

4.4 NOISE AND VIBRATION

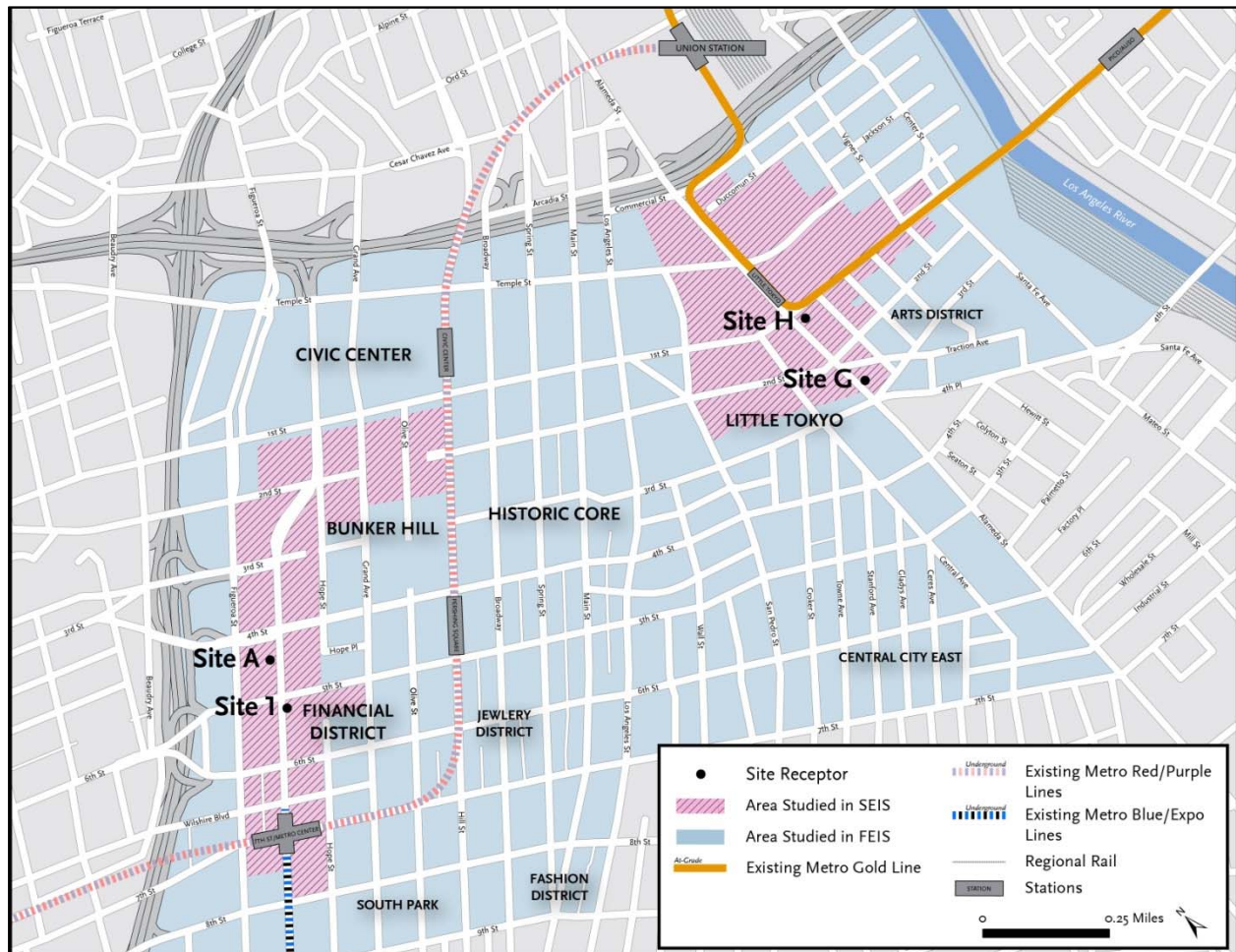
This section discusses the existing noise and vibration environment within the Study Area for the SEIS and evaluates the potential noise and vibration impacts resulting from construction of Alternatives A and B. The construction methods that would be employed for each of the tunneling method alternatives are described in Chapter 2, Alternatives Considered. Operation and operational impacts of Alternatives A and B would be the same as the Project; therefore no operational noise analysis was performed. Noise and vibration conditions and analytical information related to the Project and the entire project alignment is described in Chapter 4.7, Noise and Vibration of the Final EIS/EIR.

4.4.1 Affected Environment

During the Final EIS/EIR analysis efforts, noise levels were measured at two locations along Flower Street (Sites 1 and A) and two locations in Little Tokyo at the Savoy apartment building (Sites G and H), as shown in Figure 4.4-1. Although the changes in construction methods on Flower Street are the focus of this noise and vibration analysis, an evaluation of potential impacts to Little Tokyo as a result of increased muck truck activity, was also conducted. Measurements included the following:

- Site 1: A short-term (10-minute) measurement was conducted at Maguire Gardens at the Los Angeles Central Library on Flower Street. A one-hour Leq of 67 dBA was measured at 2:00 PM. and a peak-hour Leq of 68 dBA was estimated at this location based on the 24-hour measurement obtained at the Westin Bonaventure. Noise levels at this location are dominated by traffic noise from Flower and 5th Streets.
- Site A: A 24-hour measurement was conducted on the pool deck of the fourth floor of the Westin Bonaventure on Flower Street. An Ldn of 71 dBA and a peak-hour Leq of 68 dBA was measured at 6:00 AM.
- Site G: A 24-hour measurement was conducted at ground level to approximate noise in certain units of the Savoy Condominium in Little Tokyo where traffic noise levels are dominated by street traffic on Alameda Street. An Ldn of 73 dBA and a peak hour Leq of 75 dBA were measured at 7:00 PM.
- Site H: A 24-hour measurement was conducted at ground level to approximate noise in certain condo units in the Savoy Condominium building where noise levels are dominated by the traffic on 1st Street and train noise from Metro Gold Line operations. An Ldn of 72 dBA and a peak hour Leq of 72 dBA were measured at 7:00 PM.

Figure 4.4-1: Noise Measurement Locations Evaluated in the Final EIS/EIR and this SEIS



4.4.2 Environmental Consequences

Noise and vibration effects during construction of Alternatives A and B were evaluated using the FTA’s detailed guidance manual on *Transit Noise and Vibration Impacts Assessment (May 2006)*. No operational impacts analysis was included in the SEIS as operations under both alternatives would remain the same as the Project.

Mitigation measures for construction were identified, evaluated, and documented as part of the detailed assessments conducted as part of the Final EIS/EIR. In general, any impact resulting from the construction of Alternatives A and B would require the same or similar mitigation measures as was identified and recommended as part of the Final EIS/EIR. Therefore, where impacts are predicted during construction, the mitigation measures proposed are based on the control measures identified in the Final EIS/EIR, and other supplementary documents prepared in support of the Project.

Methodology

The various noise and vibration modeling assumptions, source reference levels for each of the proposed construction equipment and other operating characteristics (such as equipment usage

factors) are described below. These data are based on FTA data, as well as information included in the Final EIS/EIR and other supplemental support documents. Qualification of a receptor as “sensitive” under FTA standards depends on the distance of the receptor from the proposed facility, and on the type of facility. Detailed information on significant thresholds is found in Appendix B – Regulatory Framework. In this SEIS effort, the following evaluation parameters were used:

- For each construction scenario, worst case or conservative parameters were applied:
 - All equipment was applied to the closest distance from each of the receptors;
 - Construction activities and phases were evaluated when all potential pieces of equipment were active (Source: Final EIS/EIR, Appendix K: Description of Construction); and receptors;
 - All construction scenarios included drilled holes rather than pile driving.
- Construction equipment noise reference levels and usage factors from both the FTA and the Federal Highway Administration (FHWA) guidelines were used for all noise sources except:
 - Grouting Plant – applied maximum usage of 100 percent; and,
 - Grouting Drill Rigs – applied maximum usage of 100 percent.

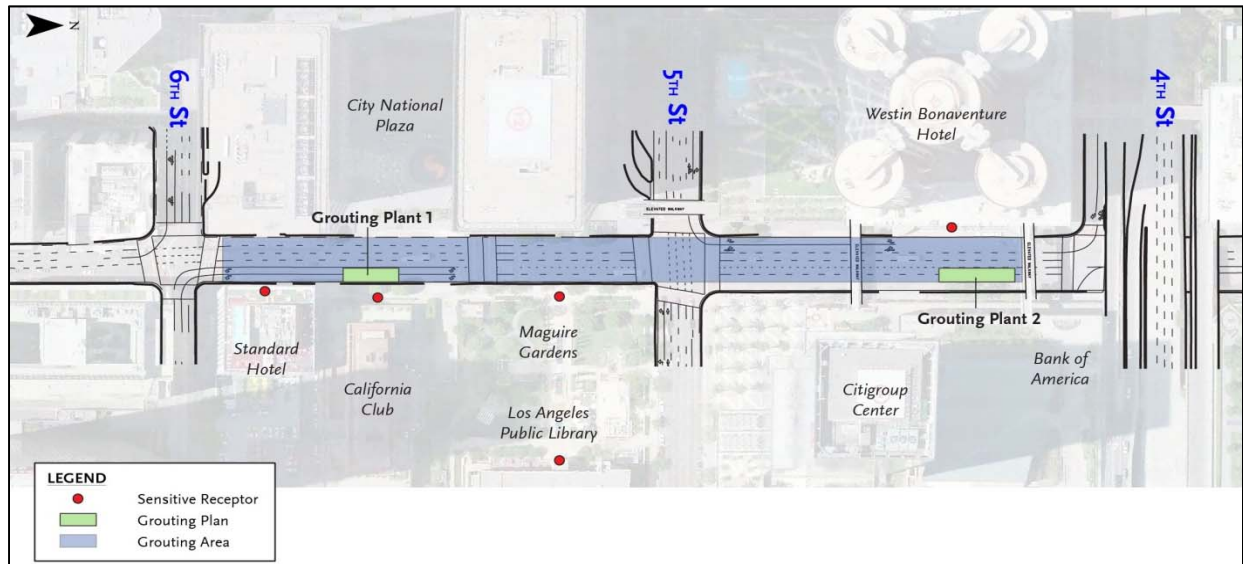
Additionally, the analysis considered impacts to historic resources along Flower Street and in Little Tokyo, as identified from the National Historic Register, from the Final EIS/EIR and confirmed in the SEIS.

In the grouting activity scenarios, two grouting plants were assumed for Alternative A and one for Alternative B. These plants were modeled to include compressors, pumps, generators, a mixing plant, and two grouting drill rigs per plant as discussed in Section 2.3.1, Construction Methods and Staging for Tunneling Method Alternatives, and Figures 2.3-2 and 2.3-3.

Figure 4.4-2 illustrates the Flower Street segment with identified sensitive receptors and construction scenarios which were assumed for this SEIS analysis. Construction detail considered in the analysis also included muck removal truck volumes developed by taking total trips per day and dividing by the estimated work day. Additionally, the TBM was assumed to be 22-feet in diameter, and was modeled at the shallowest point of each alternative’s vertical alignment in order to capture the maximum predicted noise and vibration caused by the TBM operations at the street level.

Similar to the Project, Alternatives A and B would have two construction staging areas located on the east side of Flower Street: 1) just south of 4th Street; and 2) just south of 5th Street. In addition to the two construction staging sites, and as shown in Figure 4.4-2: Alternative A would have two grouting plants located on the east side of Flower Street: 1) between 5th and 6th Streets (Grouting Plant 1); and 2) just south of 4th Street (Grouting Plant 2). Alternative B would have a single grouting plant located between 5th and 6th Streets (Grouting Plant 1).

Figure 4.4-2: Representative Sensitive Receptors and Grouting Areas along Flower Street – Alternatives A and B



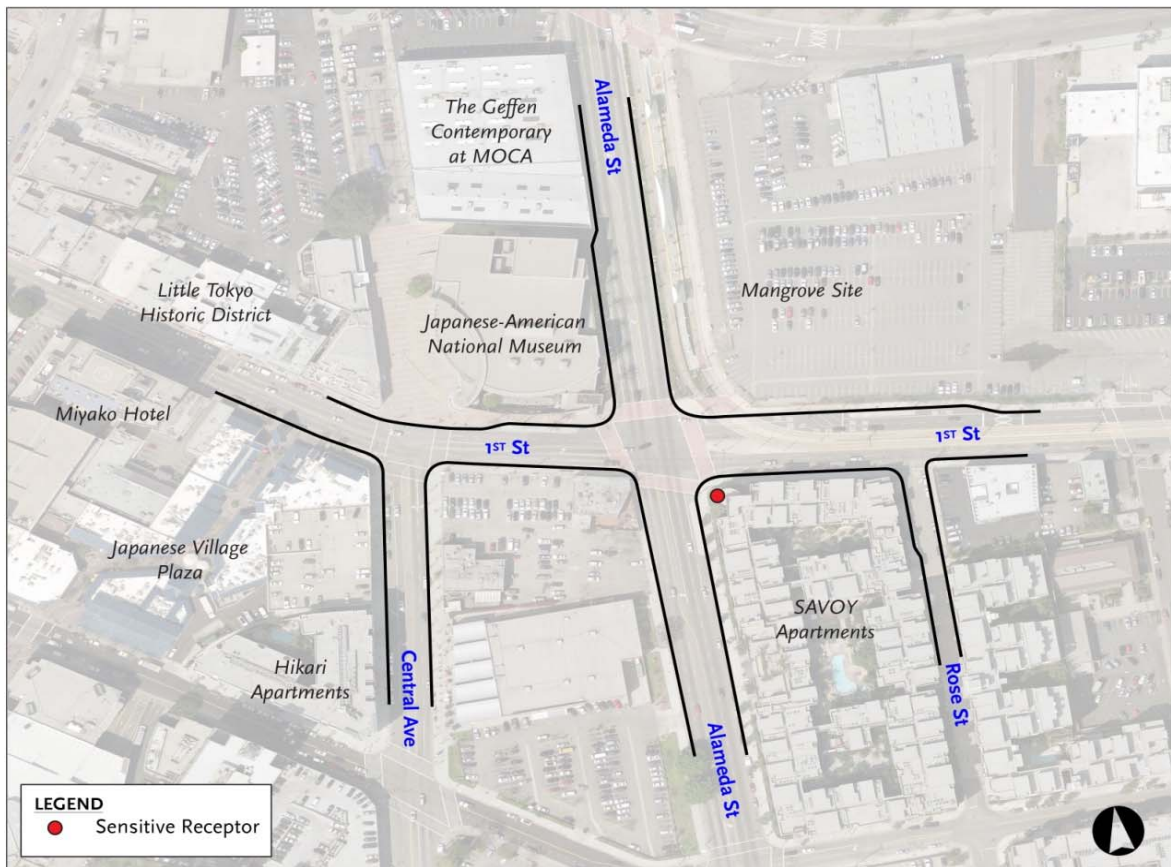
Little Tokyo

The Mangrove property in Little Tokyo, shown below in Figure 4.4-3, was identified under the Project and remains the location for the removal of the tunnel excavation materials by truck for Alternatives A and B. For purposes of the noise and vibration analysis, the duration of the construction methods identified for Alternatives A and B was taken into account for identifying impacts to sensitive receptors in the Little Tokyo area, due to extended construction and haul truck activities. Alternatives A and B would shift a majority of muck truck activities from Flower Street to this site in Little Tokyo and for a longer duration than the Project resulting in increased exposure to truck noise and vibration. As shown in Table 4.4-1, the construction duration for Alternative A would be 15 months longer than the Project and 7 months longer for Alternative B.

Table 4.4-1: Summary of Construction Impacts

Alternative	Muck Truck Activity		Excavation Duration
	Flower Street	Little Tokyo	Difference over Project (Months)
Project	81%	19%	--
Alternative A	25%	75%	15
Alternative B	20%	80%	7

Figure 4.4-3: Representative Sensitive Receptor at the Staging Area in Little Tokyo



4.4.2.1 Alternative A – EPBM/Open Face Shield/SEM Project Profile

4.4.2.1.1 Construction Impacts

Under Alternative A, maximum cumulative noise levels (L_{eq}) from street and surface construction activities along Flower Street are predicted to occur from the construction and grouting staging sites that would be located in front of the Maguire Gardens and the Los Angeles Central Library, and between 4th and 5th Streets adjacent to the Citigroup Center and The Westin Bonaventure Hotel.

The construction noise levels under Alternative A are anticipated to be 3 to 6 dBA greater than the levels predicted under the Project. The increase in noise levels is due to the use of four grouting rigs required by this alternative to provide ground stabilization. Grouting activities would operate from: 1) a joint construction and grouting staging site located between 4th and 5th Streets; and 2) a grout plant located adjacent to the construction staging area between 5th and 6th Streets. Construction is expected to occur in two shifts per day, while grouting activities are currently planned to take place in one ten-hour, daytime shift per day for a 12 month time period, possibly extending up to 24 months due to unforeseen underground conditions. Depending on the final contractor work schedule, a second nighttime grouting shift may be added.

Except for Maguire Gardens, all of the identified sensitive receptors include indoor land uses. Although the noise levels predicted at the exterior facade of the Flower Street buildings would be reduced for interior spaces due to the buildings' transmission loss of 20 to 25 dBA, implementation of the control measures identified in the Final EIS/EIR are recommended to minimize any exceedances of the FTA construction noise criteria. Mitigating noise generated by grouting equipment would be challenging due to the size of the equipment, with the grouting rigs more than 100 feet in height.

Implementation of mitigation measures identified for the Project would reduce adverse noise effects to sensitive or historic buildings to not substantially adverse, though impacts would remain due to the size of the grouting equipment. Due to daytime-only grouting operations, construction of Alternative A is expected to result in noise levels below the "severe" impacts level identified by FTA noise criteria, and would not result in adverse noise effects on sensitive land uses under NEPA. Refer to Appendix F for noise and vibration prediction model outputs for Alternative A.

Under Alternative A, maximum vibration levels from both surface and tunneling construction activities are predicted to range from 0.003 in/sec PPV at the Los Angeles Central Library to 0.118 in/s PPV at the Westin Bonaventure Hotel. The higher vibration level at the Westin Bonaventure Hotel is due to the TBM operations, which are estimated to occur approximately 45 feet from the hotel's Flower Street building edge, and at a higher depth than that of the Project at approximately 30 feet below street level. Overall, the construction vibration levels under Alternative A are predicted to be essentially equal to the levels predicted under the Project. No exceedances of the vibration damage threshold of 0.5 in/sec for sensitive properties or 0.2 in/sec for fragile historic properties are predicted. Similarly, most of the identified receptors include indoor land-uses, except for Maguire Gardens. With regard to the physical structure of the gardens, Alternative A would not result in any adverse effects or damage due to construction-related activities. Therefore, the ground-borne vibration levels predicted at the Los Angeles Central Library's exterior façade would not be adverse due to the coupling loss at the building's foundation of approximately 10 VdB.

In summary, adverse noise or vibration effects from construction of Alternative A to sensitive land uses or historic resources are not anticipated. The Little Tokyo alignment remains unchanged; however the duration of construction noise would be extended.

4.4.2.2 Alternative B – EPBM/SEM Low Alignment

4.4.2.2.1 Construction Impacts

Under Alternative B, the construction noise levels are predicted to be 6 to 7 dBA greater than the noise levels predicted under the Project. The increase in noise levels is due to the use of two grouting rigs required by this alternative to provide ground stabilization. Grouting activities would operate from a single joint construction and grouting staging site located on the east side of Flower Street between 4th and 5th Streets. Construction is expected to occur in two shifts per day, while grouting activities are currently planned to take place in one ten-hour, daytime shift per day for an 8 month time period, possibly extending up to 16 months due to unforeseen underground conditions. Depending on the final contractor work schedule, a second nighttime grouting shift may be added.

Except for Maguire Gardens, all of the selected receptors include indoor land uses. Similar to Alternative B, Although the noise levels predicted at the exterior facade of the Flower Street buildings would be reduced for interior spaces due to the buildings' transmission loss of 20 to 25 dBA, implementation of the control measures identified in the Final EIS/EIR are recommended to minimize any exceedances of the FTA construction noise criteria. Mitigating noise generated by grouting equipment would be challenging due to the size of the equipment, with the grouting rigs more than 100 feet in height. With daytime operation of the grouting equipment, noise effects would be below "severe" impact levels identified under FTA criteria.

Implementation of mitigation measures identified for the Project would reduce adverse noise effects to sensitive or historic buildings to not substantially adverse, though impacts would remain due to the size of the grouting equipment. Due to daytime-only grouting operations, construction of Alternative B is expected to result in noise levels below the "severe" impacts level identified by FTA noise criteria, and would not result in adverse noise effects on sensitive land uses under NEPA. Refer to Appendix F for noise and vibration prediction model outputs for Alternative A.

Under Alternative B, the construction vibration levels from both surface and tunneling construction activities are predicted to be essentially equal to the levels predicted under the Project. No exceedances of the vibration damage threshold of 0.5 in/sec for sensitive properties or 0.2 in/sec for fragile historic properties are predicted. Similarly, most of the selected receptors include indoor land-uses (except Maguire Gardens at Site R5). Therefore, the ground-borne vibration levels predicted at the exterior facade of the Los Angeles Central Library would not be adverse due to the coupling loss at the building's foundation of approximately 10 VdB.

In summary, adverse noise or vibration effects from construction of Alternative B to sensitive land uses or historic resources are not anticipated. The Little Tokyo alignment remains unchanged; however the duration of construction noise would be extended.

4.4.3 Mitigation Measures

Mitigation measures to reduce potential noise and vibration impacts during construction were identified in the Final EIS/EIR. Implementation of mitigation measures NV-1 through NV-29 from the Final EIS/EIR for the Project would apply for Alternatives A and B. Below is a summary of these mitigation measures, and a detailed description can be found in Appendix H:

- NV-1: Monitoring for sensitive and/or historic structures within 21 feet of construction
- NV-2: Preparation of vibration monitoring plan for sensitive buildings
- NV-3: Appropriate distances maintained during construction to vibration-sensitive locations
- NV-4: Use of less vibration-sensitive equipment near sensitive locations
- NV-5: Heavy construction vehicles routed away from vibration-sensitive locations
- NV-6: Earthmoving equipment to be operated far from vibration-sensitive locations
- NV-7: Sequencing of vibration producing construction activities
- NV-8: Avoidance of nighttime construction near vibration-sensitive locations
- NV-9: Use of minimal impact devices

- NV-10: Use of non-impact demolition methods near vibration-sensitive locations
- NV-11: Use of building protection measures to prevent deterioration
- NV-12: Use of pavement breakers, vibratory rollers, and packers far from sensitive locations
- NV-13: Appropriate procedures for noise complaints and measures to reduce construction noise below FTA criteria
- NV-14: Temporary noise barriers around construction sites and equipment
- NV-15: Use of back-up alarms/warning procedures where feasible
- NV-16: Use of mufflers for construction equipment near sensitive land uses
- NV-17: Portable noise sheds for smaller construction equipment
- NV-18: Specific requirements in/around vicinity of the Walt Disney Concert Hall
- NV-19: Maintenance and operation of TBM by contractor to minimize vibration impacts
- NV-20: Coordination and notification of TBM use in/around vicinity of Disney Concert Hall, Colburn School, and Broad Art Foundation Museum
- NV-21: Delivery train speed in/around Disney Concert Hall, Colburn School, and Broad Art Foundation Museum
- NV-22: Use of resilient system to support and fasten delivery train tracks
- NV-23: Use of conveyor system on delivery train if exceedances of FTA annoyance criteria
- NV-24: Coordination of delivery train during vacancies at Disney Concert Hall, Colburn School, and Broad Art Foundation Museum
- NV-25: Coordination and notification of tunneling activities prior to commencement
- NV-26: Appropriate notification strategies in/around Little Tokyo and monitoring ground borne noise (GBN)/ground borne vibration (GBV) levels during TBM activity
- NV-27: Implementation of measures around Disney Concert Hall and Colburn School as needed to reduce GBN
- NV-28: During final design, conduct engineering studies to verify GBN and implement appropriate measures if needed, in/around Hikari Lofts and Nakamura Tetsujiro Building
- NV-29: During final design, conduct engineering studies to verify GBN and implement appropriate measures if needed, in/around the Japanese Village Plaza and Broad Art Foundation Museum.

As with the Project, there would be no potentially construction-related adverse effects after implementation of these mitigation measures for Alternatives A and B. However, the alternatives may have additional noise impacts along Flower Street beyond those identified for the Project due to the size and type of grouting and support equipment required for ground stabilization. Additionally, Alternative A and B would increase the muck truck activity in Little Tokyo for a longer duration than the Project.