye junction (i.e., three-way junction). The yard lead tracks for MSF Sites 1 and 2 would connect to the mainline alignment in an aerial configuration and transition to at-grade as the track approaches the MSF.

MSF Site 3 would be located west of MSF Sites 1 and 2, at the tunnel boring machine launch (TBM) site at Gayhart Street, east of Saybrook Avenue. The tracks to the MSF would come off the mainline in the LRT ROW north of Washington Boulevard on the parcel east of Saybrook Avenue and south of Gayhart Street as the alignment transitions from an underground to an aerial configuration.

The evaluation of the MSF in this report refers to MSF Sites 1, 2, and 3. MSF Sites 1, 2, and 3 are discussed separately only when there is a difference in the analysis between the three sites. **Figure 2.9** shows the location of the three MSF site options, which are described in greater detail in the following sections.

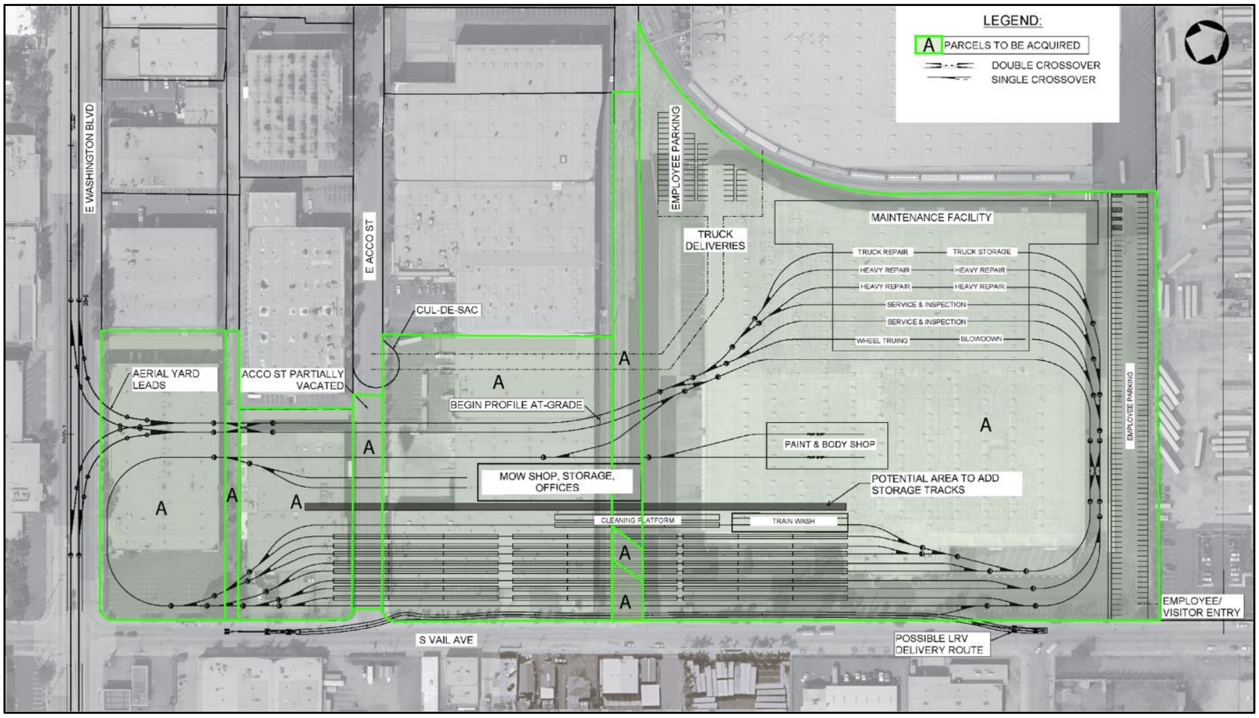


Source: HNTB/Cordoba 2026.

Figure 2.9. MSF Site Options

2.2.4.1.1 MSF Site 1: Aerial Yard Lead Tracks Located Mid-Block

MSF Site 1, shown in **Figure 2.10**, would be approximately 25 acres in size and would encompass four parcels on the west side of Vail Avenue between Flotilla Street and Washington Boulevard. The yard lead tracks to MSF Site 1 would be in an aerial configuration from Washington Boulevard, paralleling Vail Avenue, and would transition to at-grade as the track approaches the MSF. The yard lead tracks would require elimination of through-access to vehicles on Acco Street from Yates Avenue to Vail Avenue. A cul-de-sac would be provided on the westerly side of the lead tracks to ensure that access to businesses in this area is maintained from Yates Avenue. MSF Site 1 would require the full acquisition of five properties and partial acquisitions of two properties with commercial and industrial uses to accommodate the MSF and the lead tracks. A partial vacation of Acco Street would also be required. MSF Site 1 would accommodate storage of up to 84 light rail vehicles (LRV) cars and would have approximately 204 employee parking stalls (including 6 ADA parking stalls).

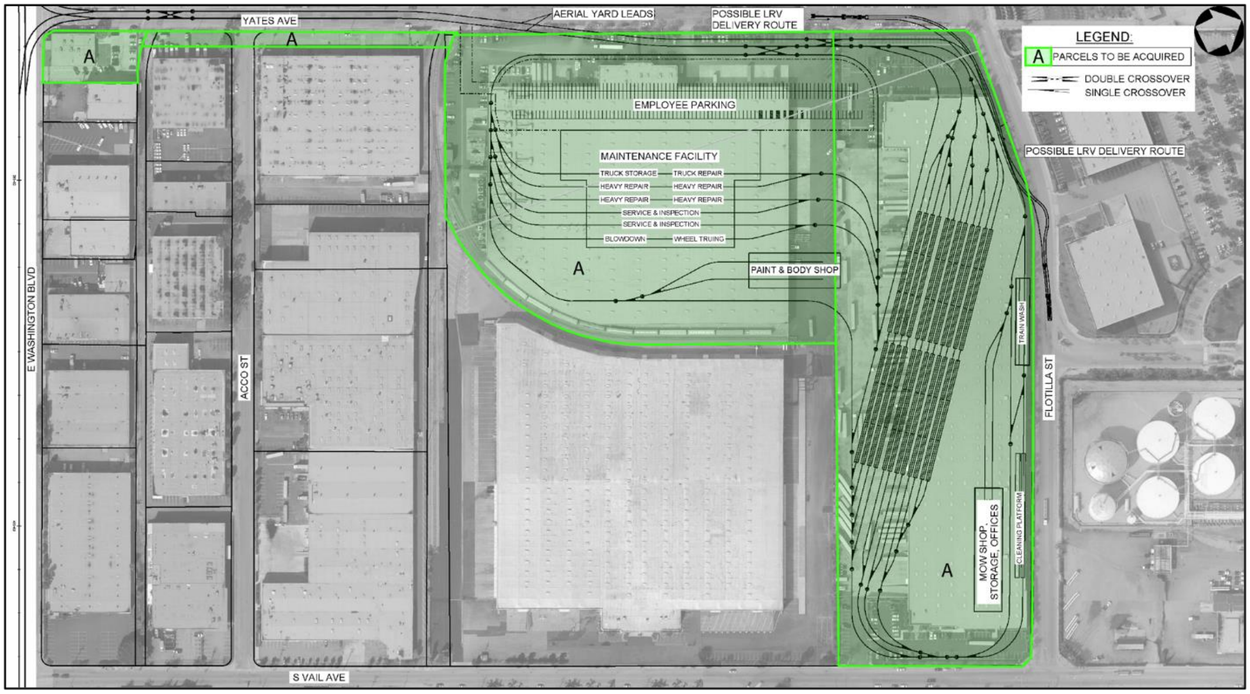


Source: Metro; HNTB/Cordoba 2026.
Key: LRV = Light Rail Vehicle; MOW = Maintenance of Way

Figure 2.10. MSF Site 1

2.2.4.1.2 MSF Site 2: Aerial Yard Lead Tracks Located along Yates Avenue

MSF Site 2, shown in **Figure 2.11**, would be approximately 28 acres in size and would encompass one parcel along the south frontage of Flotilla Street between Yates Avenue and Vail Avenue, and one adjacent parcel immediately to the south, east of Yates Avenue. Additional acreage would be needed to accommodate the yard lead tracks and associated construction staging. If MSF Site 2 is selected, the aerial guideway east of Gayhart Street would be located immediately to the north of Washington Boulevard and merge into the center median of Washington Boulevard east of Garfield Avenue. The yard lead tracks to the MSF would partially be in the City of Commerce, starting in an aerial configuration from Washington Boulevard along the easterly edge of Yates Avenue, and transitioning to at-grade as the tracks approach the MSF. Yates Avenue would retain one vehicle lane in both directions. Two lanes of traffic would be maintained in each direction along Washington Boulevard. MSF Site 2 would require full acquisition of seven parcels for the MSF and the yard lead tracks. MSF Site 2 would also require 10 partial acquisitions of properties including properties along Yates Avenue between Washington Boulevard and MSF Site 2 to accommodate the yard lead tracks and along Washington Boulevard between Gayhart Street and Yates Avenue for the mainline alignment and lead tracks. The MSF would accommodate storage of up to 84 LRV cars and would have approximately 255 employee parking stalls (7 ADA parking stalls).

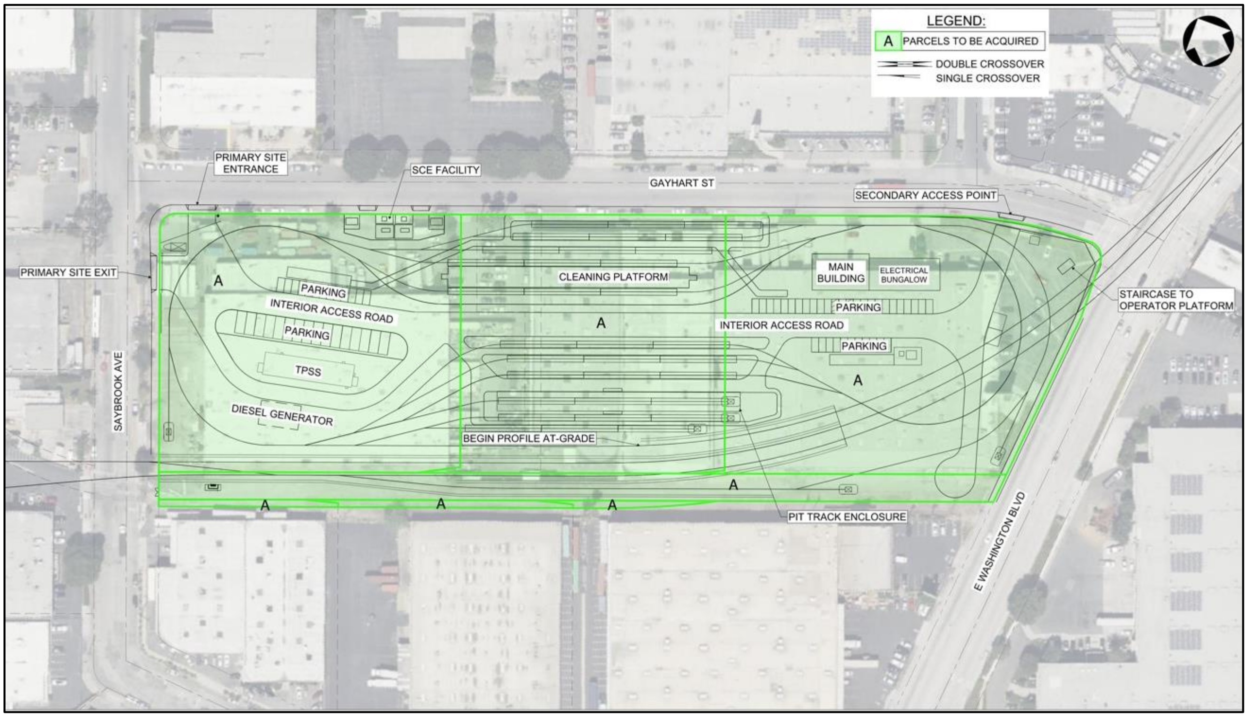


Source: Metro; HNTB/Cordoba 2026.
Key: LRV = Light Rail Vehicle; MOW = Maintenance of Way

Figure 2.11. MSF Site 2

2.2.4.1.3 MSF Site 3: Satellite Yard at Gayhart Street

MSF Site 3, shown in **Figure 2.12**, would be approximately 8.9 acres in size and would encompass three parcels south of Gayhart Street between Saybrook Avenue and Washington Boulevard in the City of Commerce. MSF Site 3 would require full acquisition of five parcels for the MSF, which would also be used for the transition from the tunnel to aerial tracks, construction staging, and the launching of the TBM. The tracks into the MSF would connect to the main line in an at-grade configuration between Saybrook Avenue and Washington Boulevard as the main line alignment transitions from underground to aerial. MSF Site 3 would accommodate storage of a minimum of 39 LRV cars and would have approximately 62 employee parking stalls (3 ADA parking stalls). MSF Site 3 would not have repair facilities.



Source: Metro; HNTB/Cordoba 2026.
Key: LRV = Light Rail Vehicle; SCE = Southern California Edison; TPSS = traction power substation

Figure 2.12. MSF Site 3

2.2.5 Construction

The Build Alternative would include the construction of an underground, aerial, and at-grade guideway for LRT. Key construction activities associated with the guideway (at-grade, aerial, underground) would include temporary roadway decking for the cut and cover sections of the underground guideway and the underground stations, tunnel boring for the remaining portions of the underground guideway, and the construction of an aerial viaduct for the aerial guideway. Additional activities would include underground and at-grade station construction, demolition, utility relocations, street improvements (such as sidewalk reconstruction and traffic signal installation), retaining walls, and LRT operating systems installation including TPSS and OCS. The Build Alternative would also include construction of a parking facility, other railroad system facilities, the Maravilla Crossover and other crossovers along the alignment, potential street widening, and the MSF. Utility relocation work would generally occur within the affected ROW and on adjacent and nearby streets.

In addition to adhering to regulatory requirements, the development of the Build Alternative would employ conventional construction methods, techniques, and equipment. All work for development of the LRT system would conform to accepted industry specifications and standards, including Best Management Practices (BMPs). Project engineering and construction would, at minimum, be completed in conformance with applicable regulations, guidelines, and criteria, including, but not limited to, Metro Rail Design Criteria, Architectural Standard and Directive Drawings, California Public Utilities Commission regulations, California Building Code, Metro Operating Rules, and Metro standard and directive drawings from other engineering disciplines as needed. Cooperation with the corridor cities and Los Angeles County would occur throughout the construction process.

Build Alternative construction is anticipated to last approximately 60 to 84 months. Construction activities for the at-grade alignment, aerial alignment, and underground alignment would occur simultaneously. The construction of the underground stations is anticipated to take 36 to 48 months, while the construction of the at-grade station is expected to last approximately 12 to 18 months. Most construction activities would occur during daytime hours. For specialized construction tasks, it may be necessary to work during nighttime hours to minimize traffic disruptions and disruptions to businesses and other land uses along the alignment. Traffic control and pedestrian control during construction would follow local jurisdiction guidelines and the Manual of Uniform Traffic Control Devices standards. Standard traffic control methods and devices would be used, including the use of signage, roadway markings, flagging, and barricades to regulate, warn, or guide road users. Laydown and storage areas (staging areas) for construction equipment and materials would be in the vicinity of the Build Alternative within parking facilities, and/or on parcels that would be acquired for the proposed stations and the MSF. Staging areas would be used to store building materials and construction equipment, assemble the TBM, temporarily store excavated materials, and house temporary field offices for Metro's contractor. A temporary electrical conduit would be extended from the existing Vail Substation north of Flotilla Street to the TBM launch site to power the TBM. This would involve installing the temporary conduit in a trench within the ROW of Yates Avenue and Washington Boulevard. The trench excavation would be approximately 3-feet wide and about 20-feet deep.

2.2.6 Operations

Operation of the Build Alternative would be managed by Metro staff and personnel. The Build Alternative would operate a train line using light rail technology. Operational activities of the Build Alternative would include train car operations, train car maintenance (including cleaning and storage), track maintenance, and general administration. In addition, the Build Alternative would include emergency lighting, communications and wayfinding systems, a command-and-control system, a public information system, and security systems to monitor activity at station platforms along the alignment and at the MSF. Operation of an MSF would include daily service and cleaning, inspection, and storage of light rail vehicles. MSF Sites 1 and 2 would also include repair facilities.

The operating hours and schedules for the Build Alternative would be comparable to the weekday, Saturday and Sunday, and holiday schedules for the Metro E Line. It is anticipated that trains would operate every day from 4 am to 1 am the following day. On weekdays, trains would operate approximately every 6 minutes during peak hours, every 10 minutes mid-day, and every 12 to 20 minutes in the early morning and after 7 pm. On weekends, trains would operate every 10 minutes from 9 am to 9 pm, and every 20 minutes before 9 am and after 9 pm. The operational headways (the time between vehicles past a given point) are consistent with Metro design requirements for future rail services.

Forecasted ridership for the Build Alternative anticipate approximately 7,550 total weekday station boardings by 2050 compared to 3,010 boardings at the existing Atlantic/Pomona Station under the No Build Alternative. Based on the operating headway requirements and ridership forecasts, Metro anticipates the need for an additional three trains for the Metro E Line to operate the Build Alternative. Each train would have three cars and there would be one spare train consisting of three train cars for a total of 12 new train cars.

2.3 No Build Alternative

The No Build Alternative evaluates the reasonably foreseeable effects within the Study Area if the Build Alternative were not approved. The No Build Alternative would maintain existing transit service through the year 2050. No new transportation infrastructure would be built within Los Angeles County aside from projects currently under construction or funded for construction and operation by 2050 via the 2008 Measure R or 2016 Measure M sales taxes. The No Build Alternative would include existing roadway and transit projects identified for funding in Metro's 2020 Long Range Transportation Plan (LRTP) and Southern California Association of Governments (SCAG) Connect SoCal 2024-2050 Regional Transportation Plan (2024 RTP). The No Build Alternative would include existing projects from the base year (2025) and planned regional projects in operation in the horizon year (2050).

The No Build Alternative is used for comparison purposes to assess the relative benefits and adverse effects of constructing a new transit project in the Study Area versus implementing only currently planned and funded projects. The No Build Alternative is required as a baseline for comparison under the National Environmental Policy Act (NEPA).

3.0 REGULATORY FRAMEWORK

3.1 Definitions

3.1.1 Noise

Noise is defined as unwanted sound. Several factors affect the actual level and quality of sound (or noise) as perceived by the human ear: loudness, pitch (or frequency), and time variation. The loudness, or magnitude, of noise determines its intensity and is measured in decibels (dB) that can range from below 40 dB (the rustling of leaves) to over 100 dB (a rock concert). Pitch describes the character and frequency content of noise, such as the very low “rumbling” noise of stereo subwoofers or the very high-pitched noise of a piercing whistle. Finally, the time variation of noise sources can be characterized as continuous, such as a building ventilation fan; intermittent, such as the passing of trains; or impulsive, such as pile-driving activities during construction. From this point forward in the document, the word “noise” means “sound.”

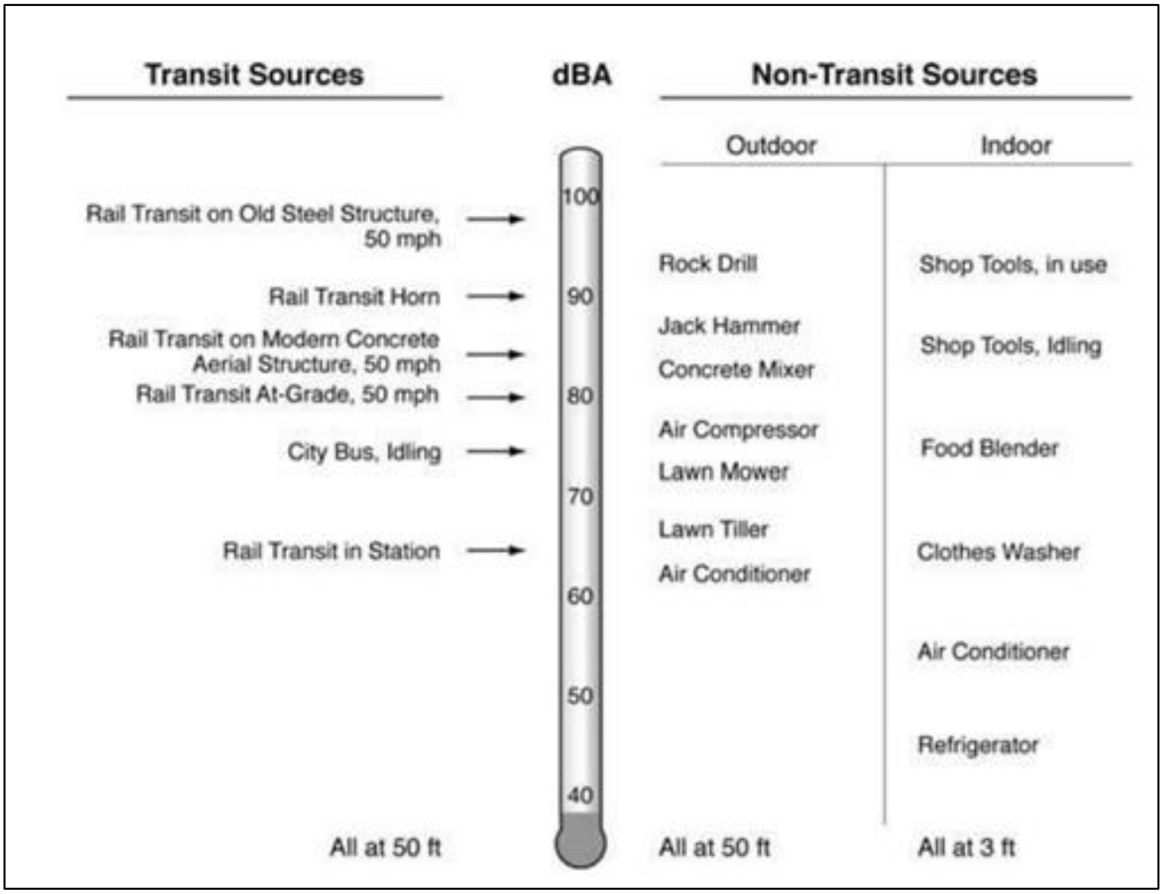
Various sound levels are used to quantify noise from transit sources, including a sound’s loudness and tonal character. For example, the A-weighted decibel (dBA) is commonly used to describe the overall noise level because it more closely matches the human ear’s response to audible frequencies. See **Table 3.1** for A-weighted noise descriptors that are used in this report.

Table 3.1. A-Weighted Noise Descriptors

Noise Metric	Description
Lmax	Represents the maximum noise level that occurs during an event such as a bus or train passing by.
Leq(h)	Represents a level of constant noise with the same acoustical energy as the fluctuating noise levels observed during a given interval, such as one hour.
Ldn	The 24-hour day-night noise level that includes a 10-dBA penalty for all nighttime activity between 10 pm and 7 am. The 10-dBA penalty is an adjustment factor added to all nighttime noise events to reflect the heightened sensitivity of residents who are sleeping.

Source: Transit Noise and Vibration Impact Assessment Manual, Federal Transit Administration (FTA), Washington DC, Sept 2018.
Key: Leq(h) = average hourly equivalent noise level; Ldn = average day-night noise level; Lmax = maximum noise level; dBA = A-weighted decibel

Since human hearing is less responsive to low frequency noise, the tonal character of A-weighted noise levels reflects mid- to high-frequency sounds, which are more audible to most listeners. Since the A-weighted decibel scale is logarithmic, a 10 dBA increase in a noise level is generally perceived as a doubling of loudness, while a 3 dBA increase in a noise level is just barely perceptible to the human ear. Typical A-weighted noise levels from transit and other common sources are summarized in **Figure 3.1**. The noise thermometer is intended to show the different levels as measured from a reference distance of 50 feet from the source.

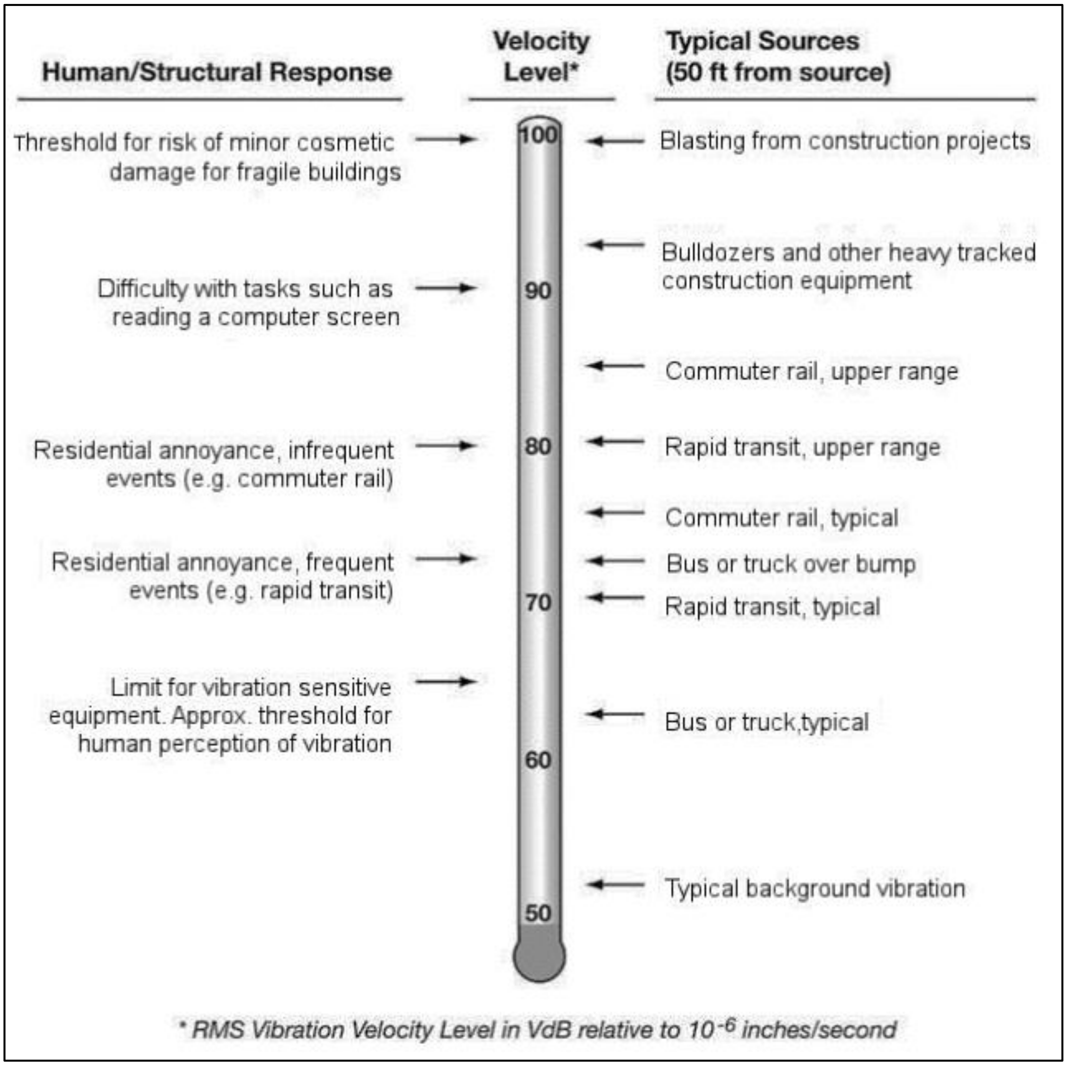


Source: Transit Noise and Vibration Impact Assessment Manual, FTA, Washington DC, September 2018.

Figure 3.1. Typical A-weighted Noise Levels

3.1.2 Vibration

Ground-borne vibration (GBV) associated with vehicle movements is usually the result of uneven interactions between wheels and the road or rail surfaces. Examples of such interactions (and subsequent vibrations) include train wheels over a jointed rail, an untrue rail car wheel with "flats," and a motor vehicle wheel hitting a pothole, a maintenance hole cover, or any other uneven surface. Typical GBV levels from transit and other common sources are summarized in **Figure 3.2**. For example, a comparison of typical GBV levels at a receptor 50 feet from different transportation sources traveling at 50 miles per hour (mph) ranges from 61 vibration decibels (VdB) for trucks and buses, to 73 VdB for LRT vehicles, to 85 VdB for diesel locomotives. Similarly, a typical background vibration velocity level in residential areas is usually 50 VdB or lower, well below the threshold of perception for humans, which is around 65 VdB (FTA 2018). The typical background levels refer to ambient ground vibrations not related to any specific transportation source (e.g., naturally occurring ground vibration). This level is assumed to be fairly constant from site to site, except in the vicinity of active fault lines.



Source: Transit Noise and Vibration Impact Assessment Manual, FTA, Washington DC, September 2018.

Figure 3.2. Typical Levels of Ground-Borne Vibration

Unlike noise, which travels in air, transit vibration typically travels along the surface of the ground. Depending on the geological properties of the surrounding terrain and the type of building structure exposed to transit vibration, vibration propagation (i.e., the method by which vibration waves travels through a medium, such as the ground or building structures) can be more or less efficient. Buildings with a solid foundation set in bedrock are "coupled" more efficiently to the surrounding ground and experience relatively higher vibration levels than buildings located in sandier soil. On the other hand, heavier buildings (such as masonry structures) are less susceptible to GBV than wood-frame buildings because they absorb more of the vibration.

Vibration induced by passing vehicles can generally be discussed in terms of displacement, velocity, or acceleration. However, human responses and responses by monitoring instruments and other objects are most accurately described with velocity. Therefore, the vibration velocity level is used to assess vibration impacts from transit projects.

To describe the human response to vibration, the average vibration amplitude (called the root mean squared, [RMS], amplitude) is used to assess impacts. The RMS velocity level is expressed in inches per second (ips) or VdB. All VdB vibration levels are referenced to 1 micro-inch per second. Similar to noise dB, vibration dBs are dimensionless because they are referenced to (i.e., divided by) a standard level (such as $1x10^{-6}$ ips in the U.S.). This convention allows compression of the scale over which vibration occurs, such as 40-100 VdB rather than 0.0001 ips to 0.1 ips.

The FTA has established noise and vibration assessment methodologies and criteria for transit projects, which are applied in this assessment. For future construction, Metro would make every effort to be consistent with local noise ordinances based on Metro baseline specifications Section 01 56 19, Construction Noise and Vibration Control, although, as a state-chartered transportation agency, it is not required to do so.

3.2 Federal

3.2.1 Noise

3.2.1.1 Operational Noise

The FTA's guidance manual, the Transit Noise and Vibration Impact Assessment Manual (September 2018) presents the basic concepts, methods, and procedures for evaluating the extent and severity of noise impacts from transit projects and is used in this analysis. The FTA guidance is applied to assess noise and vibration. Transit noise impacts are assessed based on land use categories and sensitivity to noise from transit sources under the FTA guidelines. As summarized in **Figure 3.3**, the FTA noise impact criteria are defined by two curves that allow project noise levels to increase as existing noise increases up to a point, beyond which impact is determined to occur based on project noise alone. The FTA land use categories and applicable noise metrics are described in **Table 3.2**.

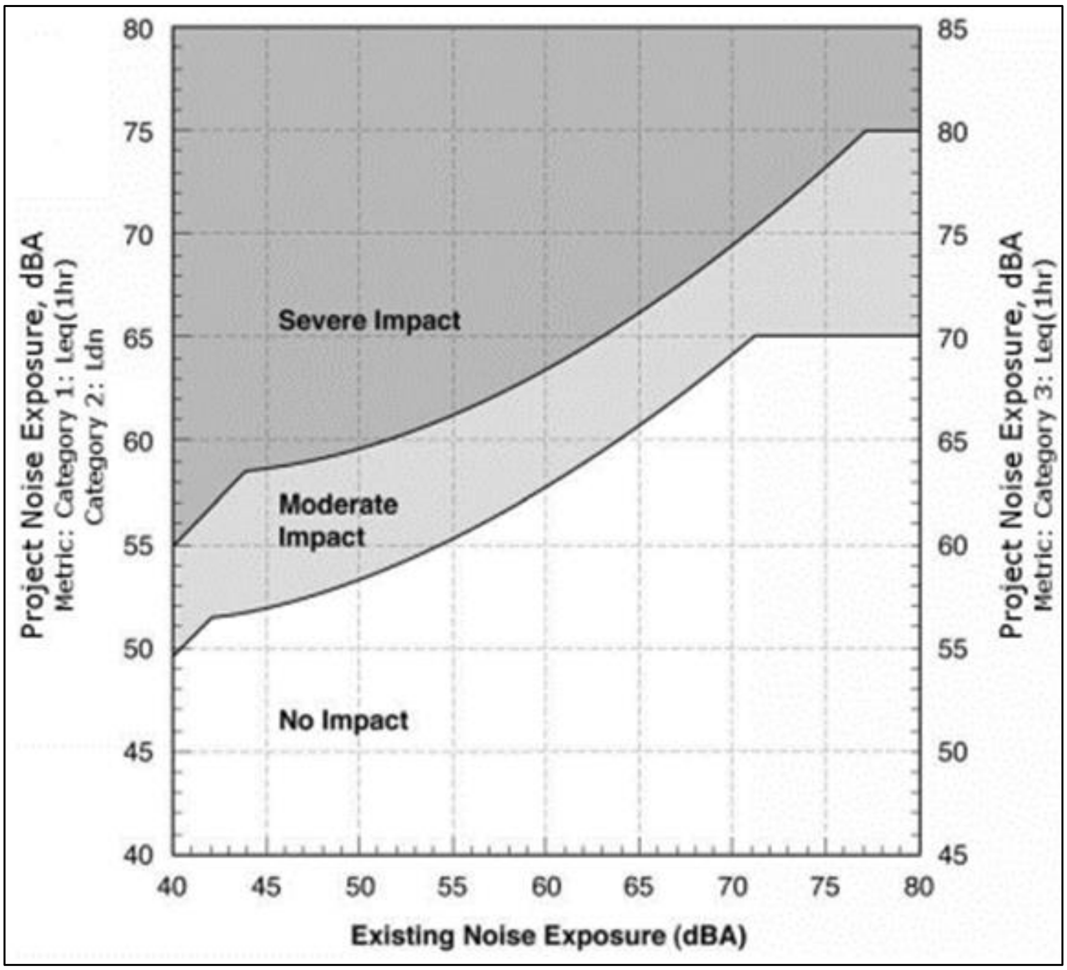
Table 3.2. FTA Land Use Categories and Noise Metrics

Land Use Category	Noise Metric	Description
1	Leq(h)	Tracts of land set aside for serenity and quiet, such as outdoor amphitheaters, concert pavilions, and historic landmarks.
2	Ldn	Buildings used for sleeping, such as residences, hospitals, hotels, and other areas where nighttime sensitivity to noise is of utmost importance.
3	Leq(h)	Institutional land uses with primarily daytime and evening uses, including schools, libraries, churches, museums, cemeteries, historic sites, parks, and certain recreational facilities used for study or meditation.

Source: Transit Noise and Vibration Impact Assessment Manual, FTA, Washington DC, Sept 2018.
Key: Leq(h) = average hourly equivalent noise level; Ldn = average day-night noise level

The FTA noise criteria create two categories of impact: moderate and severe impact. The moderate impact threshold defines areas where the change in noise is noticeable, but may not be sufficient to cause a strong, adverse community reaction. The severe impact threshold defines the noise limits above which a significant percentage of the population would be highly annoyed by new noise. The level of impact at any specific site can be established by comparing the predicted future project noise level at the site to the existing noise level at the site. For example, for residences and other FTA Category 2 land uses with an existing noise level of 65 dBA, a moderate impact would occur with a future project noise level in the range from 61 to 66 dBA, while a severe impact would occur with a future project noise level greater than 66 dBA.

The FTA noise impact criteria for all three land use categories are summarized in **Figure 3.3**.



Source: Transit Noise and Vibration Impact Assessment Manual, FTA, Washington DC, September 2018.

Figure 3.3. Noise Impact Criteria for Transit Projects

The average day-night noise level (Ldn) over a 24-hour period is used to characterize noise exposure for residential areas (FTA Category 2). The Ldn descriptor describes a receptor's cumulative noise exposure from all events over a full 24 hours, with events between 10 pm and 7 am increased by 10 dB to account for greater nighttime sensitivity to noise. Similarly, the average hourly equivalent noise level (Leq(h)) during the facility’s peak operating period is used to characterize noise exposure at all other noise-sensitive land uses, such as schools and libraries (FTA Category 3) or outdoor amphitheaters (FTA Category 1).

3.2.1.2 Construction Noise

During the environmental analysis phase of a project, construction details are limited. Therefore, the FTA guidelines suggest evaluating prototypical construction scenarios against local ordinances or the FTA one-hour Leq thresholds summarized in **Table 3.3** if no other applicable criteria are available. The FTA design guidelines, for example, are evaluated against noise levels from the two loudest pieces of equipment (such as a crane and a dump truck) that, under worst-case conditions, are assumed to operate continuously for one hour during both the daytime (7 am to 10 pm) and nighttime (10 pm to 7 am) periods.

Table 3.3. FTA Recommended Construction Noise Limits (dBA)[1]

Land Use Category	Construction Period	
	Daytime (7 am – 10 pm)	Nighttime (10 pm – 7 am)
Residential	90	80
Commercial (non-residential)	100	100
Industrial	100	100

Source: Transit Noise and Vibration Impact Assessment Manual, FTA, Washington DC, Sept 2018.
Note:
[1] The recommended construction evaluation criteria are evaluated against the one-hour equivalent noise level from the two loudest pieces of equipment.
Key: dBA = A-weighted decibel

3.2.2 Vibration

3.2.2.1 Operational and Construction Vibration

The FTA vibration criteria for evaluating GBV impacts from transit operations (such as train passbys)[3] and construction at nearby sensitive receptors are summarized in **Table 3.4**. These vibration criteria are related to RMS GBV levels that are expected to result in human annoyance. The FTA's experience with community response to GBV indicates that when there are fewer vibration events per day, it would take higher vibration levels to evoke the same community response that would be expected from more frequent events. This is taken into account in the FTA criteria to distinguish projects with frequent, occasional, and infrequent vibration events, where a frequent event category is defined as more than 70 events per day. Similarly, the occasional event category is defined as 30 to 70 events per day and the infrequent category as fewer than 30 events per day. The FTA frequent criteria were used to assess operational GBV impacts along the Build Alternative. The FTA infrequent criteria were used to assess construction GBV along the Build Alternative.

[3] A passby refers to the event of a transit vehicle (e.g., train, light rail vehicle, or bus) moving past a specific location.

The vibration criteria levels summarized in **Table 3.4** are defined in terms of human annoyance for land use categories such as high sensitivity (Category 1), residential (Category 2), and institutional (Category 3). In general, the vibration threshold of human perceptibility is approximately 65 VdB.

For above-grade (i.e., at-grade or elevated) sections of transit systems, LRT operations are typically not a substantial source of vibration-induced ground-borne noise (GBN), except for buildings that have sensitive interior spaces and that are well insulated from exterior noise. Airborne noise often masks GBN for aboveground transit system sections.

GBN from underground sections of transit systems may be audible and the FTA's guidance manual, the Transit Noise and Vibration Impact Assessment Manual, September 2018, provides procedures for evaluating the extent and severity of noise impacts from below-grade transit alignments. The FTA vibration criteria for evaluating GBN impacts from transit operations (such as train passbys) and construction at nearby sensitive receptors are summarized in **Table 3.4**. The frequent event category is applied for train passbys.

Table 3.4. Ground-Borne RMS Vibration Impact Criteria for Annoyance During Transit Operations and Construction (VdB)

Receptor Land Use		GBV Impact Levels RMS Vibration Levels (VdB)1			GBN Impact Levels dB2		
Category	Description	Frequent Events[3]	Occasional Events[2]	Infrequent Events[2]	Frequent Events[2]	Occasional Events[2]	Infrequent Events[2]
1	Buildings where low vibration is essential for interior operations	65	65	65	N/A	N/A	N/A
2	Residences and buildings where people normally sleep	72	75	80	35 dBA	38 dBA	43 dBA
3	Daytime institutional and office use	75	78	83	40 dBA	43 dBA	48 dBA
Specific Buildings	TV/Recording Studios/ Concert Halls	65	65	65	25 dBA	25 dBA	25 dBA
	Auditoriums	72	80	80	30 dBA	38 dBA	38 dBA
	Theaters	72	80	80	35 dBA	43 dBA	43 dBA

Source: Transit Noise and Vibration Impact Assessment Manual, FTA, Washington DC, Sept 2018.
Notes:
1 Ground-borne vibration levels are referenced to 1x10^{-6} inches per second (VdB re 1 micro-inch/sec).
2 Decibels are defined as dB referenced to 20 micropascals, where the prefix "micro" represents a factor of 10^{-6}. The pascal is the unit of pressure that is equivalent to one newton per square meter.
3 The frequent event category is defined as more than 70 events per day, the occasional event category as 30 to 70 events per day, and the infrequent category as fewer than 30 events per day.
Key: dBA = A-weighted decibels; N/A = not applicable; GBV = ground-borne vibration; GBN = ground-borne noise; RMS = Root mean square; VdB = vibration decibels.

3.3 State

The state of California does not have applicable limits for operational or construction noise, or for operational or construction vibration.

3.4 Local

Los Angeles County and the Cities of Commerce and Montebello do not limit noise from operating light rail movement. Also, as a state-chartered transportation agency, Metro is not required to meet local noise ordinances for construction. However, during construction, Metro's contractor would conduct activities to be consistent with noise ordinances of Los Angeles County and the Cities of Commerce and Montebello, whenever feasible and reasonable.

4.0 METHODOLOGY

4.1 Screening Assessment

A screening assessment using FTA screening distances for noise assessments shown in **Table 4.1** and **Table 4.2** was conducted to identify the location and land use category of noise- and vibration-sensitive receptors along the Build Alternative. These include residential areas and buildings such as hospitals, schools, churches, parks, and noise-sensitive historic resources. Per the FTA guidance manual, historic resources that are not noise-sensitive are not evaluated. The list of noise-sensitive community facilities and historic resources was obtained through analysis from the **Appendix K**, Historic, Archaeological and Tribal Resources Technical Report, and **Appendix H**, Community Impacts Assessment, of this EA.

Table 4.1. Screening Distance for Noise Assessments (FTA)

Project Systems	Screening Distance, ft[1] Unobstructed	Screening Distance, ft[1] Intervening Buildings
Fixed-Guideway Systems		
Commuter Rail Mainline	750	375
Commuter Rail Station – With Horn Blowing	1,600	1,200
Commuter Rail Station – Without Horn Blowing	250	200
Commuter Rail Road Crossing with Horns and Bells	1,600	1,200
RRT	700	350
RRT Station	200	100
LRT	350	175
Streetcar	200	100
Access Roads to Stations	100	50
Low and Intermediate Capacity Transit – Steel Wheel	125	50
Low and Intermediate Capacity Transit – Rubber Tire	90	40
Low and Intermediate Capacity Transit – Monorail	175	70
Yards and Shops	1000	650
Parking Facilities	125	75
Access Roads to Parking	100	50
Ancillary Facilities: Ventilation Shafts	200	100
Ancillary Facilities: Power Substations	250	125
Bus Systems		
Busway	500	250
Bus Rapid Transit (BRT) on exclusive roadway	200	100
Bus Facilities – Access Roads	100	50
Bus Facilities – Transit Mall	225	150
Bus Facilities – Transit Center	225	150
Bus Facilities – Storage & Maintenance	350	225
Bus Facilities – Park & Ride Lots w/Buses	225	150
Ferry Boat Terminals	300	150

Source: Transit Noise and Vibration Impact Assessment Manual, Table 4-7, FTA, Washington DC, Sept 2018.
Note:
[1] Measured from centerline of guideway for fixed-guideway sources, from the ROW on both sides of the roadway for highway/transit sources, from the center of noise-generating activity for stationary sources, or from the outer boundary of the proposed project site for fixed facilities spread out over a large area.

Table 4.2. Assumptions for Screening Distances for Noise Assessments (FTA)

Type of Project	Operations	Speeds	Metric[1]
Fixed-Guideway Systems			
Commuter Rail Mainline	66 day / 12 night; 1 loco, 6 cars	55 mph	L_dn
Commuter Rail Station – With Horn Blowing	22 day / 4 night	N/A	L_dn
Commuter Rail Station – Without Horn Blowing	22 day / 4 night	N/A	L_dn
Commuter Rail-Highway Crossing with Horns and Bells	22 day / 4 night	55 mph	L_dn
RRT	220 day / 24 night; 6-car trains	50 mph	L_dn
RRT Station	220 day / 24 night	20 mph	L_dn
LRT	150 day / 18 night; 2 artic veh.	35 mph	L_dn
Streetcar	150 day / 18 night	25 mph	L_dn
Access Roads to Stations	1000 cars, 12 buses	35 mph	L_eq(1hr)
Low & Intermediate Capacity Transit – Steel Wheel	220 day / 24 night	30 mph	L_dn
Low & Intermediate Capacity Transit – Rubber Tire	220 day / 24 night	30 mph	L_dn
Low & Intermediate Capacity Transit – Monorail	220 day / 24 night	30 mph	L_dn
Yards and Shops	20 train movements	N/A	L_eq(1hr)
Parking Facilities	1000 cars	N/A	L_eq(1hr)
Access Roads to Parking	1000 cars	35 mph	L_eq(1hr)
Ancillary Facilities: Ventilation Shafts	Rapid Transit in Subway	50 mph	L_dn
Ancillary Facilities: Power Substations	Sealed shed, air conditioned	N/A	L_dn
Bus Systems			
Busway	30 buses, 120 automobiles	50 mph	L_eq(1hr)
BRT on exclusive roadway	30 buses	35 mph	L_eq(1hr)
Bus Facilities – Access Roads	1000 cars	35 mph	L_eq(1hr)
Bus Facilities – Transit Mall	20 buses	N/A	L_eq(1hr)
Bus Facilities – Transit Center	20 buses	N/A	L_eq(1hr)
Bus Facilities – Storage & Maintenance	30 buses	N/A	L_eq(1hr)
Bus Facilities – Park & Ride Lots w/Buses	1000 cars, 12 buses	N/A	L_eq(1hr)
Ferry Boat Terminals	8 boats with horns used in normal docking cycle	N/A	L_eq(1hr)

Source: Transit Noise and Vibration Impact Assessment Manual, Table 4-8, FTA, Washington DC, Sept 2018.
Note:
[1] Metric based on project-related activity during hours of noise sensitivity.
Key: N/A = not applicable

To determine the existing background noise levels at sensitive receptors in the vicinity of the proposed transit rail corridor alignment, a noise monitoring program was conducted at six representative locations selected based on the FTA guidelines (shown in **Figure 5.1**). An average hourly equivalent noise level [or Leq(h) in dBA] was measured during the peak hour at non-residential or institutional sites (such as schools and parks) and continuously over a 24-hour period at residential sites to determine the average ambient conditions during a typical weekday. The noise measurements document existing noise sources along the Study Area, such as existing aircraft traffic overhead and background traffic. At residences and other FTA Category 2 land uses (described in **Table 3.2**), 24-hour Ldn were reported in accordance with the FTA guidelines. Similarly, peak-hour equivalent noise levels were measured at non-residential or institutional receptors such as schools and parks.

Since the intent of the noise monitoring program was not to document the background noise level at every receptor, sites were strategically selected to document existing noise exposure at different residential clusters along the Build Alternative alignment. The noise levels from these existing sources were adjusted to reflect distance propagation to other nearby clusters of residences and other noise-sensitive uses where appropriate. The measured noise levels were applied to these other noise-sensitive receptor sites based on their similarities to nearby roadways and intersections, land use densities, and geographical distance from the monitoring sites.

The sound-level meters that were used to measure current noise conditions meet American National Standards Institute (ANSI) standards for Type I meters. The sound-level meters were calibrated before and after each measurement. All measurements were conducted according to ANSI Standard S1.13-2005, Measurement of Sound Pressure Levels in Air. All noise levels are reported in dBA, which approximate the sensitivity of human hearing.

4.2 Noise Evaluation

Noise impacts were evaluated using the FTA's "Detailed Assessment" guidelines to reflect the type of input data available more accurately. However, noise impacts from the stationary sources (such as the MSF) were evaluated using the FTA's "General Assessment" guidelines to reflect a single large stationary source (FTA 2018). Similarly, although baseline vibration measurements were not conducted, vibration impacts were evaluated using the FTA's "General Assessment" guidelines to reflect average or typical ground conditions.

4.3 Construction Noise Assumptions

Construction noise differs from transit noise in the following ways:

- Construction noise lasts for the duration of the construction contract, and is usually limited to daylight hours when most human activity occurs. Nighttime work is usually restricted to essential construction activities that would be unsafe or impractical to conduct during the day, or when other activities may be impacted (such as road closures). Construction activities are generally of a short duration and, depending on the nature of construction operations, could last from seconds (such as for a truck passing by) to months (such as when constructing a bridge at an overpass). Transit noise occurs during all periods of the day and night and is a permanent part of the acoustical environment, such as highway noise.
- Construction noise is also intermittent and depends on the type of operation, location, and function of the equipment as well as the equipment usage cycle. Transit noise, however, is present in a more continuous fashion after construction activities are completed.

An analysis was prepared to estimate the potential for noise impacts during temporary construction activities. Details of the proposed construction activities are normally developed in the later project stages after a transit agency retains the services of the construction contractor for the project. Therefore, short-term construction impacts from the Build Alternative were evaluated based on prototypical construction tasks and equipment summarized in **Section 2.0**, Description of Alternatives, and Section 3.17, Construction Impacts, of the EA. Typical construction activities could include aerial and surface trackwork, cut and cover excavation, utility relocation, station construction, and retaining wall construction.

Based on the FTA guidelines, the two loudest pieces of equipment (such as jack hammers and dump trucks) were selected to operate at full power over a period of one hour. The cumulative noise level at the closest noise-sensitive receptor was used to estimate the level of impact.

The resultant noise level was compared with the FTA recommended construction noise limits from **Table 3.3** to determine the onset of impact. Conservative assumptions (such as no shielding effects from existing structures or temporary noise barriers) were used to estimate the potential for impact.

The following construction scenarios were selected to be representative of the types of activities expected during construction of the Build Alternative; these represent the noisiest construction activities:

- track-laying (at-grade)
- track-laying (aerial)
- excavation and boring
- station construction
- parking facility construction
- MSF Site 1, 2, or 3 construction

The equipment types and the maximum FTA reference noise levels are summarized in **Table 4.3** for each of the selected prototypical construction scenarios using the loudest pieces of equipment. Although numerous equipment types would be used during each scenario as determined by the contractor, the FTA guidelines suggest using only the two loudest pieces of equipment during the preliminary noise impact assessment.

Table 4.3. Construction Scenario Equipment Noise Reference Lmax Levels[1] for the Two Loudest Pieces of Equipment for Each Scenario (dBA)

Equipment Type	Construction Scenario		Stations	Parking	MSF
	At-grade	Aerial			
Crane, Derrick	--	88	--	88	--
Grader	85	--	85	85	--
Loader	--	--	--	--	85
Tie Inserter	85	--	--	--	--
Truck	--	84	84	--	84

Source: Morgner, 2019 and 2021.
Note:
[1] Default FTA noise levels reported at a reference distance of 50 feet.
Key: dBA = A-weighted decibel; MSF = maintenance storage facility; -- = Equipment type not included in the selected construction scenario

4.4 Operational Noise Assumptions

The reference noise levels for each of the proposed noise sources (such as train passbys and wheel squeal) and other operating characteristics (such as average dwell times and source heights), are summarized in **Table 4.4** and **Table 4.5**. These data are based on default FTA data, as well as information included in other recent Metro studies, such as the Crenshaw/LAX Transit Corridor Final Environmental Impact Statement/Environmental Impact Report (Metro 2011). Operations data is summarized for various peak and off-peak periods of the day. The assumptions used in this evaluation are listed after the tables.

Table 4.4. Summary of Noise Source Reference Data

Category	Noise Source Name	Noise Source Description	Duration (seconds)	Height (feet)	Noise Level (dBA)[1] Lmax	Noise Level (dBA)[1] SEL
LRT	Passbys	Passby operations	--[2]	2	78[3]	80
	Warning device	Onboard bell	5	10	76[3]	79[3]
	Switches/ crossovers	Special trackwork	--	0	86[3]	88
	Wheel squeal	Curves <65 feet	4	0	100	136
	Auxiliary equipment[6]	Stations only	30[4]	10	70	106
Crossing bell	Grade crossing bell	Grade crossing	15[3]	10	72[5]	108
Parking	Park and ride	Parking facility	--	10	56	92
Yard	Maintenance yard	Yard	--	2	82	118

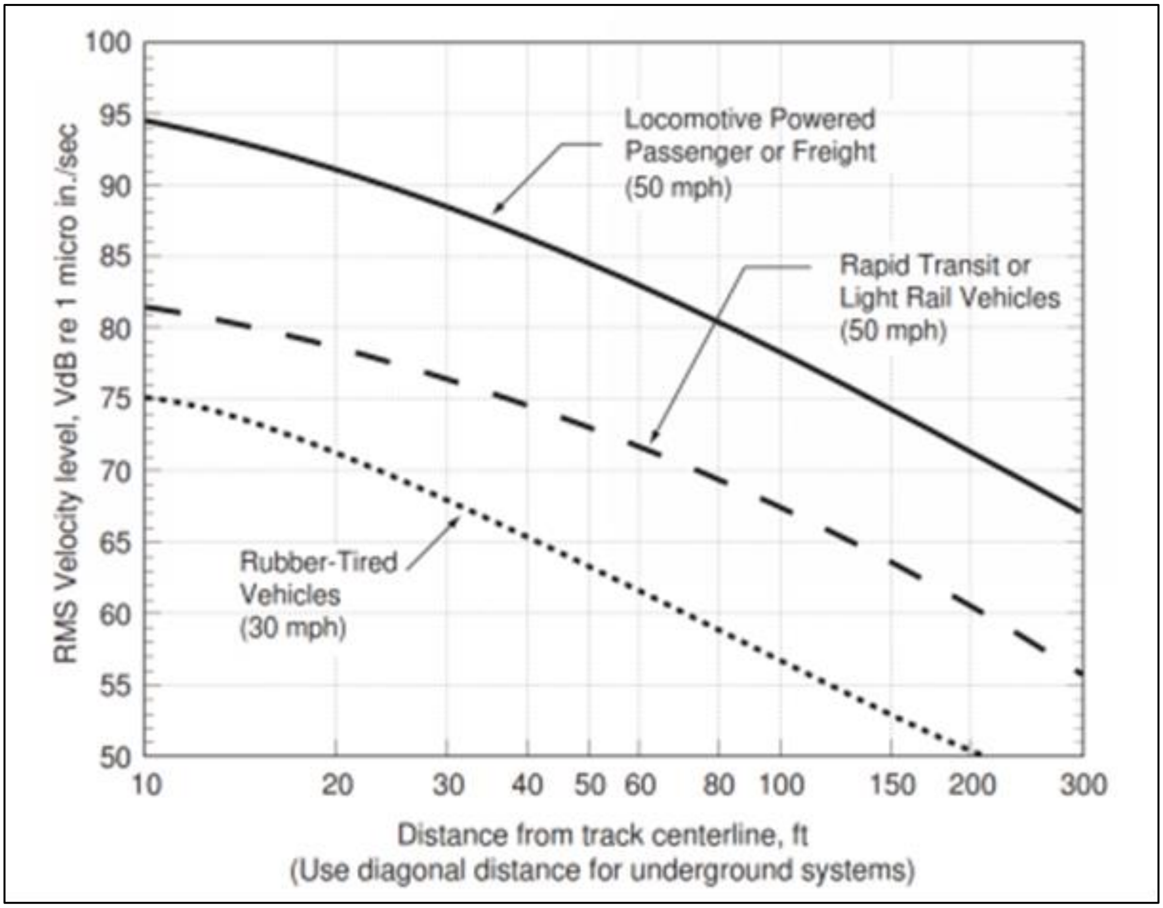
Source: Morgner 2019/2020.
Notes:
1 All noise levels are reported in A-weighted decibels at a reference distance of 50 feet and a reference speed of 50 mph for passbys only. Lmax represents the maximum noise level during an event and the sound exposure level (SEL) converts the cumulative noise energy of an event to one second. Default FTA reference levels are reported except where noted.
2 Duration time is not used to compute passby and facility noise levels.
3 Noise levels and duration times are based on the Metro Gold Line Phase II – Pasadena to Montclair Draft EIS/EIR Study (April 2004).
4 The default dwell time is 30 seconds at all proposed stations.
5 The Lmax level for the crossing bell reflects a 5-dBA penalty to account for the intrusive character of the noise source.
6 The exact location of tunnel vent fans has not yet been determined at this stage in conceptual design. Additionally, noise from tunnel vent fans does not have a base level which then needs to be assessed; tunnel vent fans can be designed to meet noise criteria.
Key: dBA = A-weighted decibel; -- = not applicable

Table 4.5. Operating Characteristics

Time Period	Hours	Frequency of Service[1]	Consist Size[2]
Early morning	4 am to 6:30 am	15	3
AM peak	6:30 am to 8:30 am	5	3
Midday	8:30 am to 4 pm	10	3
PM peak	4 pm to 7 pm	5	3
Early evening	7 pm to 8 pm	10	3
Late evening	8 pm to 1:30 am	15	3

Source: Metro, 2010/2020.
Notes:
1 The frequency of service (or headway time) is reported in minutes.
2 Consist size is the number of LRT vehicles coupled together into one train.

- Total daily operations were determined based on 5 minute headways during peak periods of the day, 10 minute headways during off-peak periods, and 15 minute headways during the late night and early morning periods.
- Operations data is summarized in **Table 4.5** for various peak and off-peak periods of the day. This service frequency is representative of a typical weekday, which includes an operating period between 4 am and 1:30 am.
- A three-vehicle train was assumed for all periods of the day and night.
- At stations, an average idling time of 30 seconds was used at each of the designated station stops to compute the noise contribution from stationary or auxiliary vehicle noise (such as rooftop mechanical equipment).
- Proposed train operating speeds were taken from speed profiles included in the track alignment designs, based on vehicle performance characteristics and system speed limits for the Build Alternative corridor, with a minimum speed of 20 mph and a maximum of 55 mph.
- Following Metro operating practices, train operators sound the 75 dBA warning device (i.e., the “quacker”) prior to all gate-protected crossings, starting approximately 300 feet prior to the crossing. At speeds greater than 35 mph, noise from the quacker adds less than 1 dB to the noise exposure caused by light-rail train operations. Because train speeds greater than 35 mph were assumed for all gate-protected crossings where the quacker would be sounded, the quacker was not included as a separate source in the noise analysis. It is assumed that emergency train horns would rarely be used and thus, they were not included in this analysis.
- The Build Alternative would operate on a concrete-embedded continuous welded rail (CWR) track at-grade.
- Wheel impacts at special trackwork are based on a Lmax of 86 dBA at 50 feet.
- Since all of the curves along revenue-service track are expected to be longer than 65 feet (the distance associated with the onset of wheel squeal), no wheel squeal is predicted along the Build Alternative. Although there is a possibility of wheel squeal at the MSF due to the shorter-radius curves, these events are expected to occur infrequently.
- The vibration impacts from LRT vehicle operations were predicted using the default FTA ground surface vibration curves summarized in **Figure 4.1**. These curves were adjusted to reflect local conditions such as changes in train speed, special trackwork such as switches, and coupling to building foundations for residential wood-frame houses.
- In lieu of a solid transit barrier or parapet, open railings with no acoustical properties were used as part of the noise modeling analysis for all elevated or aerial sections of the Build Alternative. However, the edge of the aerial structure (which is a solid footing for the railing and has an approximate height of six inches) was included in the noise modeling analysis to provide some limited acoustical screening benefit.
- Vehicular noise from the activities at the proposed parking facilities was also included in the modeling analysis using the FTA "General Assessment" guidelines.



Source: Transit Noise and Vibration Impact Assessment Manual, FTA, Washington DC, September 2018.

Figure 4.1. Generalized Ground Surface Vibration Curves

4.5 Vibration Monitoring Methodology

Since the Build Alternative alignment is not along an existing rail corridor, no existing vibration measurements were conducted. In general, rubber-tired vehicles with a soft suspension system, do not contribute to vibration impacts; therefore, since there are only rubber-tired vehicles in the area, no existing vibration measurements were conducted. Unlike noise, where the Build Alternative criteria are based on existing conditions, the vibration criteria are absolute and based on future service frequency alone.

The default FTA ground-surface vibration curves were used to predict future vibration levels from Metro LRT vehicles along the Build Alternative. The FTA "General Assessment" guidelines were used to determine future impacts from vibration under the Build Alternative.

4.6 Construction Vibration Assumptions

An analysis was prepared to estimate the potential for vibration impacts during temporary construction activities. Based on the FTA guidelines, the piece of equipment with the highest reference level (such as pile drivers) was selected. The maximum vibration level at the closest vibration-sensitive receptor was used to estimate the level of impact. The resultant vibration levels were compared with the FTA ground-borne RMS vibration impact criteria for annoyance from **Table 3.4** to determine the onset of impact. Conservative assumptions (such as efficient ground propagation effects) were used to estimate the potential for impact.

4.7 Operational Vibration Assumptions

Future GBV levels from LRT passbys were predicted using the default FTA ground surface vibration curves summarized in **Figure 4.1**. These curves were adjusted per the FTA methodology to reflect local conditions such as changes in train speed, special trackwork such as switches, aerial track structures, ground type, and different building construction types (e.g., masonry versus timber).

4.8 Ground-Borne Noise

GBN can occur when a vibration source such as a train passby causes floors and walls to vibrate in nearby buildings, resulting in a low frequency rumble sound within the building. GBN is determined by applying adjustment factors to the predicted train vibration level that reflect the surrounding ground.

FTA has developed impact criteria to assess the potential for GBN due to transit project construction and operations (U.S. Department of Transportation 2006). Impacts of GBN typically occur from underground transit construction and operations. Where adverse vibration impacts are predicted, mitigation measures would be provided.

4.9 Roadway Traffic Noise Assumptions

Regarding traffic noise, there is a reduction in VMT between the No Build Alternative and the Build Alternative. As discussed in **Appendix O**, the Transportation Impacts Report, VMT decreases under the Build Alternative. Since noise is logarithmic, it takes a halving of the traffic volumes (or a 50 percent decrease), or a doubling of the traffic volumes (or a 100 percent increase) for the noise levels to change by 3 dBA (FTA 2018). The decrease in VMT would not result in a halving of traffic volumes, and, thus, the change in traffic noise due to a decrease in VMT would not be acoustically perceptible. Therefore, the Build Alternative would not result in a substantial change in traffic noise from the No Build Alternative. As a result, no further traffic noise analysis was conducted.

4.10 Area of Potential Impact

In accordance with the FTA Transit Noise and Vibration Impact Assessment Manual (FTA 2018), a screening assessment was conducted to determine the location and number of noise- and vibration-sensitive receptors along the Build Alternative corridor. The FTA screening distances for operations are based on typical LRT systems and were adjusted to reflect Project-specific conditions. The FTA screening distances listed below were used to develop the population of receptors included in the noise and vibration modeling analyses.

- 350 feet – unobstructed noise screening distance
- 150 feet – unobstructed vibration screening distance

As discussed in **Section 4.1**, the screening distances were applied from the centerline of the proposed transit corridors to determine the area of potential impact for operations.

The area of potential impact for construction activities varies, depending on factors such as type and number of construction equipment operating in an area at the same time and the specific location and distance between the construction activity and the sensitive receptor. As mentioned, the specific types and locations of equipment in any one location are difficult to predict at this early stage of project development. Therefore, the same area of potential impact used to assess operational impacts may also be used to assess the potential for construction impacts. Nevertheless, strategies to reduce or minimize the effect are detailed.

4.11 Impact Determination

Thresholds for adverse effects from noise and vibration are presented below. The impact analysis assesses impacts related to the Build Alternative, including the alignment, crossovers, railroad systems, and proposed stations. The MSF (including MSF Sites 1, 2, and 3) is discussed separately from the Build Alternative. The impact analysis of the MSF applies to MSF Sites 1, 2, and 3 as there is no difference in the analysis between the three sites for this report.

4.11.1 Operational Noise

The thresholds for determining the significance of operational impacts for the NEPA analysis are based on the FTA Transit Noise and Vibration Impact Assessment Manual (FTA 2018), also referred to as the FTA Guidance Manual, and are detailed in the subsections below.

As discussed in **Section 3.2.1.1**, the FTA Guidance Manual presents both moderate and severe noise impact thresholds. The severe noise impact criteria are used to determine adverse operational noise impacts from the Build Alternative.

4.11.2 Construction Noise

According to FTA noise criteria, there may be an adverse community reaction related to construction noise when levels exceed 80 dBA at residences for work at night, 90 dBA at residences for work during the day, and 100 dBA at commercial uses for work at night or during the day. Therefore, noise levels of 80 dBA and 90 dBA or higher at residences during the night and day, respectively, and 100 dBA or higher at commercial uses are considered an adverse construction noise impact.

4.11.3 Operational Vibration

The FTA has established specific operational vibration criteria for transit projects in the FTA Guidance Manual. For frequent annoyance from operational vibration (e.g., more than 70 events per day), the FTA considers an exceedance of 72 VdB at residential or other Category 2 land uses as an impact. Therefore, vibration levels of 72 VdB or higher at residential or other Category 2 land use is considered an adverse operational vibration impact.

4.11.4 Construction Vibration

The FTA has established specific construction vibration criteria for transit projects in the FTA Guidance Manual.

- For infrequent annoyance from construction vibration (e.g., less than 30 events per day), the FTA considers an exceedance of 80 VdB at residential or other Category 2 land uses as an impact. Therefore, vibration levels of 80 VdB or higher at residential or other Category 2 land use is considered an adverse construction vibration impact.
- For structural damage from construction vibration, the FTA considers an exceedance of ppv 0.2 ips for typical timber and masonry residences as an impact. An exceedance of ppv 0.2 ips for typical timber and masonry residences is adverse. Therefore, vibration levels of ppv 0.2 ips or higher for structural damage is considered an adverse construction vibration impact.

4.12 Mitigation

NEPA establishes a broad policy regarding mitigation as a means of establishing its environmental objectives. The FTA Transit Noise and Vibration Impact Assessment Manual provides guidance on how to assess noise and vibration impacts of proposed public transit projects, and includes a range of measures for controlling excessive noise and vibration. Mitigation measures for the Build Alternative are discussed in **Section 7.2**.

5.0 AFFECTED ENVIRONMENT

As described in **Section 1.0** and shown in **Figure 5.1**, the Study Area encompasses the Cities of Commerce and Montebello, and unincorporated East Los Angeles. The Study Area includes the area within a 0.5-mile to 2-miles distance from the guideway centerline, as shown in **Figure 5.1**.

A diverse mix of land uses are located within the Study Area, including single- and multi-family residences, commercial and retail uses, industrial development, parks and recreational, health and medical uses, educational institutions, and vacant land. The Build Alternative would traverse densely populated, low-income, and heavily transit dependent communities with major activity centers within the Gateway Cities subregion of Los Angeles County.

5.1 Existing Noise

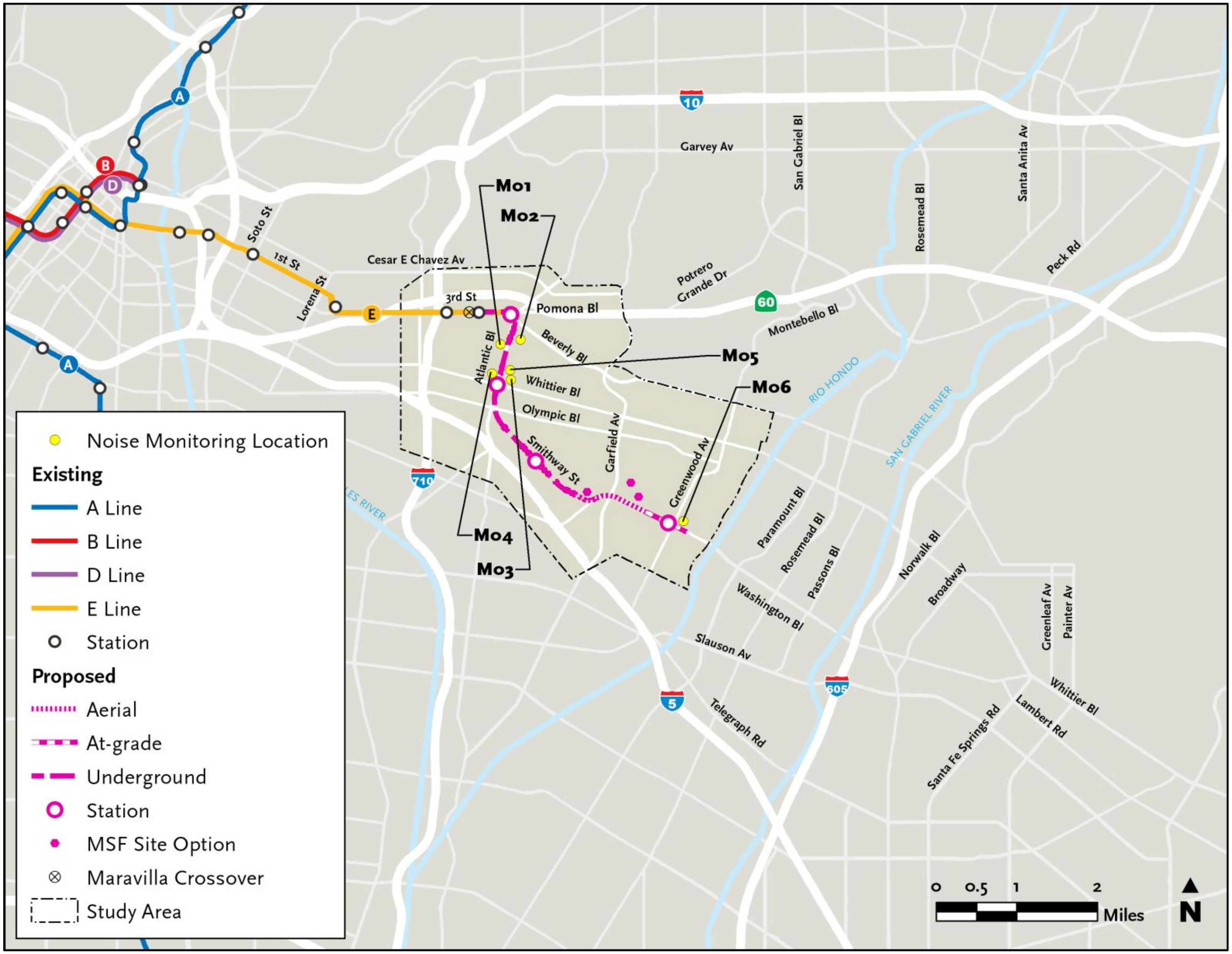
In 2010 and 2011, AECOM conducted baseline noise measurements to support conceptual development of the Build Alternative. Further measurements were conducted by Morgner in 2019 and 2021. The 2010 measurements represent a valid baseline for evaluating noise because the general land use patterns remain broadly unchanged and the development pattern remains a densely populated urban area. Road traffic represents the largest contributor to the existing noise environment. Road traffic must vary substantially to effect a noticeable change in noise. For instance, a doubling of vehicles only results in a 3dB increase.

The locations where existing background noise levels were measured are shown in **Figure 5.1** and identified in **Table 5.1. Table 5.1** also shows the measured day-night noise levels along the Build Alternative corridor. Noise levels range from 57 dBA at Receptor M04 (740 ½ Woods Avenue) to 71 dBA at Receptor M06 (860 Washington Boulevard). In general, the noise levels represent urban locations with city streets.

Measured peak-hour noise levels along the Build Alternative corridor range from 57 dBA at Receptor M04 (740 ½ Woods Avenue) to 68 dBA at Receptor M06 (860 Washington Boulevard). These levels are representative of active urban land uses.

Background noise measurement locations were selected based on surrounding land uses (e.g., the Build Alternative's proximity to sensitive receptors) and the Build Alternative's potential noise profile. The aerial and at-grade alignment is in a predominantly commercial and industrial area, and there is only one sensitive receptor (860 Washington Boulevard) within the screening distance that is exposed to passbys from LRT vehicles, which is located proximate to Receptor MO6.

In general, the Build Alternative is under or adjacent to a mix of residential, industrial, and commercial communities along urban arterials. Based on the monitoring results, the high ambient noise conditions identified in **Table 5.1** reflect the proximity of residences to heavily-used transportation corridors.



Source: CDM Smith/AECOM JV 2025.

Figure 5.1. Noise Monitoring Locations

Table 5.1. Baseline Noise Levels Measured along the Build Alternative Corridor (in dBA)

Receptor		Land Use		24-Hr Ldn	Pk-Hr Leq
ID No.[1]	Noise Measurement Location	Type	FTA[2]		
M01	376 South Woods Avenue	SFR	2	62	63
M02	5224 ½ Via Corona Street	SFR	2	66	65
M03	743 Amalia Avenue	SFR	2	58	59
M04	740 ½ Woods Avenue	SFR	2	57	57
M05	668 South Atlantic Boulevard	School	3	--[3]	63
M06	860 Washington Boulevard	SFR	2	71	68

Sources: AECOM, November 2010; Morgner, December 2019 and July 2021.
Notes:
1 Refer to **Figure 5.1** and **Attachment A** of this Impacts Report for locations of representative noise measurements.
2 FTA Land Use Categories: Category 1 - high sensitivity, Category 2 – residential, and Category 3 - institutional.
3 The day-night noise level is not applicable to institutional land uses.
Key: ID No. = identification Number, dBA = A-weighted decibel; SFR = Single-Family Residence

5.2 Existing Vibration

The Study Area is dominated by busy auto-oriented corridors, including busy city streets and congested highways. Therefore, although no vibration measurements were conducted, current ambient vibration levels are dominated by vehicular traffic, particularly heavy trucks at locations adjacent to active roadways such as Atlantic Boulevard and Washington Boulevard.

6.0 ENVIRONMENTAL CONSEQUENCES

6.1 No Build Alternative

6.1.1 Noise

Under the No Build Alternative, the Build Alternative would not be constructed or operated. As discussed in **Section 2.3**, the No Build Alternative would maintain existing transit service through the year 2050. No new transportation infrastructure would be built within the Study Area aside from projects currently under construction or funded for construction and operation by 2050 via the 2008 Measure R or 2016 Measure M sales taxes. This alternative would include the operation of highway and transit projects in Metro's 2020 LRTP Update and the SCAG 2024 RTP.

There would be no major construction activities under the No Build Alternative. Future noise levels under the No Build Alternative are anticipated to be similar to those under existing conditions. The Study Area is characterized by urban communities that include major highways and arterials (such as Atlantic Boulevard and Washington Boulevard). Irrespective of other projects in the Metro LRTP, ambient noise under the No Build Alternative is anticipated to be similar to existing conditions without the Build Alternative. For example, it takes a doubling of the traffic volumes for the noise levels to increase by 3 dBA, the threshold where most listeners detect the change. However, increases in traffic levels of less than 40 percent in the Study Area between now and 2050 are expected to result in higher congestion and lower average travel speeds. Therefore, no adverse noise effects are expected under the No Build Alternative.

6.1.2 Vibration

No major construction activities are proposed under the No Build Alternative. Therefore, no construction vibration impacts are expected under the No Build Alternative. Future vibration levels under the No Build Alternative are expected to be similar to those currently experienced under existing conditions. Traffic, including heavy trucks and buses, rarely creates perceptible GBV unless vehicles are operating very close to buildings or there are irregularities in the road, such as potholes or expansion joints. The pneumatic tires and suspension systems of automobiles, trucks, and buses eliminate most GBV. Therefore, no adverse vibration impacts are expected under the No Build Alternative.

6.2 Atlantic to Greenwood Alternative

6.2.1 Noise

6.2.1.1 Operational Impacts

Noise impacts at the selected noise monitoring locations were used to characterize noise impacts from the Build Alternative at receptors throughout the Study Area as described in **Section 4.1** and **Section 4.2**. To evaluate the change in noise levels from the existing condition, the predicted future noise levels from operation of the Build Alternative are summarized in **Table 6.1** for the same representative receptor locations used to monitor current noise levels (see **Figure 5.1**) based on FTA criteria. The criteria are based on land use category, existing noise levels, and projected Project noise levels. At residences and other FTA Category 2 land uses sensitive to nighttime activity, the Ldn descriptor was used to reflect the particularly heightened sensitivity to nighttime noise. As a result of this overall evaluation, corridor-wide Project noise levels along the Build Alternative are predicted to exceed the FTA moderate impact criteria at one residence. The Ldn day-night noise level at the sole impacted residence at representative Receptor M06 (single-family residence at 860 Washington Boulevard) along the proposed alignment is 66 dBA. This equals the FTA moderate impact criteria.

No noise level exceedances are predicted above the FTA severe impact criteria at sensitive receptors and thus, no adverse noise effects would occur. The predicted corridor-wide noise effects are summarized in **Table 6.2** and shown in **Attachment A**.

Table 6.1. Summary of Project Operational Noise Levels at Representative Receptors (in dBA)

Receptor		Land Use				FTA Criteria		Adverse Effect? (Build noise greater than FTA "Severe Criteria")
ID No.[1]	Noise Measurement Location	Type[2]	FTA[3]	Existing Noise	Build Noise[4]	Moderate	Severe	
M01	376 South Woods Avenue	SFR	2	62	N/A[5]	59	65	No
M02	5224 ½ Via Corona Street	SFR	2	66	N/A[5]	62	68	No
M03	743 Amalia Avenue	SFR	2	58	N/A[5]	57	63	No
M04	740 ½ Woods Avenue	SFR	2	57	N/A[5]	57	63	No
M05	668 South Atlantic Blvd	School	3	63	N/A[5]	65	71	No
M06	860 Washington Blvd	SFR	2	71	66	**<u>66</u>**	71	No

Source: AECOM, November 2010; Morgner, December 2019 and July 2021.
Notes:
1 See **Attachment A** for receptor locations.
2 FTA moderate impacts are bold and underlined.
3 FTA Land Use Categories: Category 1–high sensitivity, Category 2–residential, and Category 3–institutional.
4 The "Build Noise" levels represent the future Project noise only. The cumulative future ambient noise with the Build Alternative would be equal to the "Existing Noise" logarithmically added to the "Build Noise."
5 These are N/A because during operations, the alignment at this receptor would be located underground in a tunnel.
Key: ID No. = identification Number, dBA = A-weighted decibel; SFR = Single-Family Residence N/A = not applicable (no airborne noise along tunnel sections)

Table 6.2. Corridor-Wide Project Noise Effects

Nearest ID No.	Location	Land Use Type	Impact (Moderate or Severe)	No. Residences Affected	Major Source(s) Contributing to Effect
M06	860 Washington Boulevard	SFR	Moderate	1	LRT Passbys
		Total FTA Category 2	Severe Moderate Total	0 1 1	

Source: AECOM, February 2011; Morgner, December 2019 and July 2021.
Note: See **Attachment A** for receptor locations.
Key: ID No. = identification Number, SFR = Single-Family Residence

6.2.1.1.1 Passby Impacts from LRT Vehicles

Except for receptors in the immediate vicinity of stationary noise sources (such as stations, the parking facility, the MSF, or special trackwork such as switches), receptor noise along the Build Alternative would be primarily due to passbys from LRT vehicles. Trains in the underground alignment are not a source of airborne noise receptors above on the surface.

Except in the vicinity of grade crossings, where onboard warning bells are used, the dominant noise sources from LRT passbys along the proposed transit corridor would be wheel-rail and aerodynamic noise. Shielding provided by the aerial guideway is offset slightly by the four-decibel increase associated with aerial track.

The Build Alternative would be in an underground alignment until it daylights to an aerial configuration after crossing Saybrook Avenue and it then transitions to an at-grade configuration either between Yates Avenue and Vail Avenue or between Vail Avenue and Maple Avenue, and terminates just east of Carob Way. The aerial and at-grade alignment is in a predominantly commercial and industrial area, and there is only one sensitive receptor (860 Washington Boulevard) within the screening distance that is exposed to passbys from LRT vehicles. The FTA severe noise impact criteria would not be exceeded at this receptor.

Therefore, noise generated by passby LRT vehicles would not exceed the FTA severe noise impact criteria at any sensitive receptors and no adverse effect would occur.

6.2.1.1.2 Impacts from At-Grade Crossings

The Build Alternative has at-grade crossings at Vail Avenue, Maple Avenue, and Greenwood Avenue. These crossings are adjacent to manufacturing and commercial properties with high existing ambient noise levels and, therefore, there would be no adverse effects from grade crossing LRT vehicle warning bells.

6.2.1.1.3 Impacts from Special Trackwork

Special trackwork (such as turnouts and crossovers) is proposed at several locations along the Build Alternative to provide operational flexibility. Turnouts or switches allow trains to move from one track to another, while crossovers allow trains to move between parallel tracks. Noise from switches or crossovers comes from a small gap in the central part of the switch known as a frog. When the steel LRT wheel hits this gap, train noise levels could increase up to 8 dBA in the vicinity of the switch. Within the tunnel, there is no special trackwork near schools that could result in an adverse noise effect on schools. Airborne noise from frogs would not be an issue because the land use surrounding the Build Alternative in its aerial and at-grade configurations is primarily commercial or industrial with high existing ambient noise levels. Therefore, no adverse effects would occur.

6.2.1.1.4 Impacts from Traction Power Substations

TPSS are transformers that "step-up" the voltage necessary to operate the trains. Although these box-like devices do not have any gears, belts or other moving mechanical parts, TPSS noise is a continuous hum. Transformer noise is caused by the constant expansion and contraction of the magnetically charged metal plates inside the casing. However, the absolute level of the TPSS is regulated by Metro's own specifications, thereby minimizing the potential for noise impact in the community.

As part of the Build Alternative, TPSS would be installed at several locations along the proposed rail corridor to provide adequate electrical power for LRT service. As identified in NEPA project measure (NPM) NOI-1, each TPSS would be located at-grade and designed in accordance with the MRDC noise guideline of 45 dBA at 50 feet or at the setback line of the nearest building or occupied area, whichever is closer. This operating noise level for the TPSS would be substantially lower than existing ambient noise levels (which range from 57 A-weighted decibel, 24-hour day-night noise level to 68 A-weighted decibel, peak-hour equivalent sound level) Therefore, noise generated by the TPSS would not exceed the FTA noise impact criteria at any receptors along the Build Alternative, and no adverse effects would occur.

6.2.1.1.5 Operational Noise Impacts at Historic Properties

One noise-sensitive historic property used as a residence, the Kelly House at 860 Washington Boulevard, is adjacent to the Build Alternative; specifically, the crossover east of Greenwood station is approximately 80 feet away from this historic resource. There are high levels of existing noise from Washington Boulevard at this location (see Location M06 in **Table 5.1**). One historic property used as a school, the Greenwood Elementary School, is also adjacent to the Build Alternative, although 461 feet away from the Build Alternative alignment and outside of the screening distance. As shown in **Table 6.3**, the noise impact at these locations are moderate and no adverse effects would occur.

Table 6.3. Summary of Noise Levels at Historic Properties along the Build Alternative Alignment (in dBA)[1]

Receptor[2]		Land Use		Existing	Build	FTA Criteria	
ID No.[2]	Description	Type	FTA[3]	Noise	Noise	Moderate	Severe
HP1	Kelly House	Historic	2	71	65	65	70
HP2	Greenwood Elementary School	Historic	3	68	56	68	73

Source: AECOM, February 2011; Morgner, December 2019 and July 2021.
Notes:
1 The Ldn noise level is reported.
2 See **Attachment A** for receptor locations.
3 FTA Land Use Categories: Category 1 – high sensitivity, Category 2 – residential, and Category 3 – institutional.
Key: ID No. = identification Number, dBA = A-weighted decibel

Another historic use, the South Montebello Irrigation District, is present in the vicinity of the at-grade alignment and is used as an office space; however, as described in **Section 4.1**, historic resources that are not noise-sensitive are not evaluated.

6.2.1.1.6 Operational Noise Impacts at Parks, Schools, and Other Institutional Receptors

Airborne noise does not impact receptors above the tunnel sections of the alignment. Two schools are potentially impacted by airborne noise: the Arts in Action Community Charter Elementary School, located approximately 200 feet from the underground Atlantic/Pomona station and Greenwood Elementary School approximately 460 feet from the at-grade alignment. Both schools are screened by existing structures and therefore outside the screening distance of 175 feet (**Table 4.1**). Noise levels at both schools would not exceed the FTA severe noise impact criteria and therefore no adverse effects would occur.

Another school, the Griffith STEAM Magnet Middle School, is present in the vicinity of the Build Alternative; however, the Build Alternative would only involve modifications to the existing Metro E Line track in the vicinity. Construction of the Maravilla Crossover would occur approximately 250 feet away from the school grounds and would necessitate a minor shift of the existing track and roadway resurfacing in the vicinity of the changes to the track within the existing ROW. A train control would be constructed on the south side of the 3rd Street between Arizona Avenue and Mednik Avenue, adjacent to an existing TPSS. This would meet the same design noise criteria as the existing TPSS. Noise levels at this school would not exceed the FTA severe noise impact criteria and therefore no adverse effects would occur.

As summarized in **Table 6.4**, four non-residential receptors that are potentially impacted by airborne noise were identified along the Build Alternative: Chet Holifield Park (1134 Greenwood Avenue, Montebello), Chet Holifield Library (1060 Greenwood Avenue, Montebello), Greenwood Elementary School (900 Greenwood Avenue, Montebello), and the Arts in Action Charter Elementary School (5115 Via Corona Street, Los Angeles). At these non-residential sites, the peak-hour Leq descriptor was used to reflect the sensitivity to daytime noise. Peak hour Leq noise levels at the non-residential receptors are predicted to range from 45 dBA at the Chet Holifield Library to 56 dBA at Greenwood Elementary School and the Arts in Action Charter Elementary School. None of the Build Alternative noise levels at the park, schools, and library are predicted to exceed the FTA moderate or severe impact criteria along the Build Alternative alignment. Note that the build noise represents noise from the Build Alternative alone, which in no case exceeds existing noise levels. No adverse effects would occur.

Table 6.4. Summary of Noise Levels at Parks, Schools, and Other Institutional Receptors along the Build Alternative Alignment (in dBA)[1]

Receptor[2] Description	Land Use Type	FTA[3]	Existing Noise	Build Noise	FTA Criteria Moderate	Severe
Chet Holifield Park	Park	3	68	45	68	73
Chet Holifield Library	Library	3	68	48	68	73
Greenwood Elementary School	School	3	68	56	68	73
Arts in Action	School	3	63	56	65	71

Sources: AECOM, February 2011; Morgner, December 2019 and July 2021.
Notes:
[1] Peak-hour Leq noise levels are reported for all receptors.
[2] See **Attachment A** for receptor locations.
[3] FTA Land Use Categories: Category 1 – high sensitivity, Category 2 – residential, and Category 3 – institutional.
Key: dBA = A-weighted decibel

6.2.1.1.7 Maintenance and Storage Facility

The MSF (Site 1, 2, or 3) would accommodate daily maintenance, inspection, and storage of the LRT vehicles. MSF Site 1 or 2 would also include repair facilities. The MSF would not require at-grade road crossings; therefore, crossing gates and bells would not be required for the tracks entering the MSF.

The MSF site options would be in an industrial area and would have no noise-sensitive receptors (such as residences, schools, churches, or parks) within the FTA screening distance of 650 feet (where there are intervening buildings) (See **Table 4.1** for the FTA screening distance for noise assessments). Therefore, no adverse effects would occur.

6.2.1.2 Construction Impacts

Construction of the Build Alternative would include:

- Potholing and utility relocation
- Demolition and site preparation
- Tunneling
- Aerial structure construction
- Guideway track laying
- TPSS, station and public area work
- Parking facility construction

Construction would be noisy during the use of various types of equipment. Demolition and site preparation would involve for the most part, breakers, backhoes, excavators, dump trucks, concrete saws, cranes, and trucks. Equipment would also include compressors and generators and handheld pneumatic tools, for temporary work to secure and make the sites safe, and carry out site preparation and pre-construction work. Guideway construction equipment would generally consist of concrete trucks, rubber-tired excavators, loaders, rubber-tired compactors, graders and small bulldozers, and water trucks for dust control. For aerial guideway construction, activities would include the placement of piles, support columns, and girders to create a span between the bents.

Equipment required for the temporary shoring of the cut and cover excavation, temporary shoring of the underground stations, and aerial guideway construction would include pile drivers (vibratory or impact), drilling rigs, possibly specialized water jet excavators, trucks to remove excavated soil, concrete trucks and concrete pumps, specialized truck trailers to deliver pre-cast concrete beams, cranes, trucks to deliver forms, reinforcing steel, pavement saws, pre-cast concrete post tensioning jacks and related equipment, and water trucks for dust control. It was assumed that potholing and utility relocation would occur ahead of major construction, to prepare for underground work. Some utility relocations must be carried out at night because these can involve road closures.

The Build Alternative also includes a tunnel section, which would involve excavation and shoring of the launching and receiving pits, tunneling with the use of the TBM, and spoil removal. Ventilation would be required for adequate circulation of air flow in the tunnels. Tunnel vent fans would be located at ground surface level and their activation would increase ambient noise levels for their surrounding areas and would therefore result in an adverse effect. Tunneling activities would require the use of machinery to remove excavation spoil from the TBM. Spoil removal and heavy machinery, such as excavators and mini-excavators, to move TBM spoil would be a source of noise that could increase ambient noise levels, resulting in adverse noise and vibration impacts. TBM tunneling would occur during both daytime and nighttime hours.

In addition to the tunneling portion, the Build Alternative would require grading, excavation, and the movement of excavated material, resulting in an increase in truck traffic and associated noise. As further described in **Appendix O**, haul routes would be located along the Build Alternative corridor ROW and/or major streets connecting to construction staging areas and the nearest freeways (e.g., State Route [SR]-60, I-5, and I-605). These haul routes would be identified during final design in cooperation with the jurisdictions along the alignment and implemented throughout the construction process. As discussed under **Section 4.9**, it takes a doubling of traffic volumes for noise levels to change by 3 dBA (FTA 2018); even assuming a higher noise factor for haul trucks compared to passenger vehicles, the addition of haul truck trips would not be so substantial as to result in an acoustically perceptible change in ambient noise levels.

Noise levels during construction vary depending on the types of construction activity and the types of equipment used for each stage of work. Heavy machinery, the major source of noise in construction, moves in unpredictable patterns and is usually not at one location very long. In addition, activities associated with construction staging and/or material laydown areas can result in adverse noise effects if they take place in noise-sensitive areas. Construction normally occurs during daylight hours when some residents are not at home, when residents who are at home are less sensitive to construction activities, and when other community noise sources contribute to higher ambient noise levels. However, since construction is expected to last about 24 months at any one location, depending on the type of activity, adverse noise effects could occur, particularly for those receptors adjacent to the alignment.

To evaluate the change in noise levels during construction, the predicted future noise levels from construction are summarized in **Table 6.5** for the same representative receptor locations used to monitor current noise levels (see **Figure 5.1**) based on FTA criteria. The criteria are based on land use category, existing noise levels, and worst-case construction noise levels as specified in the FTA general assessment.

Table 6.5. Summary of Construction Noise Levels at Representative Receptors (in dBA)

Receptor		Land Use		FTA Criteria[2]		Adverse Effect? (Construction noise greater than FTA Criteria)
ID No.[1]	Noise Measurement Location	Type	Construction Noise[2,3]	Daytime	Nighttime	
M01	376 South Woods Avenue	Residential	**103**	90	80	**Yes**
M02	5224 ½ Via Corona Street	Residential	**101**	90	80	**Yes**
M03	743 Amalia Avenue	Residential	**95**	90	80	**Yes**
M04	740 ½ Woods Avenue	Residential	**103**	90	80	**Yes**
M05	668 South Atlantic Boulevard[4,5]	Commercial	-	100	100	No
M06	860 Washington Boulevard	Residential	**93**	90	80	**Yes**

Sources: AECOM, February 2011; Morgner, December 2019 and July 2021.

Notes:

1 See **Attachment A** for receptor locations.

2 Based on worst case, two impact pile driving rigs. Operation taken as 20 percent on time.

3 One hour Leq, dB(A).

4 FTA does not separately identify schools or museums. Commercial category applied here.

5 Alignment in tunnel close to receptor. No airborne construction noise is predicted because the alignment is underground near this representative receptor.

Key: ID No. = identification Number, dBA = A-weighted decibel

Construction normally occurs during the day; therefore, construction impacts were evaluated based on the FTA daytime noise limits of 90 dBA at residential receptors and 100 dBA at commercial receptors. The distances at which an exceedance of the FTA daytime noise limits of 90 dBA at residential receptors is predicted ranges from 32 feet during station construction to 40 feet during at-grade track laying. The distances at which an exceedance of the FTA daytime noise limits of 100 dBA at commercial receptors would occur range from 10 feet during station construction to 13 feet during at-grade track-laying. As a result of these construction noise estimates, construction activities are predicted to exceed the FTA daytime noise limits at 31 noise sensitive receivers. Construction at night is not expected to occur under typical conditions; however, unforeseen schedule or operational limitations may require certain construction activities to occur at night at points along the Build Alternative alignment. If construction at night must occur, construction noise activities would be predicted to exceed the FTA nighttime noise limits of 80 dBA at nearby residential receptors.

Section 7.1 describes project measures related to construction noise that are components to the Build Alternative. As set forth in NPM NOI-2, all construction activities would be carried out in compliance with Metro's baseline specifications Section 01 56 19, Construction Noise and Vibration Control, to reduce noise generation associated with construction activities to the degree feasible by using methods that may include, but would not be limited to, conducting at-grade construction adjacent to residential neighborhoods in daytime hours whenever practicable, using construction equipment with noise-suppression devices, and using noise barriers or other noise control measures. Implementation of these project measures would reduce construction noise; however, mitigation measures identified in **Section 7.2** and discussed below would be required to further reduce adverse noise effects.

NEPA mitigation measure (NMM) NOI-1 would require implementation of a noise control plan and construction monitoring plan that would meet, at minimum, the FTA general assessment noise criteria for daytime and nighttime construction work. NMM NOI-2 would require Metro’s contractor to use cast-in-drilled hole (CIDH) or drilled piles rather than impact pile drivers where necessary to meet construction noise performance criteria established in the construction noise control plan and construction monitoring plan. NMM NOI-3 would require the construction contractor to erect temporary noise barriers between noisy activities and noise sensitive receptors to ensure compliance with applicable noise limits. Noise barriers block the direct path of sound waves and would reduce noise effects from receptors when applied. NMM NOI-4 would require Metro's contractor to locate construction equipment and material staging areas away from sensitive receptors where practicable to increase the distance between receptors and noise generating construction equipment/material staging areas. NMM NOI-5 would require construction traffic and haul route routing in areas without noise-sensitive receptors where practicable, thereby minimizing traffic noise. NMM NOI-6 would require contractors to use best available control technologies (e.g., piling noise shrouds) to limit excessive noise when working near residences where practicable to muffle sounds created by Project-related construction equipment and therefore reduce noise levels. NMM NOI-7 would require Metro to establish a Construction Hotline to resolve noise issues arising from construction activities.

Implementation of NMM NOI-8 and NMM NOI-9 would lessen noise associated with spoil removal where necessary and minimize residential noise effects. NMM NOI-10, would reduce impacts from ventilation fans by requiring that they be placed away from sensitive receptors, thereby increasing distance between sensitive receptors and noise generating ventilation fans.

Therefore, with implementation of these mitigation measures, no adverse effect would occur.

6.2.1.2.1 Station Construction Staging Area Options

Options have been identified for the construction staging area for the one relocated and three new stations that would be constructed under the Build Alternative. The potential construction noise effects are identified below.

Atlantic/Pomona Station Construction Staging Area Options

The construction staging areas for the relocated underground Atlantic/Pomona station, connection to the existing Metro system would be located at the Atlantic/Pomona station site between Pomona Boulevard, Beverly Boulevard and Atlantic Boulevard. The construction staging area for the TBM extraction pit would be located east of Atlantic Boulevard between Repetto Avenue and 4th Street. Additional sites for the tunnel would be used east of Atlantic Boulevard between Repetto Avenue and one parcel north of Beverly Boulevard. Construction staging area options could have an adverse noise effect on adjacent properties. However, with implementation of NMM NOI-1 through NMM NOI-10, as described in **Section 7.2**, there would be no adverse noise effects from construction.

Atlantic/Whittier Station

Construction staging areas for the underground Atlantic/Whittier station would be located east of Atlantic Boulevard, either on a property north of Whittier Boulevard, or on a property south of Whittier Boulevard. Either construction staging area option could have an adverse noise effect on adjacent properties. With implementation of NMM NOI-1 through NMM NOI-10, as described in **Section 7.2**, there would be no adverse noise effects from construction.

Commerce/Citadel Station Construction Staging Area Options

Construction staging areas for the underground Commerce/Citadel station would be either located on a property to the southwest of the alignment, or on a property to the northeast of the alignment. These sites would not have a construction noise effect on adjacent properties because there are no noise sensitive receptors immediately adjacent to the sites.

Greenwood Station Construction Staging Area Options

The construction staging area for Greenwood station would be located to the south of Washington Boulevard east of Greenwood Avenue. Construction staging could have an adverse noise effect on adjacent properties. However, with implementation of NMM NOI-1 through NMM NOI-10, as discussed in **Section 7.2**, there would be no adverse effect.

6.2.1.2.2 Tunnel Boring Machine Launch Site

The TBM launch site would be located north and south of the alignment west of Saybrook Avenue. This is an industrial area where the nearest sensitive receptors (such as residences, schools, churches, or parks) are more than 1,000 feet away with intervening buildings. However, noise levels could exceed the FTA criteria for commercial or industrial receivers of 100 dBA through the day or 100 dBA at night at the buildings immediately adjacent to the site. However, with implementation of NMM NOI-1 through NMM NOI-10, as discussed in **Section 7.2**, there would be no adverse effect.

6.2.1.2.3 Maintenance and Storage Facility

Construction of the MSF (Site 1, 2, or 3) would require site demolition and facility construction, which would produce noise from various construction activities. Demolition and site preparation would generally involve breakers, backhoes, excavators, dump trucks, concrete saws, cranes, and trucks. Equipment would also include compressors, generators, and handheld pneumatic tools for temporary work to secure the sites and construct enabling works.

The MSF site options are in an industrial area where the nearest sensitive receptors (such as residences, schools, churches, or parks) are located more than the identified FTA screening distance of 650 feet away with intervening buildings. Noise levels from construction would not exceed the FTA criteria for residential receivers of 90 dBA through the day or 80 dBA at night. However, noise levels would exceed the FTA criteria for commercial or industrial receivers of 100 dBA through the day or 100 dBA at night at one industrial building immediately adjacent to the MSF 1 Site.

All construction activities would be carried out in compliance with Metro's Construction Noise and Vibration Control specifications as identified in NPM NOI-2. Additionally, NMM NOI-1 through NMM NOI-7, discussed in **Section 7.2**, would reduce construction noise levels through means such as use of noise buffers, maximizing the distance between noise generating activities and sensitive receptors to the degree feasible, minimizing noise generation such as through the use of equipment mufflers to the degree feasible, and establishing a Construction Hotline to resolve noise issues. With implementation of NMM NOI-1 through NMM NOI-7, there would be no adverse construction noise effects.

6.2.2 Vibration

6.2.2.1 Operational Impacts

Unlike noise, which is assessed using cumulative noise levels over a 24-hour period, transit vibration impacts are assessed based on individual events, such as when a train passes by. The Build Alternative would be constructed with CWR track. In the at-grade configuration, the track would be embedded. CWR track is continuous and therefore produces less vibration than non-CWR track because it does not have any breaks or gaps that could cause vibrations when a wheel passes over the track. Embedded track is vibration isolated by a material which reduces transmitted vibration. Per the FTA Transit Noise and Vibration Impact Assessment Manual (2018), resiliently supported tie systems have been found to provide very effective control of low frequency vibration and thus, this analysis applies a 10-dB reduction in vibration levels. Along the aerial section, elevated structures create additional separation between the train source and the ground-level receptors resulting in greater attenuation. At at-grade crossings, embedded track at cross streets is not expected to result in any vibration impacts, due to the short section limited to the width of the cross street. Along tunnel sections, train steel wheels over steel rails would input vibration into the track support structures and onwards to the ground. CWR track would reduce this vibration to some degree. All predicted vibration levels were compared with the FTA frequent impact criteria to assess the onset and severity of impact.

The Build Alternative would have three potential sources of vibration during operations: LRT vehicle passbys along CWR track; LRT passbys through special trackwork, such as switches along the corridor during revenue service; and switches at the MSF.

6.2.2.1.1 Passby Impacts from LRT Vehicles

To show the variation in vibration levels along the Build Alternative, transit vibration levels were predicted at the same receptor locations as for the noise analysis. As summarized in **Table 6.6**, the maximum vibration levels from LRT vehicles are predicted to range from 62 VdB at representative Receptor M03 (a single-family residence), to 80 VdB at representative Receptor M05 (KIPP Raices Academy, 668 S Atlantic Boulevard). Except for representative Receptor M05, all of the vibration levels at the representative receptor sites are predicted to be below the FTA frequent impact criteria.

Table 6.6. Summary of Project Vibration Levels at Representative Receptors from the Build Alternative (in VdB)

Receptor		Land Use			FTA Criteria	
ID No.[1]	Vibration Receptor Location	Type	FTA[2]	Build Vibration[3]	"Frequent"	Adverse Effect?
M01	376 South Woods Avenue	SFR	2	52	72	No
M02	5224 ½ Via Corona Street	SFR	2	68	72	No
M03	743 Amalia Avenue	SFR	2	62	72	No
M04	740 ½ Woods Avenue	SFR	2	64	72	No
M05	KIPP Raices Academy, 668 South Atlantic Boulevard and Esperanza College Prep School, 414 South Atlantic Boulevard	School	3	**80**	75	Yes
M06	860 Washington Boulevard	SFR	2	66	72	No

Sources: AECOM, November 2010; Morgner, December 2019 and July 2021.
Notes:
1 See **Attachment A** for receptor locations.
2 FTA Land Use Categories: Category 1 – high sensitivity, Category 2 – residential, and Category 3 – institutional.
3 Exceedances of the FTA frequent criteria are bold and underlined.
Key: ID No. = identification Number, VdB = vibration decibel; SFR = Single-family Residence

As summarized in **Table 6.7**, corridor-wide vibration levels are predicted to exceed the FTA frequent criterion of 72 VdB at 56 residences. These impacts are due to the proximity of residences to proposed switches, and proximity to the tunnel section of the alignment. Additionally, two vibration impacts exceeding the criteria of 75 VdB are predicted at the FTA Category 3 receptors, KIPP Raices Academy, 668 Atlantic Boulevard, and Esperanza College Prep School at 414 Atlantic Boulevard close to the alignment. However, 4th Street Elementary at 420 Amalia Avenue is located more than 300 feet from the alignment and would not be impacted by vibration. The predicted corridor-wide vibration impacts are shown in **Attachment A**.

Mitigation measures, presented in **Section 7.2**, would be implemented to reduce adverse vibration effects. High resilience fasteners typically reduce vibration by 5 dB, ballast mats by 10 dB, and floating slab track bed by 15 dB. NMM NOI-11 would require the use of track support systems to reduce vibratory impacts caused by steel wheels rolling over steel rails at rail joints during the passby of LRT vehicles at residences and NMM NOI-12 would reduce vibratory levels by reducing the width of gaps at joints when steel wheels roll over steel rails at rail joints. MM NOI-12 would require methods such as installation of ballast mats under conventional switches or using a monoblock frog or other low vibration switches, which would reduce the width of gaps at joints when steel wheels roll over steel rails at rail joints. A monoblock frog is designed without bolted joints and rails which results in a smoother running surface compared with traditional frogs. With implementation of NMM NOI-11 and NMM NOI-12, there would be no adverse operational vibration effects from passbys.

Table 6.7. Corridor-wide Project Vibration and GBN Impacts Along the Build Alternative

Nearest ID No.[1]	Location	Type Use	Impact (Frequent)	No. Properties Affected	Major Source(s) Contributing to Effect[2]
FTA Category 2					
M01	376 South Woods Avenue	SFR	Frequent	12	Crossover
M02	5224 ½ Via Corona Street	SFR MFR	Frequent	6 3	Crossover
-[3]	Area local to East Olympic Boulevard	SFR MFR	Frequent	28 7	Operations
Total FTA Category 2			Frequent	56	
FTA Category 3					
M05	KIPP Raices Academy, 668 South Atlantic Boulevard and Esperanza College Prep School, 414 South Atlantic Boulevard	School	Frequent	2	Operations
Total FTA Category 3			Frequent	2	
Total – All Uses			Total	58	

Sources: AECOM, February 2011; Morgner, December 2019 and July 2021.
Notes:
1 See **Attachment A** for receptor locations.
2 Major sources include LRT passbys, LRT warning bells, and switches or special trackwork. The MSF and TPSS are not expected to be a major source of impacts in any noise-sensitive locations.
3 There are no ambient noise measurement locations close to these vibration impacted properties.
Key: ID No. = identification Number, GBN = ground-borne noise; MFR = Multi-Family Residence; SFR = Single-Family Residence

6.2.2.1.2 Operational Vibration Impacts at Historic Properties

The crossover east of Greenwood station is approximately 80 feet from the William and Florence Kelly House (860 Washington Boulevard), a single family residence and historic property. The Build Alternative would not impact the vibration sensitive historic property at 860 Washington Boulevard (the Kelly House), given its distance from the alignment. Similarly, the Build Alternative would not impact the vibration sensitive historic property at the Greenwood Elementary School, given its distance from the alignment (see **Table 6.6**) and no adverse effects would occur.

6.2.2.1.3 Operational Vibration Impacts at Parks, Schools, and Other Institutional Receptors

Maximum vibration levels at two institutional receptors along the Build Alternative are predicted to reach 80 VdB at the KIPP Raices Academy on Atlantic Boulevard and Esperanza College Prep School at 414 Atlantic Boulevard, exceeding the FTA frequent impact criteria (see **Table 6.8**). However, compliance with NMM NOI-11 and NMM NOI-12, summarized in **Section 7.2** would reduce adverse effects caused by steel wheels rolling over steel rails at rail joints during the passby of LRT vehicles at these sensitive receptors. Thus, with implementation of NMM NOI-11 and NMM NOI-12, there would be no adverse operational vibration effects on institutional receptors.

Table 6.8. Summary of Project Vibration Levels at Parks, Schools, and Other Institutional Receptor Sites Along the Build Alternative (in VdB)

Receptor		Land Use		Build Vibration	FTA Criteria	
ID No.	Description	Type	FTA		"Frequent"	Adverse Effect
M05	KIPP Raices Academy, 668 South Atlantic Boulevard and Esperanza College Prep School, 414 South Atlantic Boulevard	School	3	**80**	75	Yes

Sources: AECOM, February 2011; Morgner, December 2019 and July 2021.
Note: Due to attenuation over large distances, the predicted vibration level is below detection level and well below the ambient background level. Therefore, it is not perceptible.
Key: ID No. = identification Number, VdB = vibration decibel

6.2.2.1.4 Maintenance and Storage Facility

The MSF (Site 1, 2, or 3) would accommodate daily maintenance, inspection, and storage of the LRT vehicles. A potential source of vibration during operations would include LRT vehicle passbys along special trackwork such as switches at the MSF. However, since the MSF site options are in a predominantly industrial area, there are no vibration-sensitive receptors (such as residences, schools, churches, or parks) identified within the FTA screening distance of 150 feet. Therefore, vibration generated from slow-moving LRT vehicles over switches and other special trackwork at the MSF would not exceed the FTA vibration impact criteria at any of the closest receptors, and no adverse vibration effects would occur.

6.2.2.2 Construction Impacts

Vibration levels from construction activities are not cumulative but rather dependent on the type of activity and equipment used. Vibration is also dependent on the ground and terrain conditions, and the type and condition of the building at the receptor.

Tunneling activities could cause construction vibration. Operation of the TBM and machinery to remove excavation spoils from the TBM could result in vibration damage to structures and annoyance to residences and other FTA Category 2 land uses. Typically, vibration from the TBM would not be perceptible at any one residence for longer than one week.

Other construction activities could cause construction vibration. Construction equipment and heavy-machinery, such as piling rigs, hoe rams, and vibratory rollers could result in vibration damage to structures and annoyance to residences and other FTA Category 2 land uses. Other vibration sources such as bulldozers and dump trucks create lower levels of vibration and are not normally an issue.

In accordance with the FTA guidelines, the vibration limit is used to identify potential impacts. The FTA infrequent event category was used to assess impacts from perceptible vibration events since not all construction activity would be perceptible.

The distances at which an exceedance of the FTA vibration infrequent annoyance criterion of 80 VdB for residences and other FTA Category 2 land uses would occur range from approximately 40 feet for trucks, 50 feet for CIDH piling (based on caisson drilling) and bulldozers, 70 feet for vibratory rollers and sonic pile drivers and 160 feet for impact pile drivers. The distances at which an exceedance of the FTA vibration damage criterion of 0.2 ips would occur (for typical timber and masonry residences) range from approximately 15 feet for trucks, 20 feet for CIDH piling (based on caisson drilling) and bulldozers, and 35 feet for vibratory rollers and sonic pile drivers and 60 feet from impact pile drivers, which is a much closer distance than the FTA vibration infrequent annoyance criterion. As a result of these preliminary construction vibration estimates, construction activities are predicted to exceed the FTA impact criteria at the closest residences and commercial properties.

As identified in NPM NOI-2, discussed in **Section 7.1**, construction activities would be carried out in compliance with Metro's baseline specifications Section 01 56 19, Construction Noise and Vibration Control. Additional mitigation measures identified in **Section 7.2** and discussed below would be required to reduce effects.

NMM NOI-2 would require Metro's contractor to use CIDH or drilled piles rather than impact pile drivers to reduce excessive vibration where necessary to meet performance criteria, because pre-drilling reduces noise and vibration effects by reducing the rate of displacement and compression of the surrounding soil. NMM NOI-4 would require Metro's contractor to locate construction equipment and material staging areas away from sensitive receptors to increase the distance in relation to sensitive receptors and thereby reduce impacts. NMM NOI-5 would require Metro's contractor to route construction traffic, and haul routes away from sensitive receptors where practicable to reduce vibratory impacts related to haul routes. NMM NOI-7 would require Metro to establish a Construction Hotline to resolve vibration issues. NMM NOI-8 would require using a spoil removal conveyor for the TBM where necessary to reduce vibration, including using temporary tunnel track with smooth rail and wheels.

NMM NOI-13 would require Metro to identify properties that may be susceptible to vibration damage within 100 feet of the alignment to determine the baseline structural integrity and condition of walls and joints to provide a basis for comparison after construction is completed and to provide baseline data for monitoring vibration effects and developing the construction vibration control plan and monitoring plan described in NMM NOI-14. Under NMM NOI-14, Metro would require the contractor to develop a construction vibration control plan and a construction vibration monitoring plan to minimize vibration effects and reduce the risk of damage to susceptible structures.

With implementation of NMM NOI-2, NMM NOI-4, NMM NOI-5, NMM NOI-7, NMM NOI-8, NMM NOI-13, and NMM NOI-14, there would be no adverse construction vibration effects.

6.2.2.2.1 Maintenance and Storage Facility

Construction of the MSF (Site 1, 2 or 3) would involve similar work to installation of the alignment and construction of stations. Since the MSF site options are in a predominantly industrial area, there are no adjacent vibration-sensitive receptors, and no adverse vibration effects would occur.

7.0 PROJECT MEASURES AND MITIGATION MEASURES

7.1 Project Measures

The following project measures are design features, Best Management Practices (BMP), or other measures required by law, including permit approvals, that are applicable to the Build Alternative.

NPM NOI-1: **Operational Design Standards for Noise.** Operational (post-Project) design standards for the Project may include but are not limited to:

- Design per Metro Rail Design Criteria (MRDC) to reduce operational noise of the traction power substations (TPSS) which would mandate the location of TPSS to be 45 A-weighted decibels (dBA) at 50 feet or at the setback line of the nearest building or occupied area, whichever is closer.

NPM NOI-2: **Construction Noise and Vibration Control**. Construction activities shall comply with Metro's baseline specifications Section 01 56 19, Construction Noise and Vibration Control. Although Metro, as a state-chartered transportation agency, is exempt from local noise ordinances, the agency is committed to consistency with local construction noise limits whenever feasible and reasonable in accordance with its own construction specifications. Metro/Metro's contractor shall utilize control measures from Metro's specifications that effectively minimize noise and vibration impacts in the community. Some mitigation measures for Noise and Vibration are based on the provisions set forth in Section 01 56 19 and are refined to have more specificity towards the Project-related impacts concerning noise and vibration. Under NPM NOI-2, the Project shall comply with the entirety of Metro's baseline specifications Section 01 56 19 and Metro/Metro's contractor shall utilize control measures from its own specifications that effectively minimize noise and vibration impacts in the community, such as:

- Conducting at-grade construction activities adjacent to residential neighborhoods during the daytime whenever practicable.
- Requiring special permits for construction within a specified distance and a specified time period for residential zones during the nighttime and weekends.
- Using construction equipment with effective noise-suppression devices whenever feasible.
- Using noise control measures, such as enclosures and noise barriers, as necessary to protect the public and achieve compliance with Metro's noise limits.
- Conducting all operations in a manner that will minimize, to the greatest extent practicable, disturbance to the public in areas adjacent to the construction activities and to occupants of nearby buildings.

7.2 Mitigation Measures

The following mitigation measures are actions required to reduce the adverse effect(s) identified in this Impacts Report.

NMM NOI-1: **Construction Noise Plan and Noise Monitoring Plan.** Metro shall require the Contractor to develop a construction noise control plan and a construction noise monitoring plan to minimize noise impacts. The construction noise plan shall include construction noise performance criteria. At a minimum, the performance criteria shall prohibit construction noise from exceeding the Federal Transit Administration (FTA) general assessment construction noise criteria of 80 A-weighted decibels (dBA) for nighttime work and 90 dBA for daytime work at residential properties, or 100 dBA at commercial or industrial properties for daytime or nighttime work. These criteria shall be measured at the boundary of any occupied property where the noise is being received.

NMM NOI-2: **Cast-in-Drilled-Hole Construction Methodology.** Metro shall require the Contractor to use construction methods that avoid pile-driving at locations containing noise- and vibration-sensitive receptors, such as residences, schools, and hospitals where practicable. Metro's Contractor shall use cast-in-drilled hole (CIDH) or drilled piles rather than impact pile drivers if necessary to meet construction noise performance criteria established in the construction noise control plan and construction noise monitoring plan.

NMM NOI-3: **Noise Barriers.** Metro shall require the Contractor to erect temporary noise barriers between noisy activities and noise sensitive receptors as necessary to ensure compliance with applicable construction noise performance criteria as specified in the construction noise monitoring plan developed under NMM NOI-1. During construction, Metro shall perform audits to monitor the effectiveness of the noise barriers.

NMM NOI-4: **Construction Staging Area.** Metro shall require the Contractor to locate construction equipment and material staging areas away from sensitive receptors where practicable.

NMM NOI-5: **Haul Routes.** Metro shall require the Contractor to route construction traffic and haul routes along roads in areas without receptors sensitive to noise and vibration, where practicable.

NMM NOI-6: **Best Available Control Technologies.** Metro shall require contractors to use best available control technologies to limit excessive noise when working near residences (e.g., piling noise shrouds) where practicable.

NMM NOI-7: **Construction Working Hours.** Metro shall notify the public, including schools, of construction operations and schedules. Metro shall provide a construction-alert publication and set up a Construction Hotline that shall reply to complaints within 2 working days.

NMM NOI-8: **Public Notification of Construction Operations and Schedules.** Metro shall require the Contractor to comply with Federal Transit Administration (FTA) ground-borne noise and vibration criteria confirmed in the construction noise monitoring plan for tunnel construction, including spoil removal and transport of segmental tunnel lining. This shall include, where necessary, methods such as installation of temporary tunnel track with smooth rail and wheels, and/or car speeds that limit structure-borne noise and vibration, or use of spoil removal conveyor.

NMM NOI-9: **Truck Staging.** Metro shall require the Contractor to not stage trucks in residential areas.

NMM NOI-10: **Tunnel Vent Fans Away From Residences.** Metro shall require temporary and permanent tunnel vent fans to be located away from residences. Metro shall require that noise from these shall be attenuated to comply with the noise control plan and local code requirements for fixed stationary heating, ventilation, and air conditioning (HVAC) or other machinery noise.

NMM NOI-11: **Operational Vibration Mitigation — Tunnel.** Within the tunnel, Metro shall reduce operational vibration impacts through the use of track support systems which incorporate resilience, such as ballast mats, high resilience track fasteners, resiliently supported ties or floating track slabs as necessary to be below Federal Transit Administration (FTA) criteria for frequent annoyance from operational vibration, with the decision to be made through final design. FTA criteria for frequent annoyance is an exceedance of 72 vibration decibels (VdB) at residential uses and 75 VdB at daytime institutional uses, including schools, for more than 70 events per day.

NMM NOI-12: **Operational Vibration Mitigation.** Metro shall reduce vibration impacts where necessary to be below Federal Transit Administration (FTA) criteria for frequent annoyance due to gaps at switches by methods such as installing ballast mats or other resilient fixings under conventional switches to “decouple” the train vibration from the track supporting structure, or using a monoblock frog or other low vibration switches. FTA criteria for frequent annoyance from operational vibration is an exceedance of 72 vibration decibels (VdB) at residential uses and 75 VdB at daytime institutional uses including schools for more than 70 events per day.

In addition, the following mitigation measures would be implemented to avoid, minimize, and/or mitigate temporary construction vibration impacts.

NMM NOI-13: **Identify Vibration Susceptible Properties.** Metro shall identify selected properties that may be susceptible to vibration damage within 100 feet of the alignment to determine the baseline structural integrity and condition of walls and joints using methods such as photographic documentation of the interior walls and/or exterior façade as a basis for comparison after construction is completed.

NMM NOI-14: **Vibration Pre-Construction Survey and Control Plan.** Metro shall require the Contractor to develop a construction vibration control plan and a construction vibration monitoring plan to minimize vibration impacts and reduce the risk of damage to susceptible structures. The construction vibration control plan shall specify implementation of vibration control measures to ensure that vibration during construction activities shall not exceed peak particle velocity (ppv) 0.2 inches per second (ips) at any non-engineered timber and masonry building.

8.0 PREPARERS QUALIFICATIONS

Name	Title	Education	Experience (Years)
Nick Antonio	Acoustic Consultant/ Technical Specialist	BSc Applied Physics, Liverpool JMU, 1986	39

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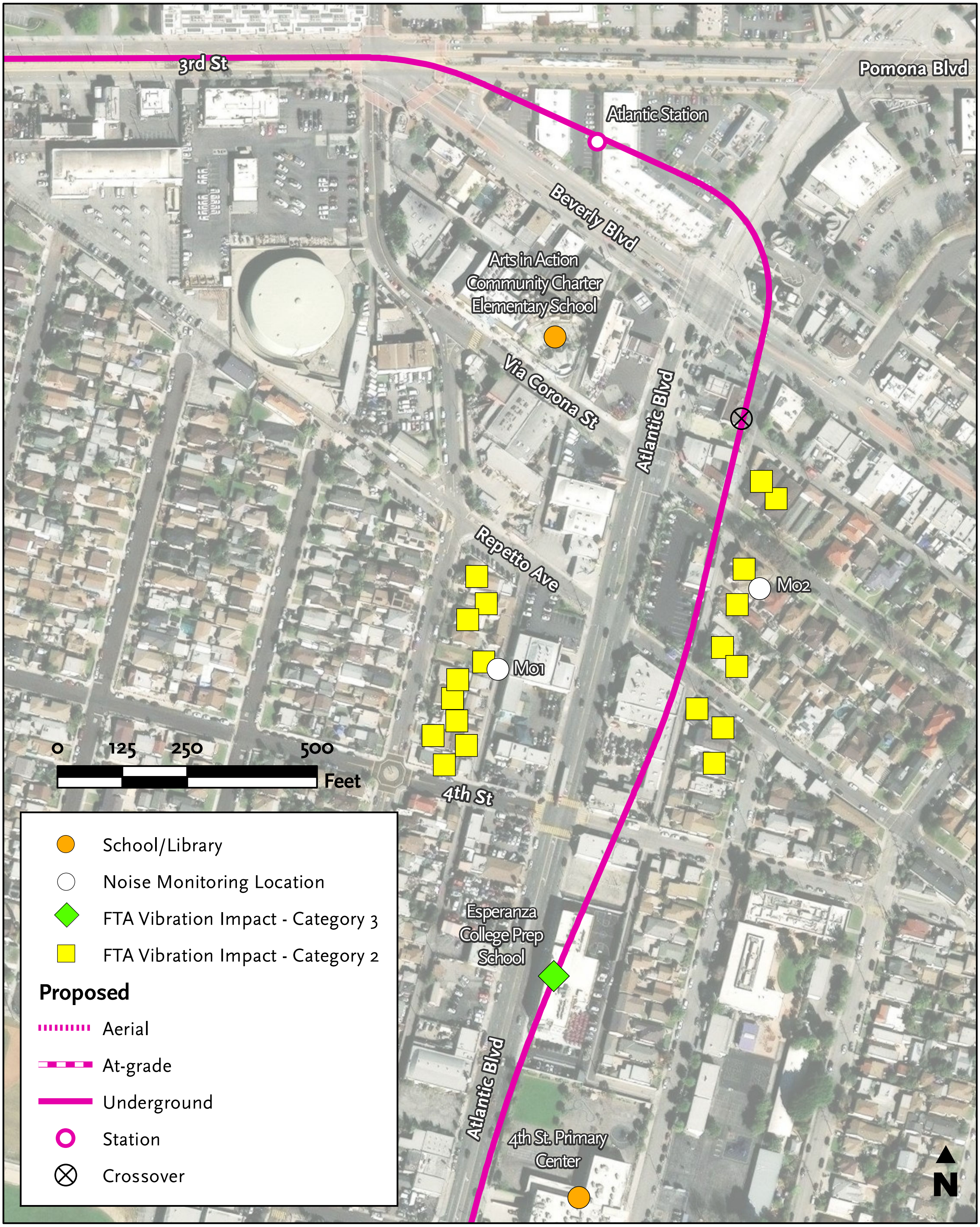
ATTACHMENT A – RECEPTOR LOCATIONS

Eastside Transit Corridor

Noise and Vibration Impacts

Eastside Transit Corridor

Noise and Vibration Impacts

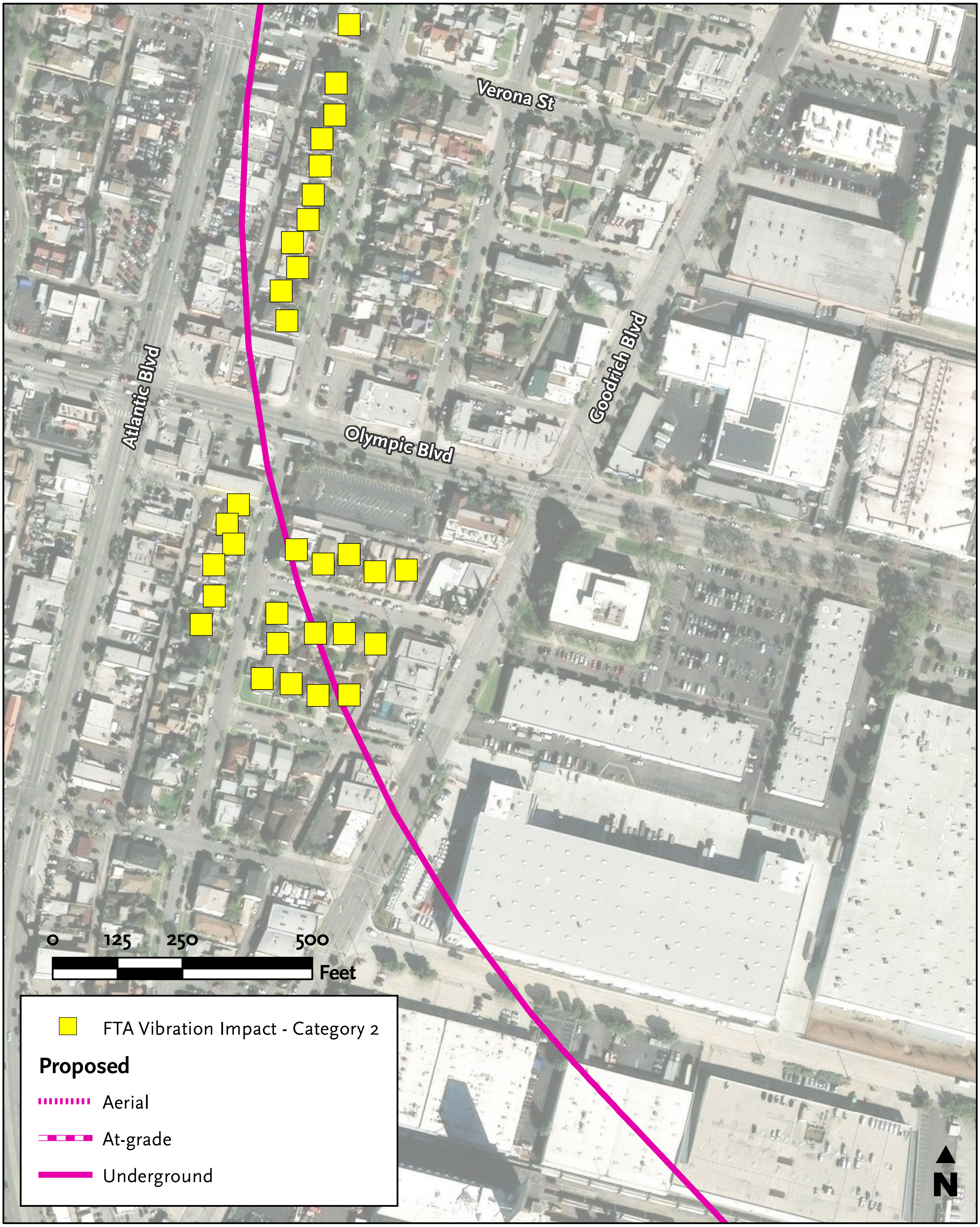


Eastside Transit Corridor

Noise and Vibration Impacts

Eastside Transit Corridor

Noise and Vibration Impacts



Eastside Transit Corridor

Noise and Vibration Impacts

Eastside Transit Corridor

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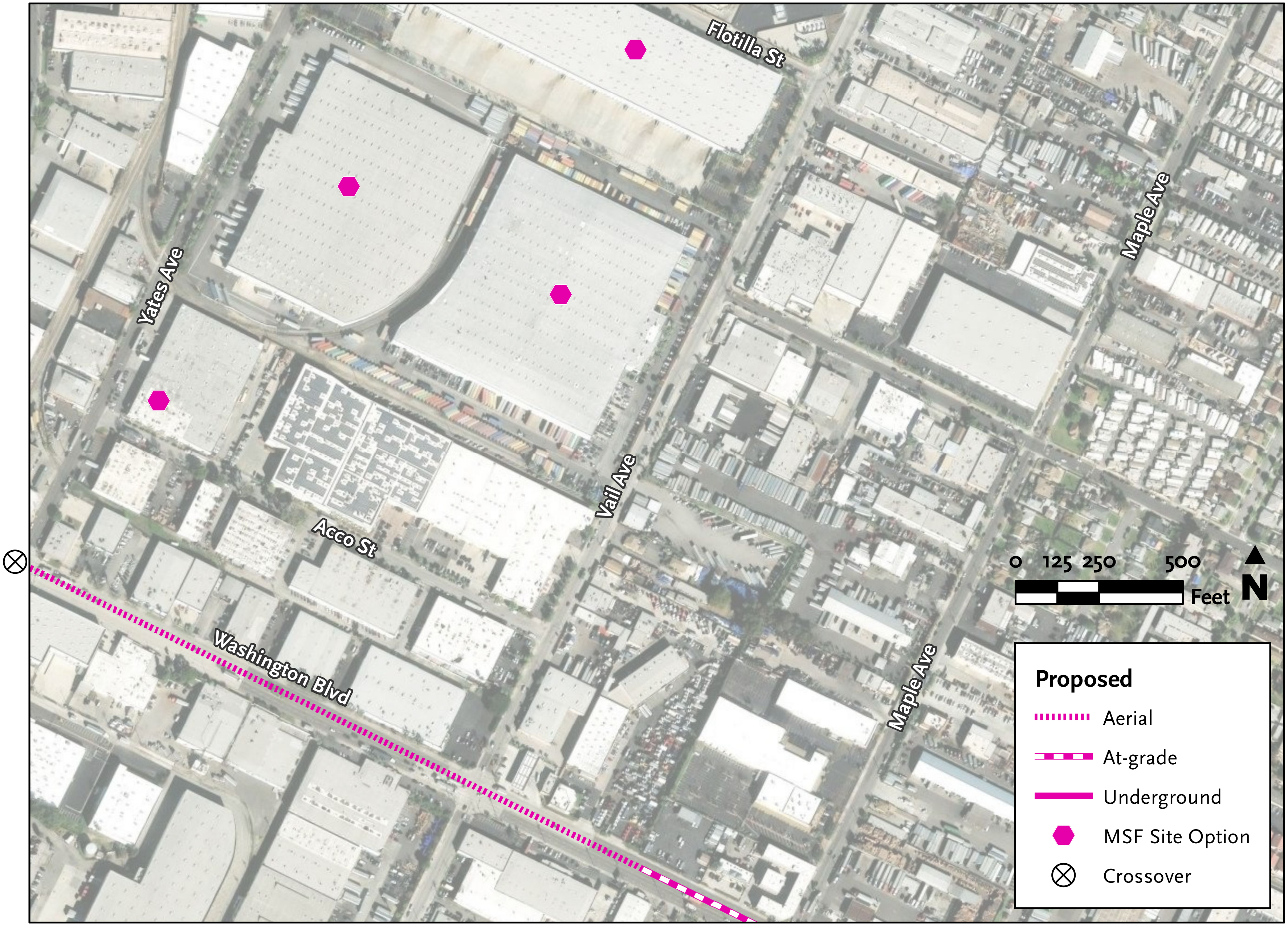
Noise and Vibration Impacts



Eastside Transit Corridor

Noise and Vibration Impacts