3.11 NOISE AND VIBRATION

This section examines potential noise and vibration impacts of the project. The analysis addresses existing conditions, predicts noise and vibration levels during operation, and evaluates measures to minimize potential significant noise and vibration impacts.

The project limits for the impact assessment extend from Citrus Avenue border of the City of Glendora to Central Avenue in the City of Montclair.

The noise and vibration analysis considers a "worst case" scenario for potential project impacts based on the train maximum design speeds of up to 65 miles per hour. Trains operating at high speeds would result in high predicted noise and vibration levels, while trains operating at lower speeds would result in lower predicted noise and vibration levels.

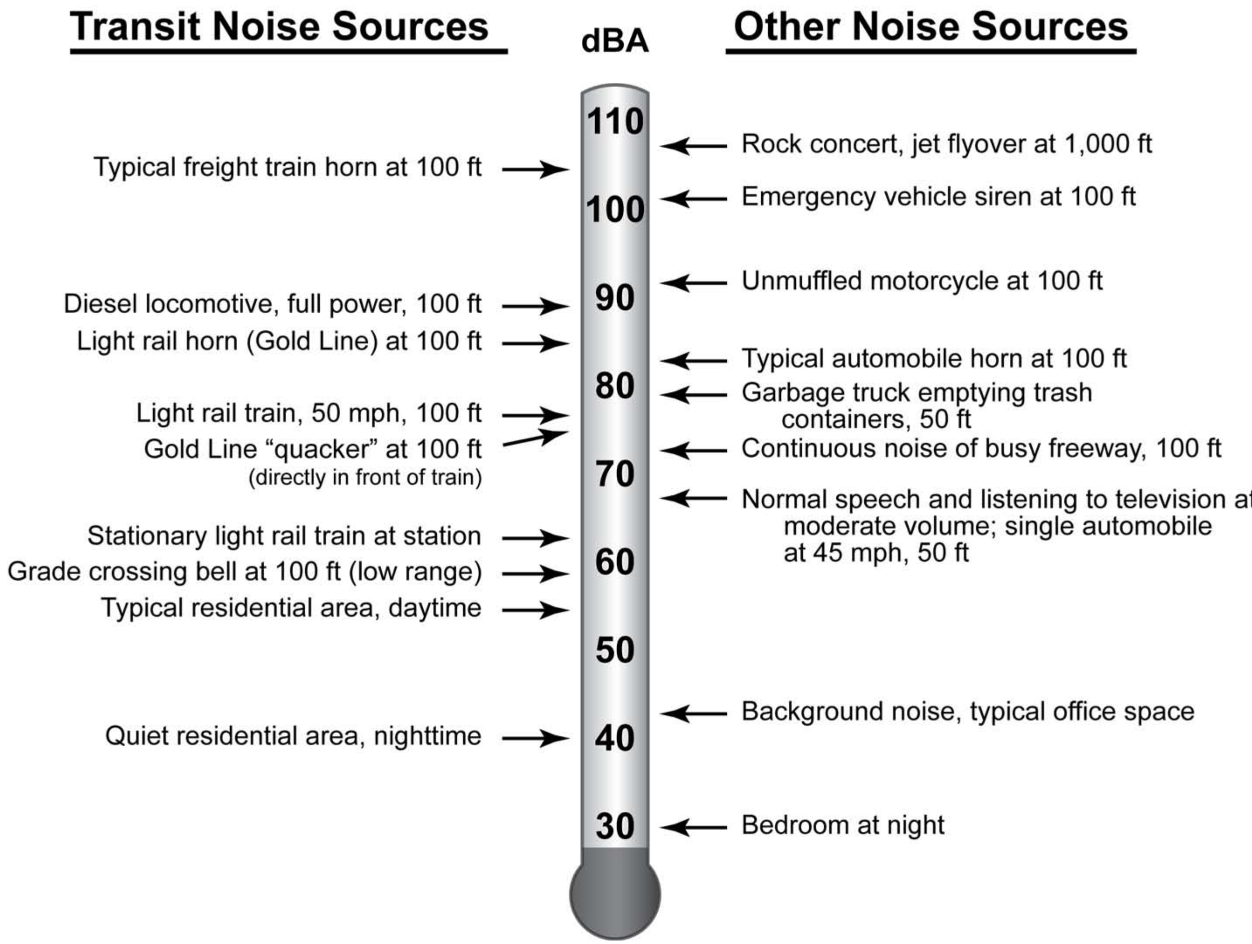
3.11.1 Background on Noise

Noise is typically defined as unwanted or undesirable sound, where sound is characterized by small air pressure fluctuations above and below the atmospheric pressure. The basic parameters of environmental noise that affect human response to sound are:

- Intensity or level
- Frequency content
- Variation with time

Intensity is determined by how greatly the sound pressure fluctuates above and below the atmospheric pressure, and is expressed on a logarithmic scale in units of decibels (dB). By using this scale, the range of normally encountered sound can be expressed by values between 0 and 120 dB. In addition, the dB scale corresponds to how humans perceive sound loudness. On a relative basis, a 3-dB change in sound level generally represents a noticeable change in loudness, whereas a 10-dB change is typically perceived as a doubling (or halving) in the loudness of a sound.

The frequency content of noise is related to the tone or pitch of the sound, and is expressed based on the rate of the air pressure fluctuations in cycles per second called hertz (Hz). The human ear can detect frequencies from about 20 Hz to 17,000 Hz; however, the sensitivity of human hearing varies with frequency. The A-weighting system is commonly used when measuring environmental noise to which humans are most sensitive. This system provides a single-number descriptor that correlates with the subjective human response. Sound levels measured using this weighting system are called "A-weighted" sound levels and are expressed as "dBA." Figure 3.11-1 includes examples of A-weighted sound levels from common indoor and outdoor noise sources.



Source: FTA 2006

Figure 3.11-1. Sound Levels of Typical Indoor and Outdoor Sources

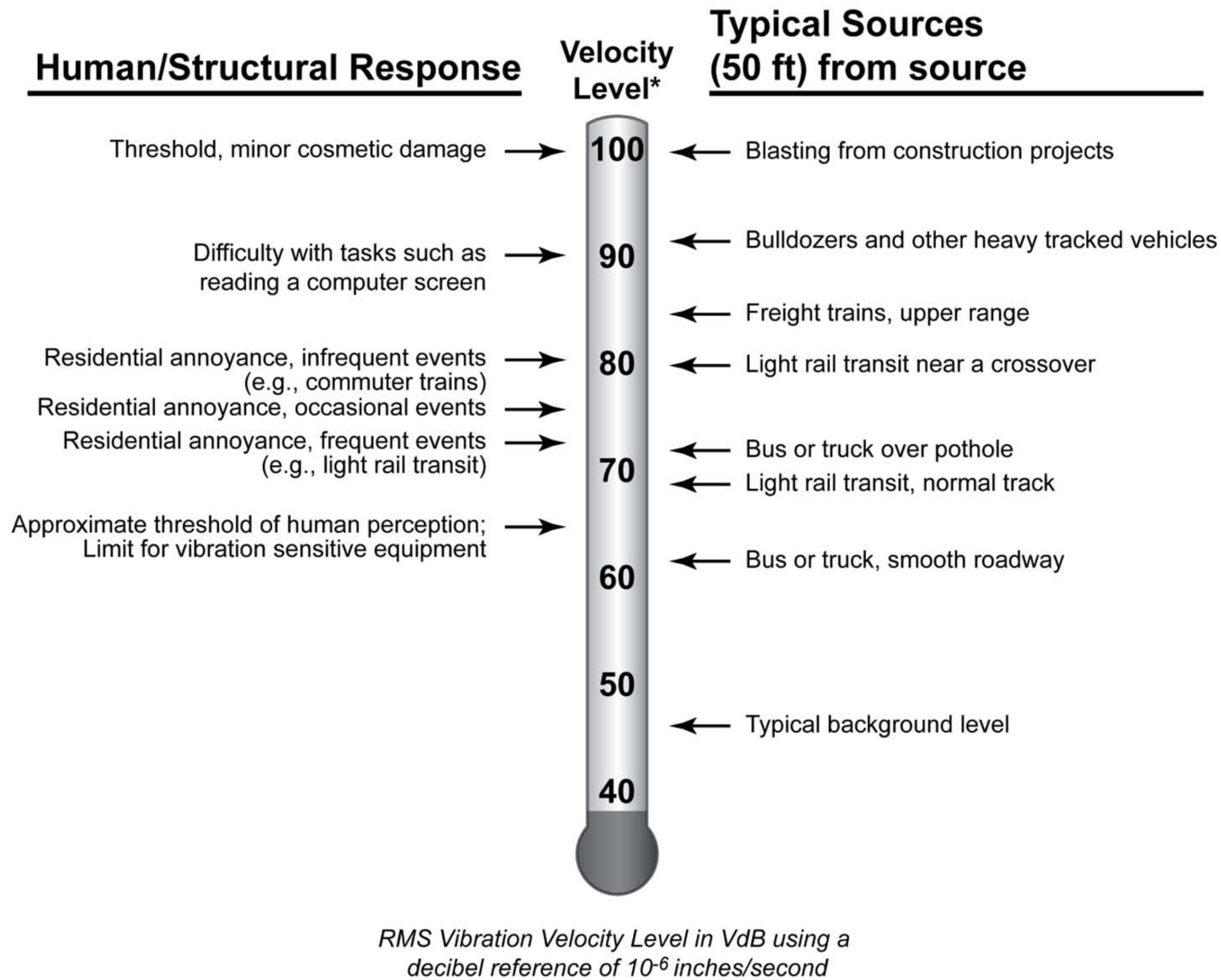
Environmental sound constantly fluctuates. The metrics used in this report to characterize varying sound environments are:

- **Maximum Sound Level (L_{max})** is the maximum sound level that occurs during an event such as a train passing. L_{max} is the maximum sound level using the slow setting on a standard sound level meter.
- **Equivalent Sound Level (L_{eq})** is the most common means of characterizing fluctuating community noise. L_{eq} represents a constant sound that, over a specified period of time, has the same sound energy as the time-varying sound. L_{eq} is used by the Federal Transit Administration (FTA) to evaluate noise effects at institutional land uses—such as schools, churches, and libraries—from proposed transit projects.
- **Day-Night Sound Level (**L_{dn}**)** is a 24-hour L_{eq} with an adjustment to reflect the greater sensitivity to nighttime noise experienced of most people. The adjustment is a 10 dB penalty for all sound that occurs between the hours of 10:00 p.m. to 7:00 a.m., which means that any event occurring during the nighttime is equivalent to 10 occurrences of the same event during the daytime. L_{dn} is the most common measure of total community noise over a 24-hour period and is used by the FTA to evaluate residential noise effects from proposed transit projects.
- **Percent Exceedance Level (L_{XX})** is the sound level that is exceeded for a certain percentage of the measurement period (e.g., L_{99} is the sound level exceeded during 99 percent of the measurement period). For a 1-hour period, L_{99} is the sound level exceeded for all except 36 seconds of the hour. L_1 represents typical maximum sound levels, L_{33} is approximately equal to L_{eq} when free-flowing traffic is the dominant noise source, L_{50} is the median sound level, and L_{99} is close to the minimum sound level.
- **Sound Exposure Level (SEL)** is a measure of the acoustic energy of an event such as a train passing. The acoustic energy of the event is compressed into a 1-second period. SEL increases as the sound level of the event increases and as the duration of the event increases. It is often used as an intermediate value in calculating overall metrics such as L_{eq} and L_{dn}.

3.11.2 Background on Vibration

Groundborne vibration travels from the train through the soil and may cause perceptible shaking or vibration inside buildings. Groundborne vibration can be measured in terms of displacement, velocity, or acceleration. Velocity is the preferred measure for evaluating groundborne vibration from transit projects because it is typically considered to correspond best with human sensitivity to vibration. In this report, groundborne vibration is expressed in terms of the root-mean-square (rms) vibration velocity level in decibels (VdB). The abbreviation VdB is used in place of dB to avoid confusing vibration decibels with sound decibels.

Figure 3.11-2 illustrates typical groundborne vibration levels for common sources and criteria for human and structural response to groundborne vibration. As the figure illustrates, the range of interest for vibration is approximately 50 to 100 VdB (from imperceptible background vibration to the threshold of potential damage). The approximate threshold of human perception to vibration is 65 VdB. Humans generally do not find vibration from light-rail transit operations annoying until the vibration exceeds 70 to 75 VdB.



Source: FTA 2006

Figure 3.11-2. Typical Groundborne Vibration Levels and Criteria

3.11.3 Noise and Vibration Sources Associated with Light-Rail Transit Systems

The following noise and vibration sources have been evaluated:

- **Light-Rail Vehicle Operations—**This is the normal noise from the operation of light-rail vehicles. It includes noise from steel wheels rolling on steel rails (wheel/rail noise) and from propulsion motors, air-conditioning, and other auxiliary equipment on the vehicles. As expected, the wheel/rail noise increases with speed. At speeds greater than 20 to 30 mph, the wheel/rail noise usually dominates noise from the vehicle auxiliary equipment. Train operations also create groundborne vibration that may be intrusive to occupants of buildings when the tracks are approximately 100 feet or closer to buildings. However, the vibration from light-rail transit (LRT) operations is almost never sufficient to cause minor cosmetic damage to buildings.
- **Traffic Noise—**The project would result in changes in traffic patterns and volumes near the proposed stations and at-grade crossings. In all cases, the forecasted change in traffic volume is insufficient to cause more than a 1 dB change in sound levels; therefore, a detailed assessment of noise impacts from traffic noise has not been performed.
- **Audible Warnings—**Audible warnings are required by the California Public Utilities Commission at all gate-protected at-grade LRT/roadway crossings. The required audible warnings are ringing bells that are located on the masts of the crossing gates and the sounding of horns located on the lead vehicle of the trains.
- **Special Trackwork—**Turnouts and crossovers require special trackwork where two rails cross. The special fixture used where two rails cross is referred to as a “frog.” Standard frogs have gaps, and the train wheels must “jump” across the gap. The wheels striking the ends of the gap increase noise levels near the ”frog” by approximately 6 dB and increase groundborne vibration levels by approximately 10 VdB.
- **Ancillary Equipment—**Traction power supply substations (TPSS) are the only ancillary equipment associated with the project that could create noise impacts. The ventilation fans provided at each substation would be the dominant noise source of most TPSS units.
- **BNSF and Metrolink Operations—**The tracks for the Burlington Northern Santa Fe Railway (BNSF) and Metrolink trains operating in the project right-of-way would be relocated within the existing right-of-way to accommodate the light-rail tracks. In some cases, the tracks would be relocated closer to residences, which would increase noise and vibration levels at those locations. The noise and vibration from BNSF and Metrolink operations, including the wheel/rail noise, groundborne vibration, and noise from audible warnings, is included in the noise and vibration assessments.
- **Construction Noise and Vibration—**All the sources discussed previously are associated with operation of the project. Similar to any other major transportation infrastructure project, construction would require use of heavy equipment that generates relatively high noise and vibration levels.

3.11.4 Regulatory Setting

The Federal Transit Authority (FTA) established specific noise and vibration criteria for light-rail transit; therefore, these criteria and analytical methodologies are applied. The analysis follows the procedures and criteria in the FTA's *Transit Noise and Vibration Impact Assessment,* also referred to as the FTA Guidance Manual (FTA 2006).

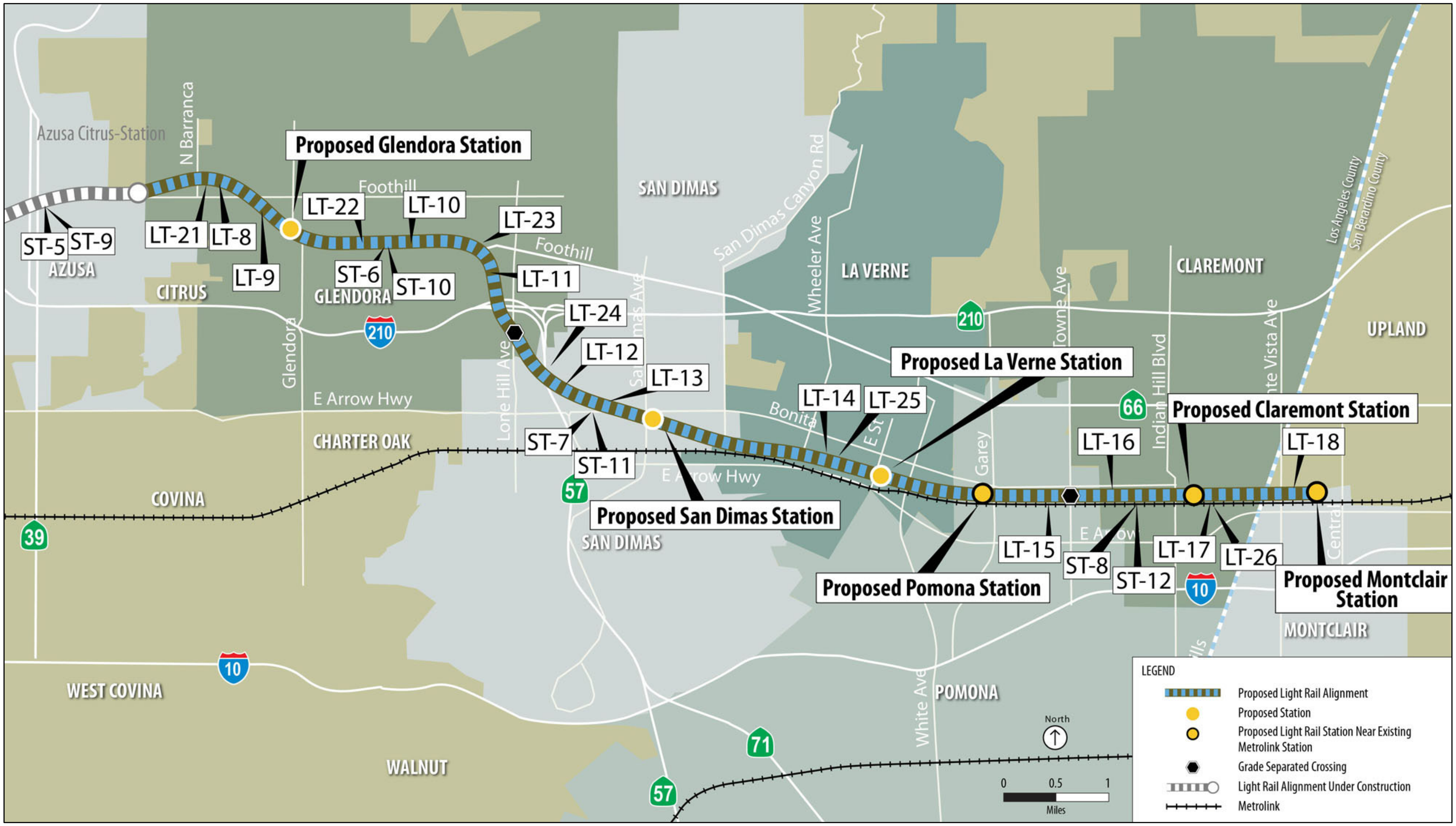
3.11.5 Existing Conditions

3.11.5.1 Noise Measurements

The existing noise test procedures follow the detailed noise analysis procedure described in the FTA Guidance Manual. Noise-sensitive land uses in the first row of buildings along the project alignment were identified within a screening distance of 250 feet based on preliminary alignment drawings, aerial photographs, and visual surveys. Areas adjacent to the project alignment include single- and multi-family residences, non-residential (commercial) uses, and institutional land uses. The adjacent areas are exposed to noise from traffic on local streets, freight trains, and, east of the La Verne Station, Metrolink commuter trains.

Existing ambient noise levels were characterized through measurements at a total of 25 sites along the alignment. The measurements consisted of long-term (24-hour) and short-term (1-hour) monitoring of the A-weighted sound levels at representative noise-sensitive locations. These measurements were conducted at 15 sites along the proposed alignment in 2003. Further measurements were carried out at 10 sites in February and March of 2011 with the dual purpose of identifying whether there have been any changes to the noise environment since 2003 and gathering data in areas that were not included in the 2003 measurement program.

All of the measurement sites were located in noise-sensitive areas selected to represent a range of existing noise conditions in such areas along the project alignment. Figure 3.11-3 shows the general locations of the 17 long-term monitoring sites labeled with the prefix "LT" and eight short-term monitoring sites labeled with the prefix "ST". At each site, the measurement microphone was positioned to characterize the exposure of the site to the dominant noise sources in the area. For example, microphones were located at the approximate setback distance of the receptors from adjacent roads or rail lines, and were positioned to avoid acoustic shielding by landscaping, fences, or other obstructions.



Source: ATS Consulting 2011

Figure 3.11-3. Locations of Long-Term (LT) and Short-Term (ST) Noise Measurements

3.11.5.2 City of Glendora

Existing ambient noise levels in Glendora were characterized through seven 24-hour noise measurements at residential sites and four one-hour measurements at institutional sites. The dominant existing noise levels in the area were traffic from local roads and two daily BNSF freight trains traversing the area. The results for measurement sites in the City of Glendora are presented in Table 3.11-1. As shown, the L_{dn} for residences in the City of Glendora ranges from 55 to 60 dBA.

Table 3.11-1. City of Glendora—Existing Noise Levels

Site Number	Measurement Location Description	Start of Measurement		Measurement Time (hours)	Noise Exposure L_{dn} (dBA)
		Date	Time		
LT-8	167 Lowell Avenue	10/7/03	11:00	24	55
LT-9	Presbyterian Hospital	10/7/03	15:00	24	58
LT-10	948 Lemon Avenue	10/7/03	13:00	24	55
LT-11	655 Remuda Drive	10/7/03	13:00	24	60
LT-21	166 Marcile Avenue	2/23/11	11:00	24	55
LT-22	520 Lemon Avenue	2/22/11	12:00	24	56
LT-23	1544 Compromise Line Road	3/2/11	15:00	24	58
Short-Term Measurements					**Noise Exposure L_{eq} (dBA)**
ST-5	Calvary Lutheran Church	10/9/03	16:43	1	51
ST-6	Foothill Christian Preschool	10/9/03	15:32	1	52
ST-9	Calvary Lutheran Church	3/2/211	10:17	1	50
ST-10	Foothill Christian Preschool	3/2/11	12:10	1	50

Source: ATS Consulting 2011
Note: “Time” category is represented using the 24-hour clock.

3.11.5.3 City of San Dimas

Existing ambient noise levels were characterized through three 24-hour noise measurements at residential sites and two one-hour measurements at institutional sites that were identified as sensitive receptors in the City of San Dimas. The dominant existing noise levels in the area were traffic from local roads and highways, plus two daily BNSF freight trains through the area. The measured L_{dn} at residences in the City of San Dimas ranged from 60 to 65 dBA. The results for measurement sites are presented in Table 3.11-2.

Table 3.11-2. City of San Dimas—Existing Noise Levels

Site Number	Measurement Location Description	Start of Measurement		Measurement Time (hours)	Noise Exposure, L_{dn} (dBA)
		Date	Time		
LT-12	The Lakes at Raintree Village Apartments	10/7/03	15:00	24	60
LT-13	Sunnyside Senior Apartments	10/8/03	12:00	24	65
LT-24	566 Pearlanna Drive	2/28/11	15:30	24	64
Short-Term Measurements					**Noise Exposure L_{eq} (dBA)**
ST-7	Pioneer Park	10/9/03	16:23	1	56
ST-11	Pioneer Park	3/1/11	14:43	1	58

Source: ATS Consulting 2011
Note: "Time" category is represented using the 24-hour clock.

3.11.5.4 City of La Verne

Existing ambient noise levels in the City of La Verne were characterized through two 24-hour noise measurements at residential sites which were the sensitive receptors identified in the City of La Verne. The dominant existing noise levels in the area were traffic from local roads and Arrow Highway, plus two daily BNSF freight trains through the area. The noise measurement details and results are shown in Table 3.11-3.

Table 3.11-3. City of La Verne—Existing Noise Levels

Site Number	Measurement Location Description	Start of Measurement		Measurement Time (hours)	Noise Exposure L_{dn} (dBA)
		Date	Time		
LT-14	1638 1st Street	10/8/03	14:00	24	65
LT-25	1736 1st Street	3/2/11	14:00	24	64

Source: ATS Consulting 2011
Note: "Time" category is represented using the 24-hour clock.

3.11.5.5 City of Pomona

Existing ambient noise levels in the City of Pomona were characterized through one 24-hour noise measurement at a residential site, which was the identified sensitive receptor site representing the few residences that are located near the right-of-way in the City of Pomona. The dominant existing noise sources in the area were vehicular traffic from local roads and train traffic. The noise measurement details and results are shown in Table 3.11-4.

Table 3.11-4. City of Pomona—Existing Noise Levels

Site Number	Measurement Location Description	Start of Measurement		Measurement Time (hours)	Noise Exposure L_{dn} (dBA)
		Date	Time		
LT-15	2655 Deodar Road	10/8/03	13:00	24	62

Source: ATS Consulting 2011
Note: “Time” category is represented using the 24-hour clock.

3.11.5.6 City of Claremont

Existing ambient noise levels in the City of Claremont were characterized through three 24-hour noise measurements at residential sites and two 1-hour measurements at an institutional site. The dominant existing noise levels in the area were traffic from local roads and the Metrolink and BNSF trains in the existing rail corridor. The measured L_{dn} at residences in the City of Claremont ranged from 62 to 65 dBA. The results for the four measurement sites are presented in Table 3.11-5.

Table 3.11-5. City of Claremont—Existing Noise Levels

Site Number	Measurement Location Description	Start of Measurement		Measurement Time (hours)	Noise Exposure L_{dn} (dBA)
		Date	Time		
LT-16	Mountain Village Senior Apartments	10/8/03	14:00	24	62
LT-17	417 Elder Drive	10/9/03	14:00	24	65
LT-26	421 Elder Drive	2/28/11	11:30	24	64
Short-Term Measurements					**Noise Exposure L_{eq} (dBA)**
ST-8	Keck Graduate Institute	10/9/03	15:03	1	58
ST-12	Keck Graduate Institute	3/1/11	11:57	1	58

Source: ATS Consulting 2011
Note: “Time” category is represented using the 24-hour clock.

3.11.5.7 City of Montclair

Existing ambient noise levels in the City of Montclair were characterized through one 24-hour noise measurement at Montclair Metrolink Station Park-n-Ride site, which is not a sensitive receptor. No sensitive receptors were identified in this segment of the project alignment. The dominant existing noise levels in the area were traffic from local roads and the Metrolink and BNSF trains in the existing rail corridor. The noise measurement details and results are shown in Table 3.11-6.

Table 3.11-6. City of Montclair—Existing Noise Levels

Site Number	Measurement Location Description	Start of Measurement		Measurement Time (hours)	Noise Exposure L_{dn} (dBA)
		Date	Time		
LT-18	Montclair Park-n-Ride	10/9/03	14:00	24	63

Source: ATS Consulting 2011
Note: “Time” category is represented using the 24-hour clock.

3.11.6 Environmental Impacts

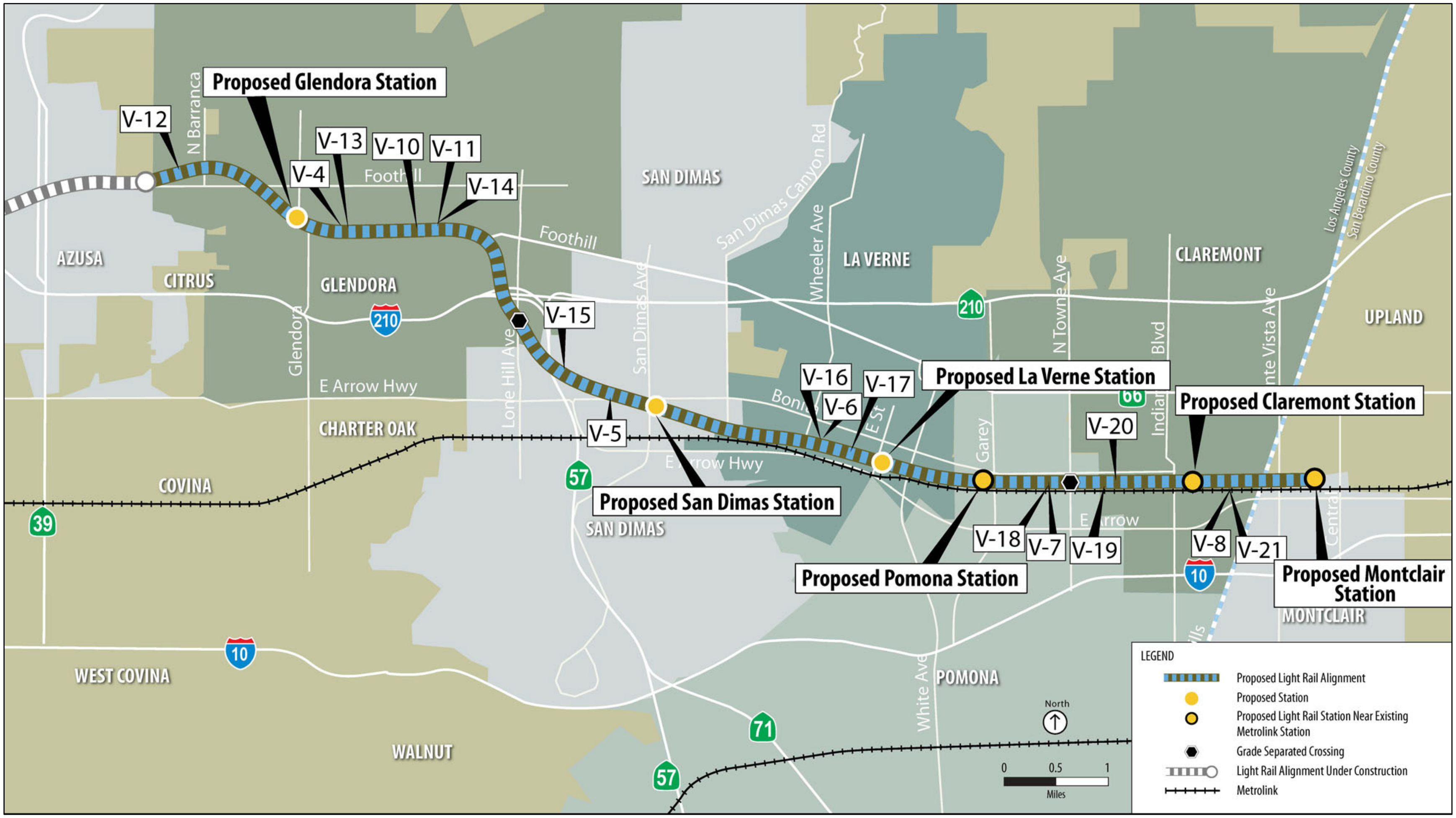
3.11.6.1 Evaluation Methodology

Vibration Propagation Measurement Procedures

Vibration propagation tests were performed to determine how vibration would propagate or travel from the tracks through the soil to vibration-sensitive receptors. The tests followed the detailed assessment approach recommended in the FTA Guidance Manual. The test characterizes how vibration travels through the soil by imparting vibration into the ground using a drop hammer as a vibration input force and measuring the input force and measuring the corresponding ground vibration response at several distances. The vibration propagation tests were performed at 20 locations, as shown in Figure 3.11-4.

Existing vibration sources along the project alignment are freight trains and, east of the La Verne Station, Metrolink trains. Vehicular traffic does not generally cause perceptible vibration, and if it does, the source can be traced usually to potholes, wide expansion joints, or other “bumps” in the roadway surface. The FTA Guidance Manual does not require measurements of existing vibration levels from traffic. At-grade crossings may generate noise and vibration from vehicles traveling along the “rumble strip” used at the transition of the tracks and the roadway surface. The noise and vibration levels from the addition of an at-grade crossing would not significantly increase the overall noise and vibration of the existing traffic.

Because of the infrequency of service, measurements of existing vibration levels from freight trains west of where the Metrolink and Gold Line alignments join (just past the La Verne Station) are not required for the vibration assessment. East of the La Verne Station, Metrolink operates approximately 36 daily trips within or close to the project right-of-way. The existing vibration levels from the Metrolink and freight service east of La Verne Station were characterized through a measurement conducted in Claremont and are included in Section 3.11.5.6.



Source: ATS Consulting 2011

Figure 3.11-4. Locations of Vibration Propagation Tests

Analytic Methodology

Data used in the analysis were taken from various sources, including the FHWA guidance manual, *FHWA Roadway Construction Noise Model User's Guide* (FHWA 2006), noise and vibration studies prepared for other LRT projects, and previous environmental studies prepared for the project.

Separate models are used to predict noise from light-rail vehicle operation, audible warnings at at-grade crossings, ancillary equipment, BNSF and Metrolink operation, and construction noise.

The predictions of groundborne vibration follow the Detailed Vibration Assessment procedure of the FTA Guidance Manual. This method is based on testing vibration characteristics in the project corridor and measurements of light-rail vehicles.

The first step of the noise and vibration analyses was identifying sensitive receptors. Then, the sensitive receptors are grouped into clusters based on their location relative to the tracks and on other operational factors that affect noise and vibration levels, such as train speed. There are usually several dwelling units within each cluster. A noise and vibration prediction is made for each cluster based on the distance from the closest sensitive receptor in the cluster to the project. The predicted noise and vibration levels for these clusters are presented in the following sections. The predicted levels include: noise from light-rail trains running on both the eastbound and westbound tracks; noise from the BNSF trains and their horns at-grade crossings for the proposed relocated track positions; and, in Claremont, noise from the Metrolink trains and horns for the proposed relocated track positions.

The clusters used for assessment are addressed for each city and are labeled numerically in ascending order from west to east. Clusters north of the right-of-way are considered westbound (WB) clusters – as they are closer to the westbound tracks – and clusters south of the right-of-way are considered eastbound (EB) clusters.

3.11.6.2 Impact Criteria

Noise and vibration impacts are considered significant if the project would result in:

- Exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies
- Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels
- A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project
- A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project

Also, federal noise impact thresholds are defined in the FTA Guidance Manual. The FTA criteria are based on the best available research on community response to noise. The research shows that characterizing the overall noise environment using measures of noise "exposure" provides the best correlation with human annoyance. The FTA provides different thresholds for different land uses. Table 3.11-7 lists the three FTA land use categories and the applicable noise metric for each category.

Table 3.11-7. FTA Land Use Categories and Noise Metrics

Land Use Category	Noise Metric (dBA)	Description of Land Use Category
1	Outdoor $L_{eq}(h)$[1]	Tracts of land where a quiet environment is an essential element of their intended purpose. This category includes lands set aside for serenity and quiet and such land uses as outdoor amphitheaters and concert pavilions, as well as National Historic Landmarks with significant outdoor use. Also included are recording studios and concert halls.
2	Outdoor L_{dn}	Residences and buildings where people normally sleep. This category includes homes, hospitals, and hotels where a nighttime sensitivity to noise is assumed to be of utmost importance.
3	Outdoor $L_{eq}(h)$[1]	Institutional land uses with primarily daytime and evening use. This category includes schools, libraries, and churches, where it is important to avoid interference with such activities as speech, meditation, and concentration on reading material. Places for meditation or study associated with cemeteries, monuments, museums, campgrounds and recreational facilities can be considered to be in this category. Certain historical sites and parks are also included.

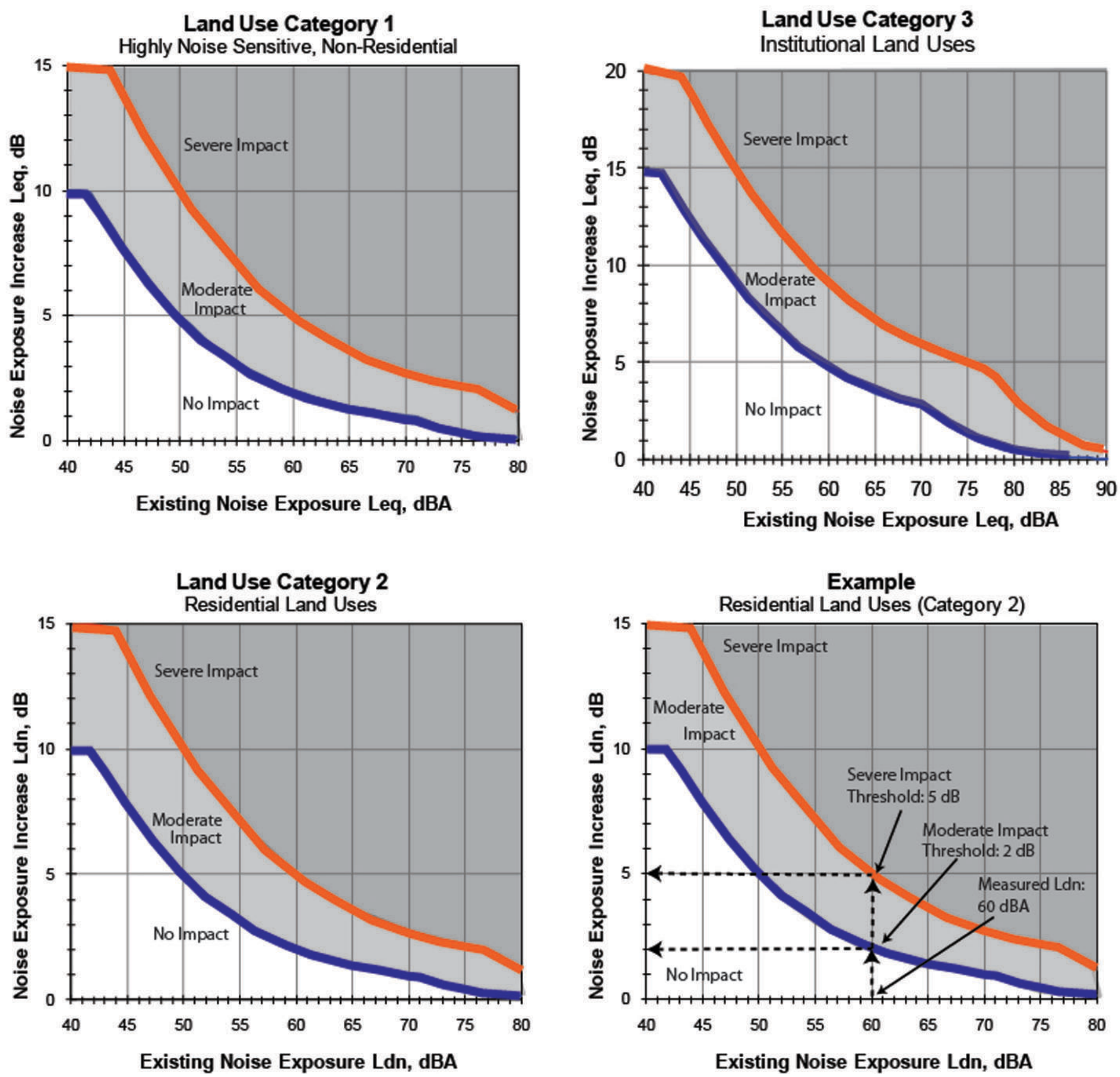
Source: FTA 2006
[1] L_{eq} for the noisiest hour of transit related activity during hours of noise sensitivity.

For Category 2 land uses (residential areas where people sleep), the noise exposure is characterized using L_{dn}. In calculating L_{dn}, noise created during the nighttime hours is more heavily weighted than daytime noise to reflect residents' greater sensitivity to noise during these hours. For Category 1 and Category 3 land uses (areas with primarily daytime use), noise exposure is characterized using the 1-hour L_{eq}, which is a time-averaged sound level over a 1-hour period.

The FTA noise impact threshold is a sliding scale based on the existing noise exposure. Noise exposure characterizes noise levels over a period of time. The basic concept of the FTA impact thresholds is that more project noise exposure is allowed in areas where existing noise exposure is higher, but the allowable increase above the existing noise exposure decreases in areas where existing noise exposure is higher. The criteria are shown graphically in Figure 3.11-5 for the three land use categories, along with an example of how the criteria are applied. The top two graphs show the Category 1 and 3 thresholds (for non-residential land uses) where L_{eq} is used. The bottom left graph shows Category 2 thresholds (residential land uses) where L_{dn} is used.

The curves in Figure 3.11-5 are defined in terms of the increase of cumulative noise over the existing noise. The cumulative noise is the combination of the existing noise and noise introduced into the area from the project. The allowable noise increase accounts for both the noise introduced from the light-rail operations and the change in noise exposure from relocating the BNSF or Metrolink tracks within the right-of-way.

The FTA defines two levels of impact: Moderate and Severe. The lower curve in Figure 3.11-5 (shown in blue) defines the threshold for a Moderate Impact, and the upper curve (shown in red) defines the threshold for Severe Impact. FTA guidance is to consider mitigation if the predicted increase in noise exposure exceeds the moderate threshold. If the predicted increase exceeds the severe threshold, FTA guidance is to include noise mitigation in the project unless there are compelling reasons why mitigation is not feasible. Both of these levels are considered significant impacts in this EIR.

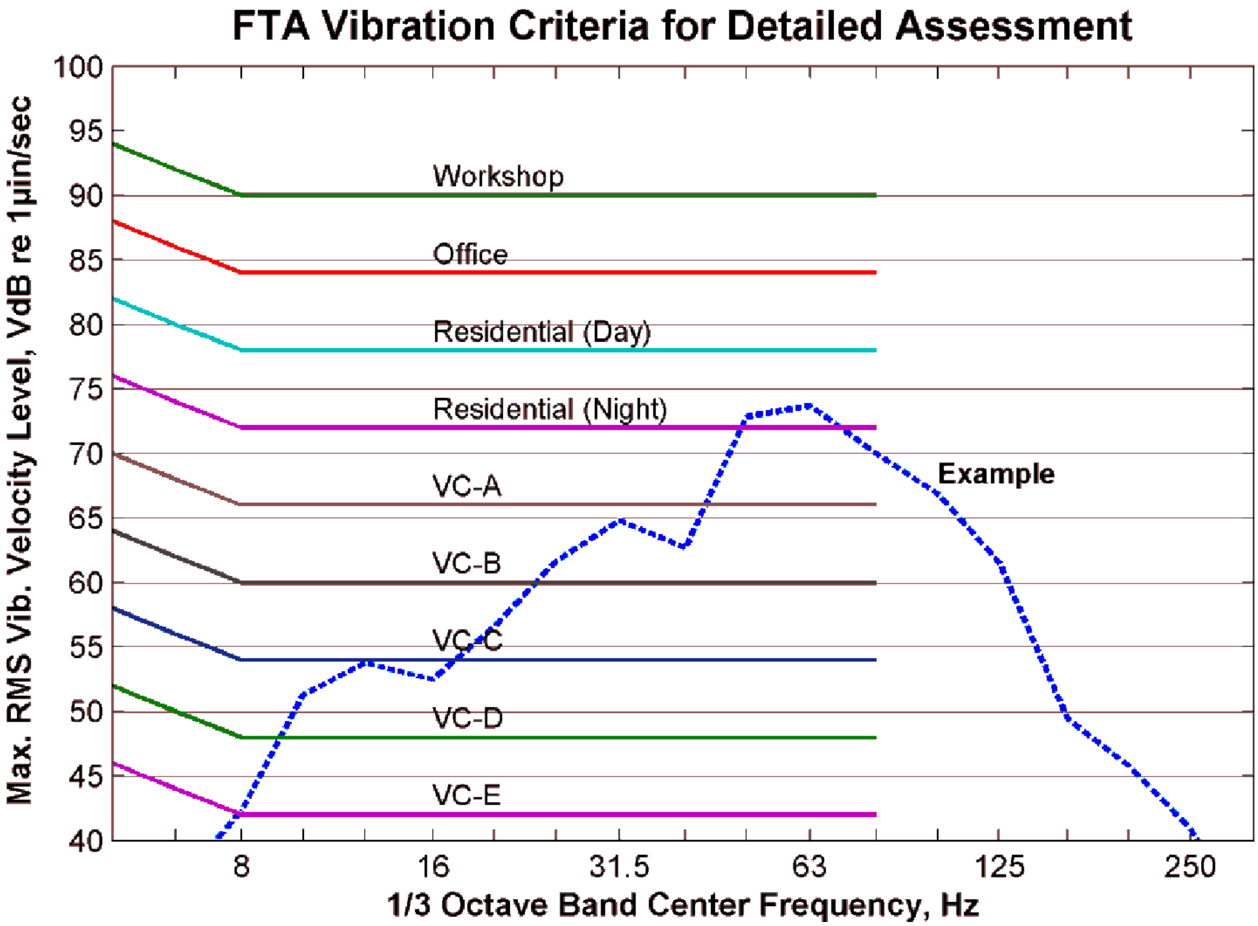


Source: ATS Consulting 2011

Figure 3.11-5. FTA Noise Impact Criteria

The FTA vibration impact criteria are based on the maximum indoor vibration level as a train passes. There are no impact criteria for outdoor spaces, such as parks, because they are not considered vibration-sensitive by the FTA. The FTA Guidance Manual provides two sets of criteria: one based on the overall vibration velocity level for use in a General Vibration Impact Assessment and one based on the maximum vibration velocity level in any one-third octave band for use with a Detailed Vibration Assessment. This study uses the Detailed Vibration Assessment criteria.

The thresholds for use with the Detailed Vibration Assessments are shown in Figure 3.11-6. The one-third octave band spectra of the predicted vibration are compared to the curves shown in Figure 3.11-6 to determine whether there is impact and the frequency range over which vibration mitigation is required. A one-third octave band is a range of frequencies. A prediction of vibration level is made for each one-third octave band, rather than for each frequency. Each one-third octave band is referred to by the center frequency in that band. Impact occurs when the predicted vibration velocity in any one-third octave band exceeds the applicable curve. Predicting vibration on a one-third octave band basis allows vibration mitigation to be designed for the frequency range in which it will be most effective. The VC-A through VC-E curves are used to specify acceptable vibration limits for sensitive equipment, such as electron microscopes.



Source: FTA 2006

Figure 3.11-6. FTA Thresholds for a Detailed Vibration Assessment

The "Residential (Night)" curve is applied to residential land uses in this study. When this curve is used, impact occurs when the predicted vibration velocity (shown on the vertical axis) exceeds 72 VdB in at least one one-third octave band (shown on the horizontal axis) between eight and 80 Hz. The use of the criteria is illustrated by the example vibration levels (the dashed blue line) shown in Figure 3.11-6. The maximum example level exceeds the "Residential (Night)" curve in the 50 and 63 Hz one-third octave bands. For this example, impact would be predicted for residential land uses and vibration mitigation would be evaluated.

The FTA vibration thresholds do not specifically account for existing vibration because it is rare that even substantial volumes of vehicular traffic, including trucks and buses, generate perceptible ground vibration unless there are irregularities in the roadway surface, such as potholes or wide expansion joints. However, it is necessary to take into account existing conditions because the project would be located in an existing rail corridor.

The project would share the right-of-way with BNSF freight traffic from Glendora through Pomona. In Claremont, the light-rail system would share the corridor with BNSF freight traffic and Metrolink (commuter rail) traffic. To accommodate two new light-rail tracks, the existing BNSF and Metrolink tracks would be relocated within the existing right-of-way. In some instances, the tracks would be relocated closer to residences, resulting in an increase in vibration levels. FTA guidance for assessing vibration impact from a relocation of existing tracks is:

- A new impact will be assessed only if the predicted vibration from the relocated tracks exceeds the FTA vibration criteria and if the relocation results in more than a three VdB increase in the vibration level.
- The criteria are meant for rail transit systems and should be applied with caution to freight rail.
- Rail lines with infrequent traffic should disregard the criteria altogether.

Because the BNSF freight traffic is infrequent (the FTA Guidance Manual suggests fewer than five trains per day as the limit for infrequent), consistent with the FTA guidance vibration impact from relocating the track in Glendora, San Dimas, La Verne, and Pomona does not merit evaluation. Metrolink service is more frequent, running approximately 36 trains per weekday. The vibration from Metrolink trains in Claremont has been evaluated. Vibration impact occurs where the predicted vibration from Metrolink trains exceeds the FTA vibration impact threshold and the relocation results in more than a 3-VdB increase over the existing vibration level.

3.11.6.3 Short-Term Construction Impacts

No Build Alternative

Under the No Build Alternative, no new infrastructure would be built within the Study Area, aside from projects currently under construction or projects funded for construction, environmentally-cleared, planned to be in operation by 2035, and identified in the Southern California Association of Governments (SCAG) *2012-2035 Regional Transportation Plan/Sustainable Communities Strategy* (RTP/SCS). Noise and vibration that would result from this alternative would be a continuation of the current Study Area levels.

Transportation Systems Management (TSM) Alternative

The TSM Alternative's rapid bus transit system would include providing new bus stops that involve minimal construction. Thus, the use of general good-practice noise control methods for construction would result in no significant noise impacts. These general noise control methods include:

- Avoiding nighttime construction
- Locating equipment and staging areas as far from noise-sensitive receivers as possible
- Limiting unnecessary idling of equipment

The TSM Alternative is unlikely to require activities resulting in groundborne vibration that approaches the vibration limits for damage for even the most fragile buildings. No adverse construction vibration impacts are identified for the TSM Alternative.

Build Alternative

Construction of the project's LRT alignment and support facilities requires the use of heavy earth-moving machinery, pneumatic tools, generators, concrete pumps, and similar standard equipment used for the LRT projects. Table 3.11-8 shows the equipment likely to be used during the noisiest periods of track construction, the typical noise generated by these pieces of equipment, the usage factors (or percent of time equipment operates under full load), and the estimated L_{eq} for an eight-hour work shift. The work-shift L_{eq} for the generic construction scenario presented in Table 3.11-8 is 84 dBA at 50 feet.

Table 3.11-8. General Construction Scenario Noise Prediction

Equipment	Sound Level at 50 feet Under Load	Usage Factor (Percentage of Time under Full Load)	Leq (8-hour Workshift)
Earthmover (bulldozer, front-end loader, etc.)	82 dBA	40%	78 dBA
Mobile Crane	81 dBA	20%	74 dBA
Dump Truck	76 dBA	40%	72 dBA
Pneumatic Tools	85 dBA	30%	80 dBA
Generator	78 dBA	40%	74 dBA
Compressor	81 dBA	40%	77 dBA
Combined L_{eq}			**84 dBA**

Source: Federal Highway Administration, 2006.

The FTA Guidance Manual provides guidance on appropriate impact thresholds for construction noise, but it states that the limits should not be considered "standardized criteria." The manual recommends a reasonable threshold for construction noise as an eight-hour L_{eq} of 80 dBA at residential land uses.

Based on the predicted construction activities generating a work-shift L_{eq} of 84 dBA at 50 feet, construction noise is likely to exceed the 80 dBA L_{eq} impact threshold in areas near residences at some location. Significant construction noise impacts are likely and, therefore, noise control measures when working near residences would be required.

In compliance with the Construction Authority's policy, construction of the project would conform to the noise requirements of each City. These requirements generally limit construction activities to daytime hours and certain days of the week (e.g., construction is often precluded on Sundays and national holidays without a variance from the local jurisdiction). Some local noise requirements may also include equipment or property line limits.

Limiting construction activities to weekday daytime hours (typically from 7 a.m. to 6 p.m.) and employing typical measures for minimizing noise during construction requirement, combined with the mitigation described in Section 3.11.5, would mitigate construction impacts to a *less than significant* level.

Construction Vibration

Some activities, such as pile driving, pavement breaking, and the use of tracked vehicles (e.g., bulldozers), could result in perceptible levels of groundborne vibration. However, these activities would be limited in duration, and associated vibration levels would likely be well below thresholds for minor cosmetic building damage. Typical vibration levels at which damage occurs are shown in Table 3.11-9. Planned construction would include a limited number of activities expected to generate vibration that approaches the lowest level in Table 3.11-9; none of those activities will be performed close enough to structures to approach that level. Therefore, no special mitigation measures are required to avoid vibration impact during construction.

Table 3.11-9. Vibration Velocity Levels at Which Building Damage Occurs

Building Type	PPV[1] (in/sec)	Source
Typical Modern Construction	2.0	Building of Mines Bulletin 656, 1971
Extremely fragile buildings	0.2	FTA, 2006
Historic and ancient buildings	0.12	German Standard DIN 4150

Source: Federal Highway Administration. 2006. FHWA Roadway Construction Noise Model User's Guide
[1] Peak particle velocity

The noise and vibration control plan would include measures to minimize vibration impacts during construction.

3.11.7 Long-term Impacts

There are no Category 1 land uses within the Study Area (Category 1 land uses are tracts of land where quiet is an essential element of their intended purpose, such as concert halls). Therefore, there are no long-term impacts to Category 1 land uses under any alternative.

No Build Alternative

Noise from motor vehicles traveling on the existing surface road network dominates the Study Area noise environment. The traffic study for the project suggests that because traffic-carrying capacity is already at or near saturation, there is almost no opportunity for any substantial increase in traffic volumes on the existing network. Any slight traffic volume increase would be accompanied by vehicle speeds being reduced, thus the net effect on Ldn is neutral with a slight bias toward a non-perceptible (<1 dBA) traffic noise increase, if any change at all. The No Build Alternative would not result in an adverse noise impact.

There would be no operational vibration associated with the No Build Alternative, and thus no associated vibration impacts.

Transportation Systems Management (TSM) Alternative

The TSM Alternative is a rapid bus system. Although the number of buses per day would increase within the Study Area, the relative change in the overall number of buses is small compared to the large existing and future volumes of automobiles and trucks using the area's local and regional highways. Thus, the effect on the noise environment would be minimal and likely would not be perceptible (<1 dBA) on an L_{dn} basis. The TSM Alternative would result in no impact.

There would be no operational vibration associated with the TSM Alternative and, therefore, no vibration impacts.

Build Alternative

The evaluation of the Build Alternative project's long-term noise and vibration impacts represents a "worst case" scenario based on the train maximum design speeds of up to 65 miles per hour. Trains operating at high speeds would result in high predicted noise and vibration levels, while trains operating at lower speeds would result in lower predicted noise and vibration levels.

City of Glendora

In the City of Glendora, the light-rail tracks run in the northern portion of the right-of-way, closer to the westbound clusters (clusters north of the right-of-way). The predicted noise levels are presented in Table 3.11-10. Moderate noise impacts are predicted at clusters WB1 through 1d and WB3a, and severe noise impacts are predicted at clusters WB2 and WB4 through WB20. The severe impacts are a result of relatively low existing noise levels and the short distances between the tracks and the residences. Moderate impacts are predicted at clusters EB6 through EB8, EB10, and EB11; and severe impacts are predicted at clusters EB1 through EB5a and EB9. The eastbound clusters also have relatively low existing noise levels and short distances between the proposed tracks and residences. In some cases, the predicted impact is due to the increase in freight train and horn noise levels that would result from relocating the BNSF tracks closer to eastbound clusters.

The highest predicted noise level is at clusters WB14 and WB15. The higher predicted noise level at these clusters is due to a crossover that would be located adjacent to the clusters; crossovers increase the levels of LRT noise by approximately six dB.

The predicted vibration levels are presented in Table 3.11-11. Vibration impacts are predicted at clusters WB2, WB4 through WB20, EB1 through EB5, EB7, and EB9 through EB12. Vibration impact is predicted at 236 dwelling units in Glendora. Impacts are identified at the majority of clusters in Glendora because the tracks are located relatively close to residences, and the vibration propagation tests showed relatively efficient vibration propagation (meaning vibration levels remain higher over a longer distance). The clusters where impact is predicted are a mix of multi- and single-family residences and include one hotel (20th Century Motor Lodge, cluster EB9).

Table 3.11-10. Glendora—Predicted Noise Levels for Residential (Category 2) Land Uses

Cluster Number[1]	Cross Streets	Direction	Distance (feet)[2]	Train Speed (mph)	Existing Ldn (dBA)	Predicted Ldn (dBA)	Threshold[3]		Impact	Number of Impacts[4]
							Moderate	Severe		
Westbound										
WB1	Citrus Ave/Barranca Ave	North	156	65	55	58.8	3.2	7.1	Moderate	—
WB1a	Barranca Ave/Grand Ave	North	162	65	55	59.4	3.2	7.1	Moderate	—
WB1b	Barranca Ave/Grand Ave	North	156	65	55	58.5	3.2	7.1	Moderate	—
WB1c	Barranca Ave/Grand Ave	North	150	65	55	58.6	3.2	7.1	Moderate	—
WB1d	Barranca Ave/Grand Ave	North	114	65	55	61.1	3.2	7.1	Moderate	5
WB2	Grand Ave/Carroll Ave	North	54	65	58	64.1	2.4	5.8	Severe	5
WB3	Carroll Ave/Vermont Ave	North	198	65	58	57.5	2.4	5.8	--	—
WB3a[5]	Vermont Ave/Glendora Ave	North	95	55	58	61.9	2.4	5.8	Moderate	19
WB4	Glendora Ave/Pasadena Ave	North	34	55	56	66.1	2.9	6.6	Severe	12
WB5	Glendora Ave/Pasadena Ave	North	22	55	56	67.3	2.9	6.6	Severe	8
WB6	Pasadena Ave/Glenwood Ave	North	12	65	56	70.4	2.9	6.6	Severe	20
WB7	Pasadena Ave/Glenwood Ave	North	28	65	56	66.9	2.9	6.6	Severe	20
WB8	Pasadena Ave/Glenwood Ave	North	34	65	56	67.0	2.9	6.6	Severe	9
WB9	Glenwood Ave/Elwood Ave	North	30	65	56	67.4	2.9	6.6	Severe	4
WB10	Glenwood Ave/Elwood Ave	North	34	65	56	67.0	2.9	6.6	Severe	4
WB11	Elwood Ave/Lorraine Ave	North	16	65	56	69.5	2.9	6.6	Severe	5
WB12	Elwood Ave/Lorraine Ave	North	50	65	56	64.6	2.9	6.6	Severe	6
WB13	Elwood Ave/Lorraine Ave	North	46	65	56	66.0	2.9	6.6	Severe	4
WB14	Lorraine Ave/Route 66	North	46	65	56	71.1	2.9	6.6	Severe	6
WB15	Lorraine Ave/Route 66	North	44	65	56	71.0	2.9	6.6	Severe	7
WB16	Lorraine Ave/Route 66	North	52	65	58	64.7	2.4	5.8	Severe	12
WB17	Lorraine Ave/Route 66	North	50	65	58	64.9	2.4	5.8	Severe	5

Cluster Number[1]	Cross Streets	Direction	Distance (feet)[2]	Train Speed (mph)	Existing Ldn (dBA)	Predicted Ldn (dBA)	Threshold[3]		Impact	Number of Impacts[4]
							Moderate	Severe		
WB18	Lorraine Ave/Route 66	North	44	65	58	65.6	2.4	5.8	Severe	7
WB19	Route 66/210 Fway	North	50	65	58	64.9	2.4	5.8	Severe	17
WB20	Route 66/210 Fway	North	54	65	58	64.5	2.4	5.8	Severe	10
Eastbound										
EB1	Citrus Ave/Barranca Ave	South	66	65	55	63.2	3.2	7.1	Severe	26
EB2	Citrus Ave/Barranca Ave	South	50	65	55	64.9	3.2	7.1	Severe	11
EB3	Citrus Ave/Barranca Ave	South	68	65	55	66.6	3.2	7.1	Severe	6
EB4	Barranca Ave/Grand Ave	South	54	65	55	68.9	3.2	7.1	Severe	5
EB5	Barranca Ave/Valencia St	South	58	65	55	64.0	3.2	7.1	Severe	7
EB5a[5]	Valencia St/Grand Ave	South	75	65	55	65.6	3.2	7.1	Severe	13
EB6	Ada Ave/Vermont Ave	South	110	45	58	61.1	2.4	5.8	Moderate	—
EB7	Pasadena Ave/Glenwood Ave	South	86	65	56	61.6	2.9	6.6	Moderate	4
EB8	Pasadena Ave/Glenwood Ave	South	112	65	56	60.1	2.9	6.6	Moderate	—
EB9	Lorraine Ave/Route 66	South	52	65	58	65.0	2.4	5.8	Severe	6
EB10	Route 66/210 Freeway	South	94	65	58	61.8	2.4	5.8	Moderate	—
EB11	Route 66/210 Freeway	South	84	65	58	62.4	2.4	5.8	Moderate	4
EB12	Lone Hill Ave/Gladstone St	South	94	65	64	65.5	1.5	3.9	—	—
Total Moderate Impacts										**76**
Total Severe Impacts										**235**

Source: ATS Consulting 2011

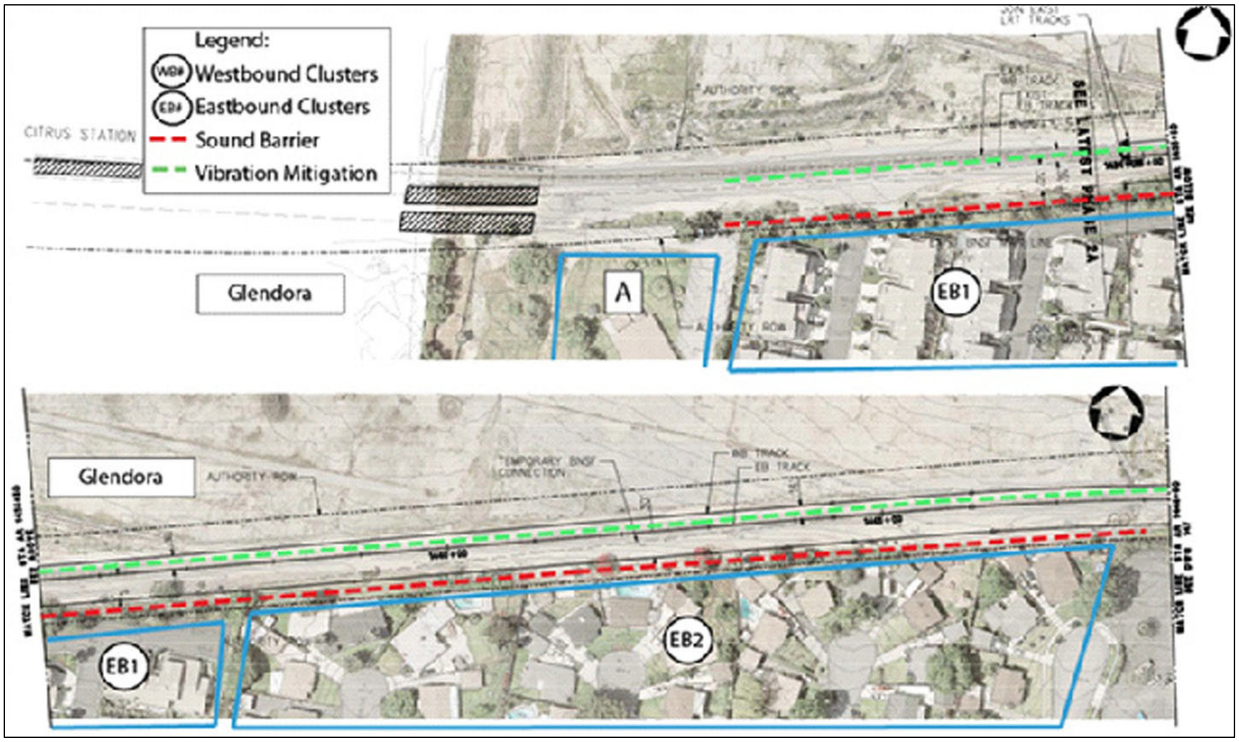
[1] The cluster numbers correspond to the labels in Figure 3.11–7 through Figure 3.11–15. The clusters are labeled from west to east in ascending order. Westbound (WB) clusters are located north of the right-of-way and Eastbound (EB) clusters are located south of the right-of-way.
[2] The distance in feet from the closest sensitive receptor in the cluster to the nearest proposed light-rail track.
[3] The threshold is the allowable increase in noise from the existing L_{dn}. The FTA designates two threshold levels: moderate and severe.
[4] Number of dwelling units in the cluster.
[5] This cluster is a proposed development.

Table 3.11-11. City of Glendora—Predicted Vibration Levels for Residential (Category 2) Land Uses

Cluster Number[1]	Cross Streets	Direction	Distance (feet)[2]	Train Speed (mph)	Threshold (VdB)	Predicted Band Max. (VdB)[3]	1/3 Octave Band (Hz)[4]	Impact	Number of Impacts[5]
Westbound									
WB1	Citrus Ave/Barranca Ave	North	156	65	72	68	31.5	—	—
WB1a	Barranca Ave/Grand Ave	North	162	65	72	68	31.5	—	—
WB1b	Barranca Ave/Grand Ave	North	156	65	72	68	31.5	—	
WB1c	Barranca Ave/Grand Ave	North	150	65	72	69	31.5	—	—
WB1d	Barranca Ave/Grand Ave	North	114	65	72	71	31.5	—	—
WB2	Grand Ave/Carroll Ave	North	54	65	72	76	50.0	Yes	5
WB3	Carroll Ave/Vermont Ave	North	198	65	72	67	31.5	—	—
WB3a[6]	Vermont Ave/Glendora Ave	North	95	55	72	71	31.5	—	—
WB4	Glendora Ave/Pasadena Ave	North	34	55	72	81	50.0	Yes	12
WB5	Glendora Ave/Pasadena Ave	North	22	55	72	87	50.0	Yes	8
WB6	Pasadena Ave/Glenwood Ave	North	12	65	72	96	50.0	Yes	20
WB7	Pasadena Ave/Glenwood Ave	North	28	65	72	85	50.0	Yes	20
WB8	Pasadena Ave/Glenwood Ave	North	34	65	72	82	50.0	Yes	9
WB9	Glenwood Ave/Elwood Ave	North	30	65	72	84	50.0	Yes	4
WB10	Glenwood Ave/Elwood Ave	North	34	65	72	82	50.0	Yes	4
WB11	Elwood Ave/Lorraine Ave	North	16	65	72	93	50.0	Yes	5
WB12	Elwood Ave/Lorraine Ave	North	50	65	72	77	50.0	Yes	6
WB13	Elwood Ave/Lorraine Ave	North	46	65	72	78	50.0	Yes	4
WB14	Lorraine Ave/Route 66	North	46	65	72	88	50.0	Yes	6
WB15	Lorraine Ave/Route 66	North	44	65	72	89	50.0	Yes	7
WB16	Lorraine Ave/Route 66	North	52	65	72	77	50.0	Yes	12
WB17	Lorraine Ave/Route 66	North	50	65	72	77	50.0	Yes	5
WB18	Lorraine Ave/Route 66	North	44	65	72	79	50.0	Yes	7
WB19	Route 66/210 Freeway	North	50	65	72	77	50.0	Yes	17
WB20	Route 66/210 Freeway	North	54	65	72	76	50.0	Yes	10

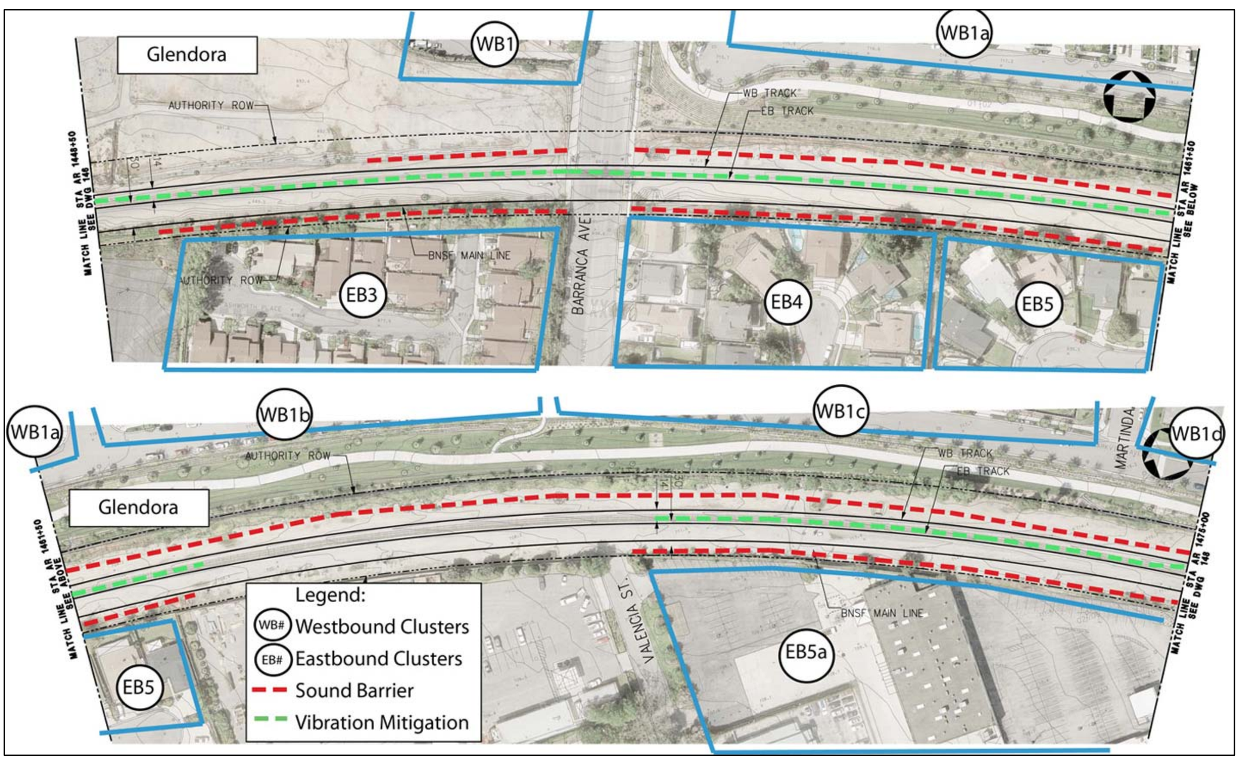
Cluster Number[1]	Cross Streets	Direction	Distance (feet)[2]	Train Speed (mph)	Threshold (VdB)	Predicted Band Max. (VdB)[3]	1/3 Octave Band (Hz)[4]	Impact	Number of Impacts[5]
Eastbound									
EB1	Citrus Ave/Barranca Ave	South	66	65	72	74	31.5	Yes	26
EB2	Citrus Ave/Barranca Ave	South	50	65	72	77	50.0	Yes	11
EB3	Citrus Ave/Barranca Ave	South	68	65	72	74	31.5	Yes	6
EB4	Barranca Ave/Grand Ave	South	54	65	72	76	50.0	Yes	5
EB5	Barranca Ave/Valencia St	South	58	65	72	75	31.5	Yes	7
EB5a[6]	Valencia St/Grand Ave	South	75	65	72	74	31.5	Yes	13
EB6	Ada Ave/Vermont Ave	South	110	45	72	68	31.5	—	—
EB7	Pasadena Ave/Glenwood Ave	South	86	65	72	73	31.5	Yes	4
EB8	Pasadena Ave/Glenwood Ave	South	112	65	72	71	31.5	—	—
EB9	Lorraine Ave/Route 66	South	52	65	72	77	50.0	Yes	6
EB10	Route 66/210 Freeway	South	94	65	72	72	31.5	Yes	4
EB11	Route 66/210 Freeway	South	84	65	72	73	31.5	Yes	4
EB12	Lone Hill Ave/Gladstone St	South	94	65	72	72	31.5	Yes	2
Total Impacts in Glendora:				**249**					

Source: ATS Consulting 2011
[1] The cluster numbers correspond to the labels in Figure 3.11–7 through Figure 3.11–15. The clusters are labeled from west to east in ascending order. Westbound (WB) clusters are located north of the right-of-way and Eastbound (EB) clusters are located south of the right-of-way.
[2] The distance in feet from the closest sensitive receptor in the cluster to the nearest proposed light-rail track.
[3] Maximum predicted vibration level in any one-third octave band.
[4] The one-third octave band in which the highest predicted vibration level occurs.
[5] Number of dwelling units in the cluster.
[6] This cluster is a proposed development.



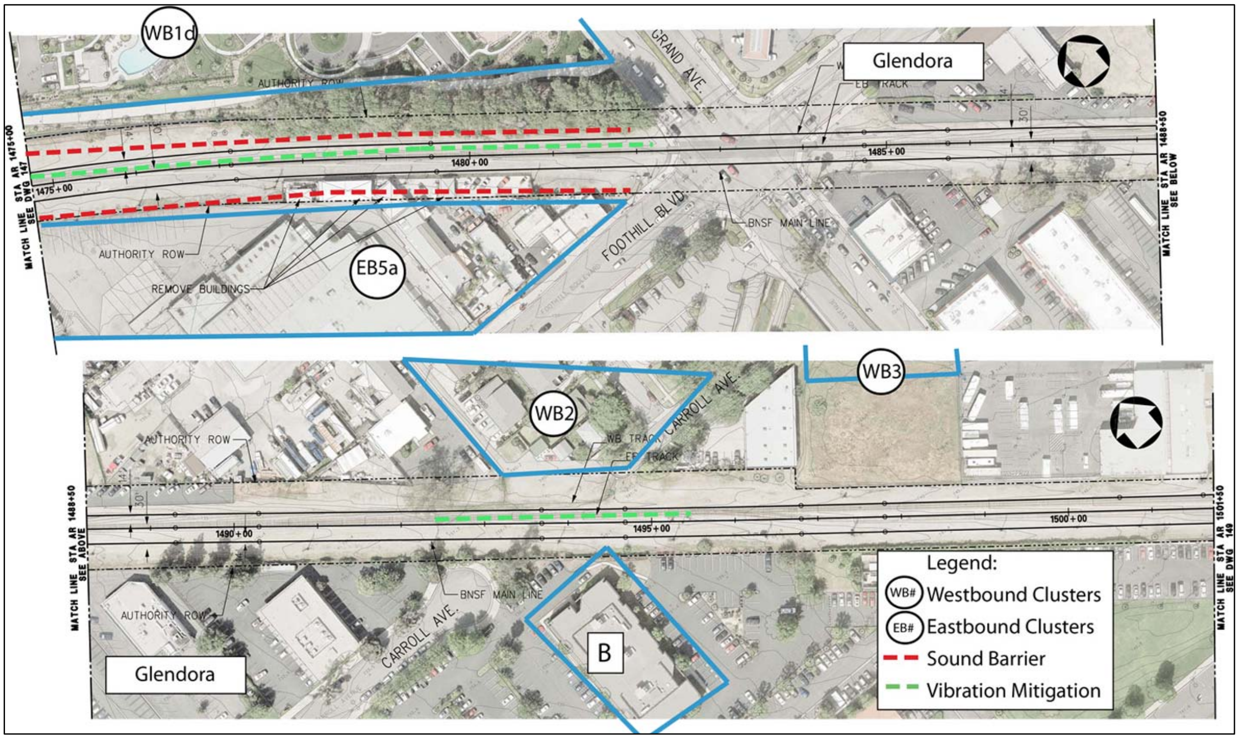
Source: ATS Consulting 2011

Figure 3.11–7. Glendora—Clusters EB 1–2



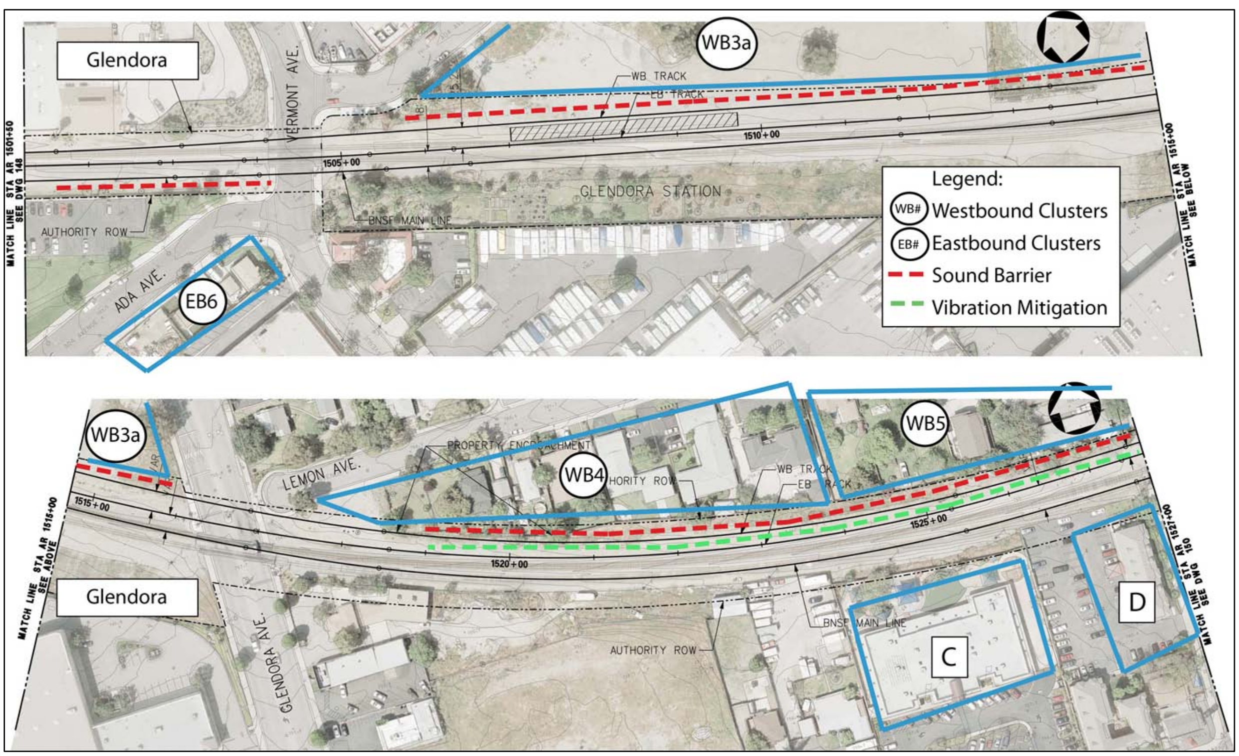
Source: ATS Consulting 2011

Figure 3.11–8. Glendora—Clusters WB 1–1d, EB 3–5a



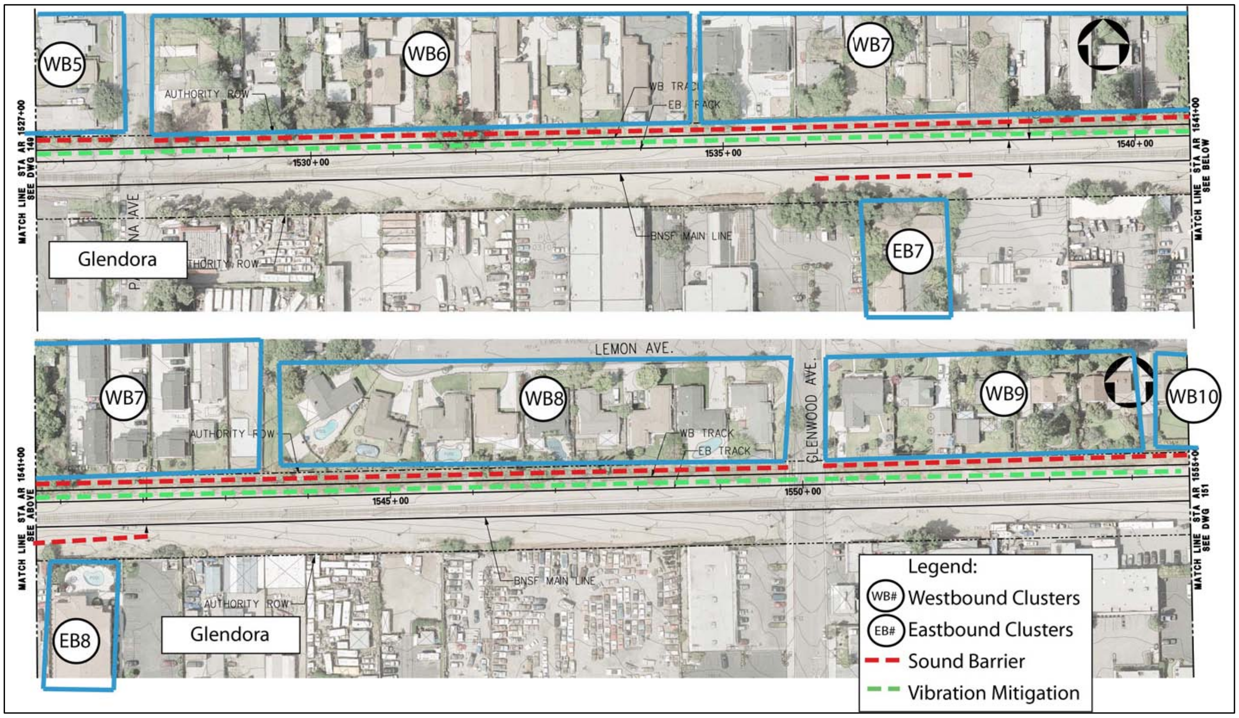
Source: ATS Consulting 2011

Figure 3.11–9. Glendora—Clusters WB 1d–3, EB 5a



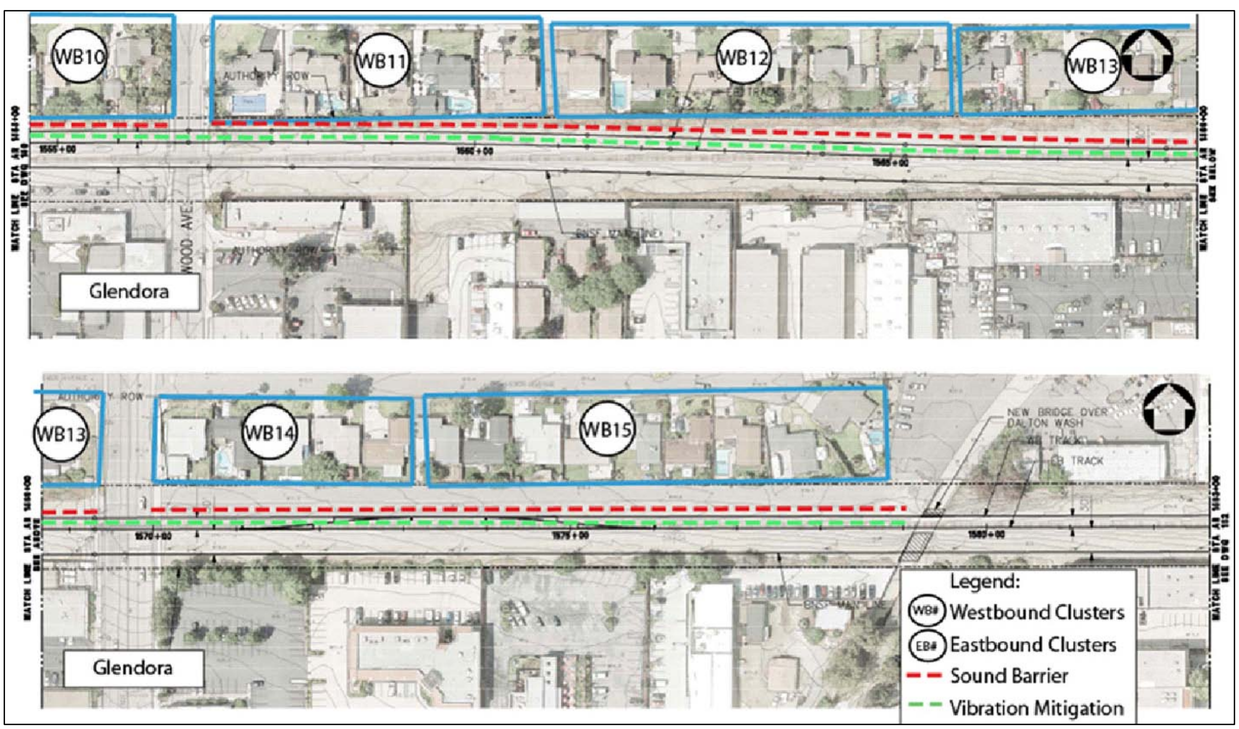
Source: ATS Consulting 2011

Figure 3.11–10. Glendora—Clusters WB 4–5, EB 6



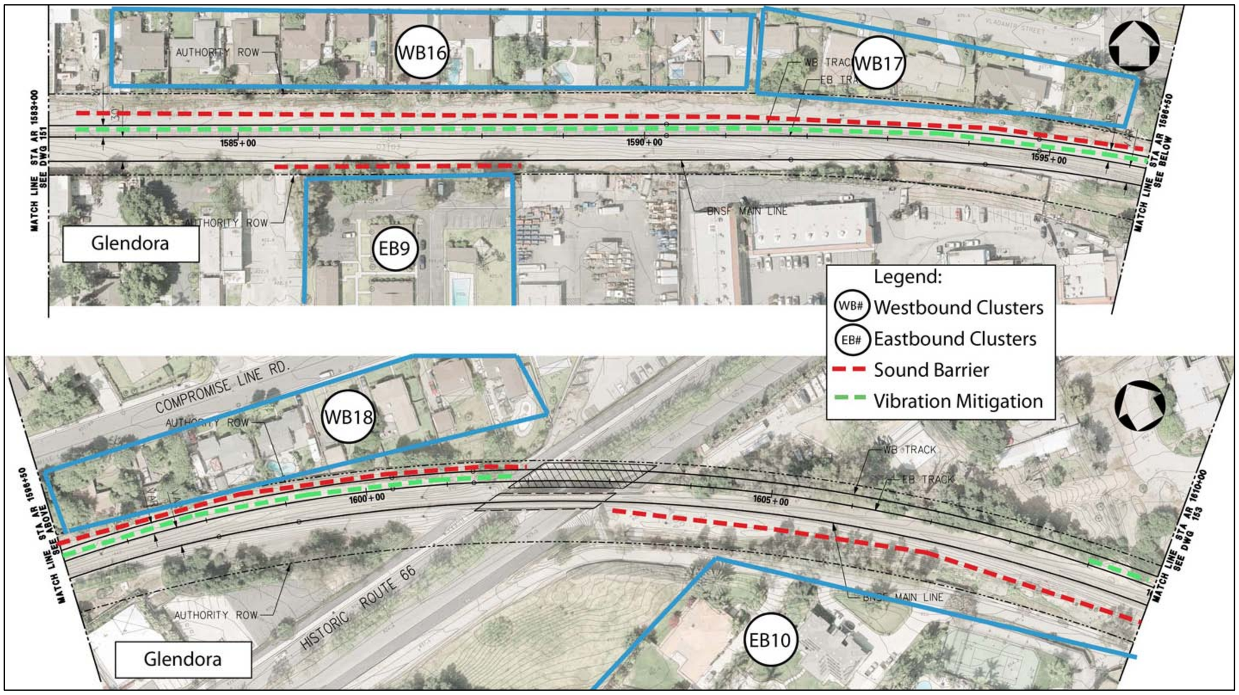
Source: ATS Consulting 2011

Figure 3.11–11. Glendora—Clusters WB 5–10, EB 7–8



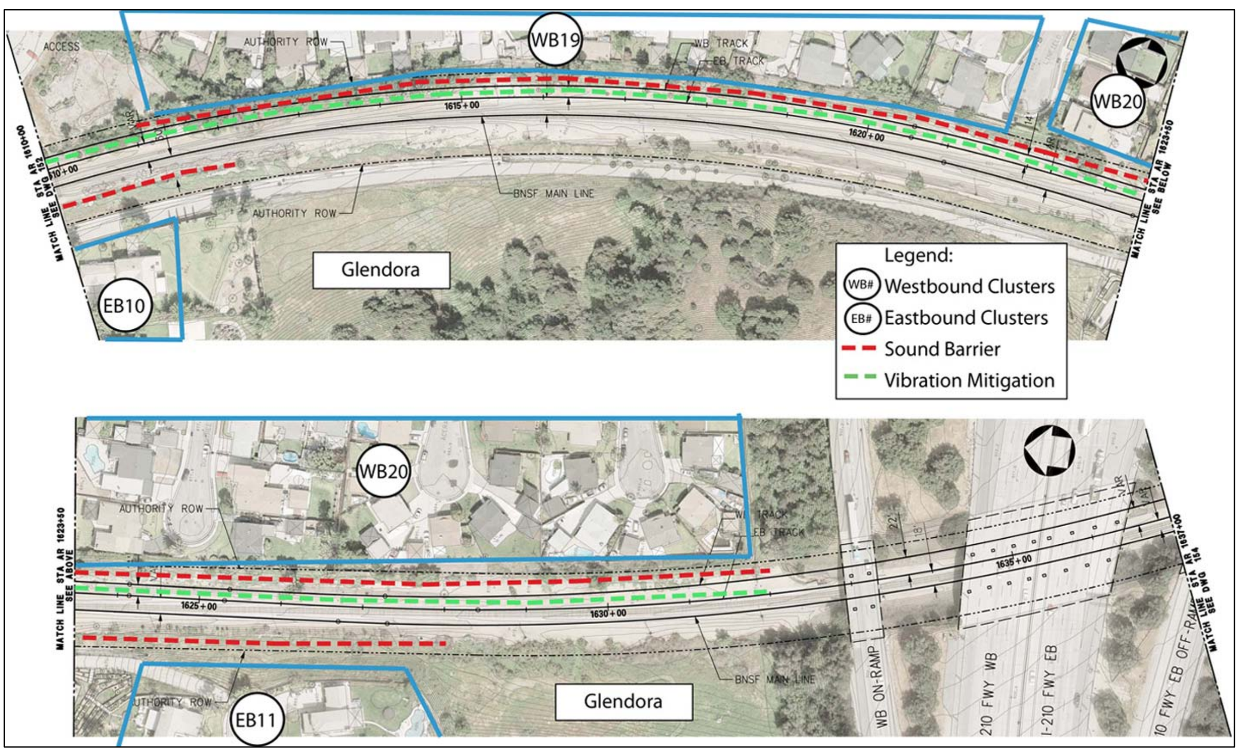
Source: ATS Consulting 2011

Figure 3.11–12. Glendora—Clusters WB 10–15



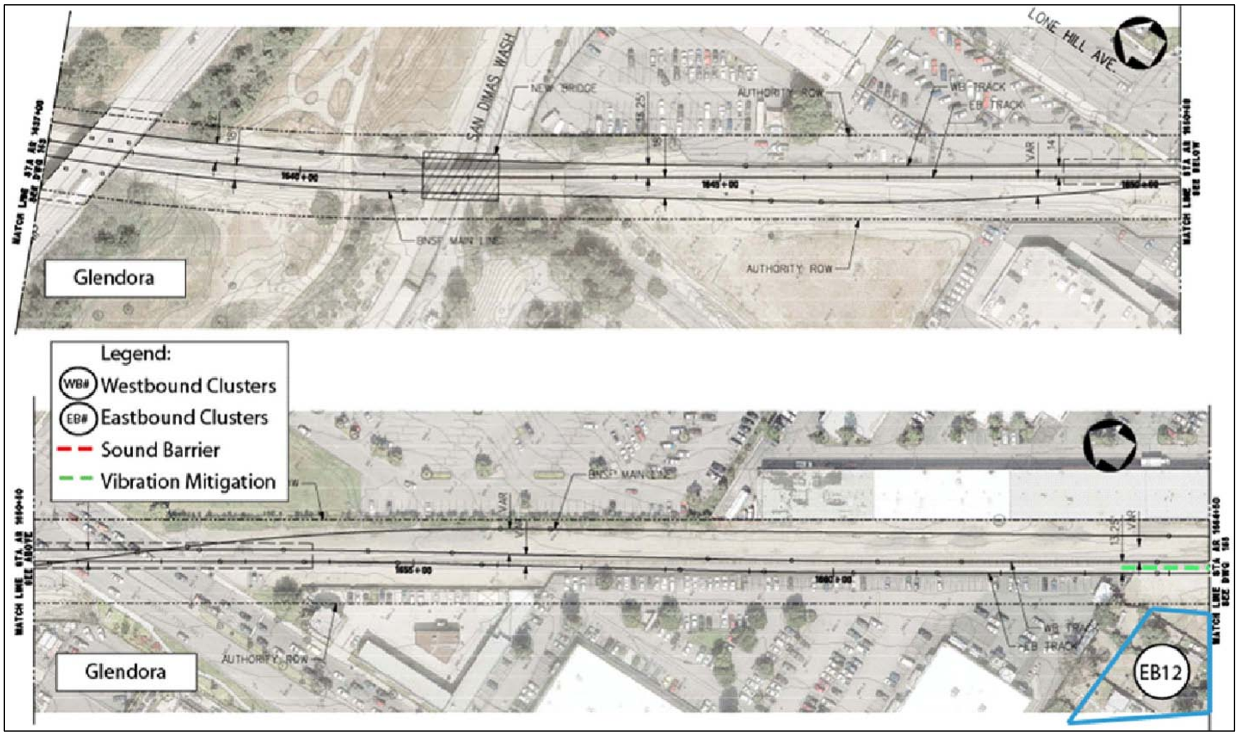
Source: ATS Consulting 2011

Figure 3.11–13. Glendora—Clusters WB 16–18, EB 9–10



Source: ATS Consulting 2011

Figure 3.11–14. Glendora—Clusters WB 19–20, EB 11



Source: ATS Consulting 2011

Figure 3.11–15. Glendora—Cluster EB 12

City of San Dimas

The light-rail tracks in the City of San Dimas run in the southern portion of the right-of-way, closer to the eastbound clusters. The predicted noise levels are presented in Table 3.11-12. Severe noise impact is predicted at clusters WB1 and EB1 (Red Roof Inn). The primary noise source at cluster WB1 is horn noise from the BNSF trains. The BNSF tracks would be located closer to residences along the westbound (north) side of the right-of-way in San Dimas, increasing the horn noise at those residences. Cluster EB1 is located on the edge of the right-of-way, only 14 feet from the eastbound light-rail track. Moderate noise impact is predicted at clusters WB2, WB3, WB7, WB8, EB3 and EB3a.

The predicted vibration levels are presented in Table 3.11-13. Vibration impacts are predicted at cluster EB1 (Red Roof Inn) and cluster WB1 (one single-family residence). Both clusters are within 50 feet of the light-rail tracks, which would result in high vibration levels.

Table 3.11-12. City of San Dimas—Predicted Noise Levels for Residential (Category 2) Land Uses

Cluster Number[1]	Cross Streets	Direction	Distance (feet)[2]	Train Speed (mph)	Existing L_{dn} (dBA)	Predicted L_{dn} (dBA)	Threshold[3]		Impact	Number of Impacts[4]
							Moderate	Severe		
Westbound										
WB1	Gladstone Street/57 Freeway	North	50	65	64	69.3	1.5	3.9	Severe	3
WB2	57 Freeway/Amelia Avenue	North	56	65	64	66.8	1.5	3.9	Moderate	3
WB3	57 Freeway/Amelia Avenue	North	76	65	60	63.5	2.0	5.0	Moderate	3
WB4	57 Freeway/Amelia Avenue	North	176	65	60	60.7	2.0	5.0	—	—
WB5	San Dimas Avenue/Walnut Avenue	North	76	45	65	65.2	1.5	3.9	—	—
WB6	San Dimas Ave/Walnut Avenue	North	94	65	64[5]	64.9	1.5	3.9	—	—
WB7	Walnut Avenue/ San Dimas Canyon Road	North	104	65	61[5]	63.8	1.9	4.7	Moderate	5
WB8	Walnut Avenue/ San Dimas Canyon Road	North	122	65	60[5]	62.9	2.0	5.0	Moderate	5
Eastbound										
EB1	57 Freeway/Amelia Avenue	South	14	65	60	69.6	2.0	5.0	Severe	20
EB2	Amelia Avenue/Eucla Avenue	South	142	65	60	61.3	2.0	5.0	—	—
EB3	Amelia Avenue/Eucla Avenue	South	82	65	60	64.0	2.0	5.0	Moderate	8
EB3a	Cataract Avenue/Monte Vista Avenue	South	86	55	60	63.1	2.0	5.0	Moderate	5
Total Moderate Impacts									**29**	
Total Severe Impacts									**23**	

Source: ATS Consulting 2011

[1] The cluster numbers correspond to the labels in Figure 3.11–16 through Figure 3.11–19. The clusters are labeled from west to east in ascending order. Westbound (WB) clusters are located north of the right-of-way and Eastbound (EB) clusters are located south of the right-of-way.

[2] The distance in feet from the closest sensitive receptor in the cluster to the closest proposed light-rail track.

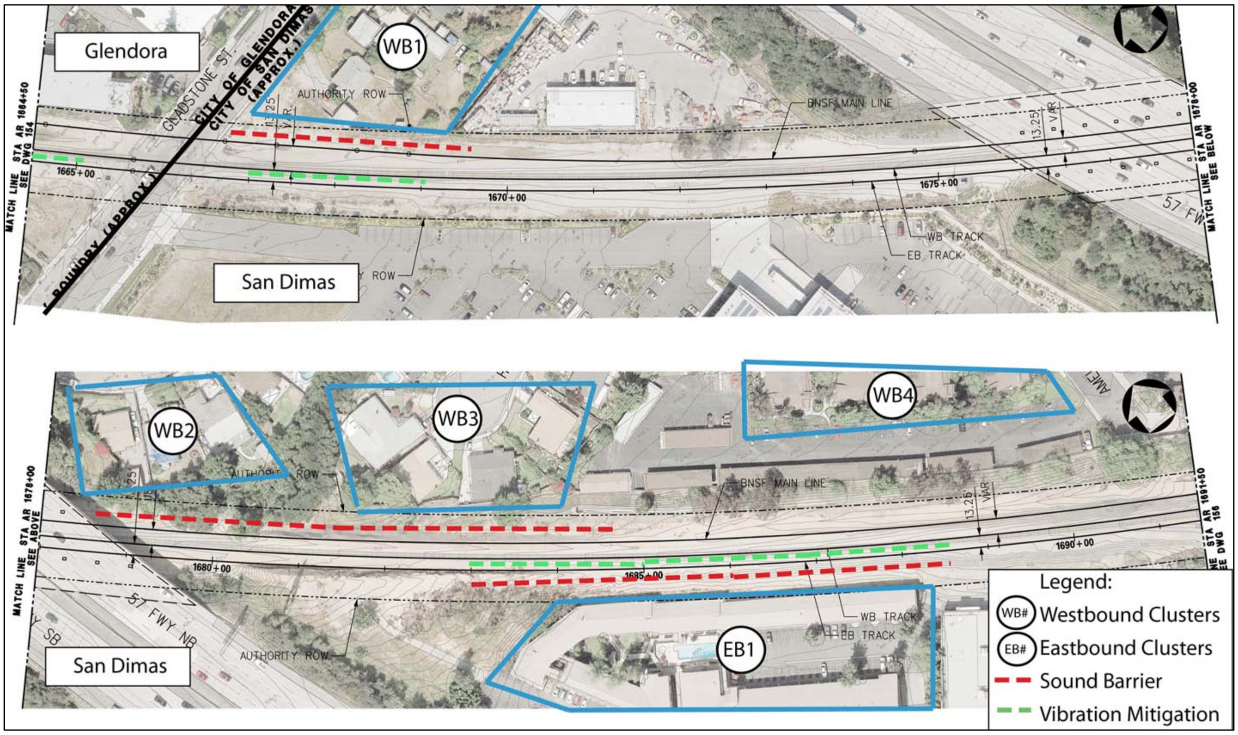
[3] The threshold is the allowable increase in noise from the existing L_{dn}. The FTA designates two threshold levels: moderate and severe.

[4] Number of dwelling units in the cluster.

Table 3.11-13. City of San Dimas—Predicted Vibration Levels for Residential (Category 2) Land Uses

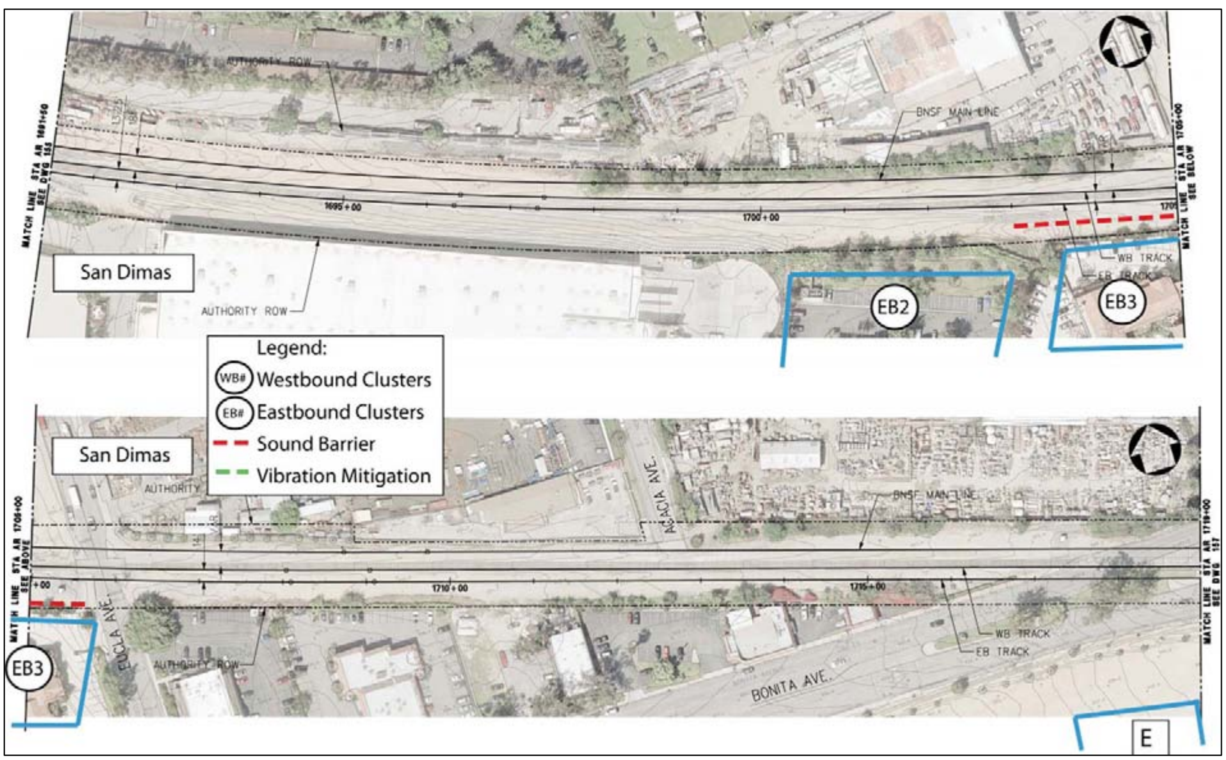
Cluster Number[1]	Cross Streets	Direction	Distance (feet)[2]	Train Speed (mph)	Threshold (VdB)	Predicted Band Max (VdB)[3]	1/3 Octave Band, (Hz)[4]	Impact	Number of Impacts[5]
Westbound									
WB1	Gladstone Street/57 Freeway	North	50	65	72	73	31.5	Yes	3
WB2	57 Freeway/Amelia Avenue	North	56	65	72	71	31.5	—	—
WB3	57 Freeway/Amelia Avenue	North	76	65	72	66	31.5	—	—
WB4	57 Freeway/Amelia Avenue	North	176	65	72	55	12.5	—	—
WB5	San Dimas Avenue/Walnut Avenue	North	76	45	72	63	31.5	—	—
WB6	San Dimas Avenue/Walnut Ave	North	94	65	72	62	31.5	—	—
WB7	Walnut Avenue/San Dimas Canyon Road	North	104	65	72	61	31.5	—	—
WB8	Walnut Avenue/San Dimas Canyon Road	North	122	65	72	58	31.5	—	—
Eastbound									
EB1	57 Freeway/Amelia Avenue	South	14	65	72	96	63	Yes	20
EB2	Amelia Avenue/Eucla Avenue	South	142	65	72	56	12.5	—	—
EB3	Amelia Avenue/Eucla Avenue	South	82	65	72	65	31.5	—	—
EB3a	Cataract Avenue/Monte Vista Avenue	South	86	55	72	62	31.5	—	—
Total Impacts									**23**

Source: ATS Consulting 2011
[1] The cluster numbers correspond to the labels in Figure 3.11–16 through Figure 3.11–19. The clusters are labeled from west to east in ascending order. Westbound (WB) clusters are located north of the right-of-way and Eastbound (EB) clusters are located south of the right-of-way.
[2] The distance in feet from the closest sensitive receptor in the cluster to the closest proposed light-rail track.
[3] Maximum predicted vibration level in any one-third octave band.
[4] The one-third octave band in which the highest predicted vibration level occurs.
[5] Number of dwelling units in the cluster.



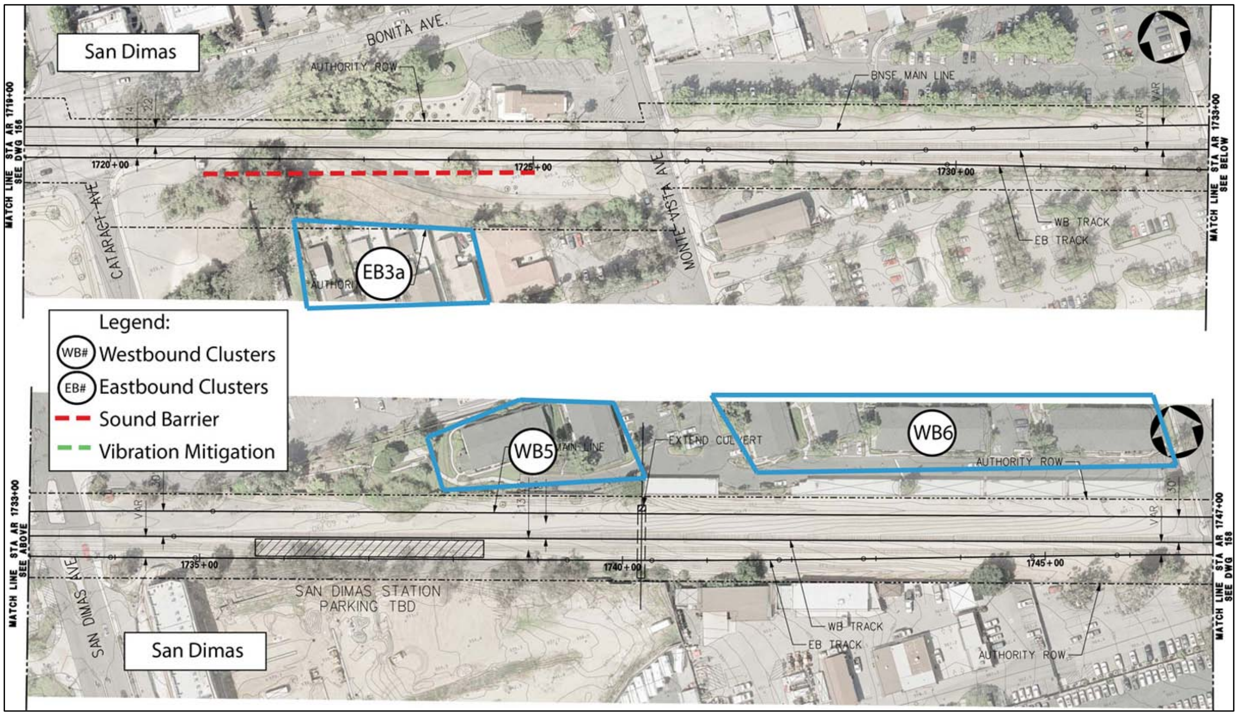
Source: ATS Consulting 2011

Figure 3.11–16. San Dimas—Clusters WB 1–4, EB 1



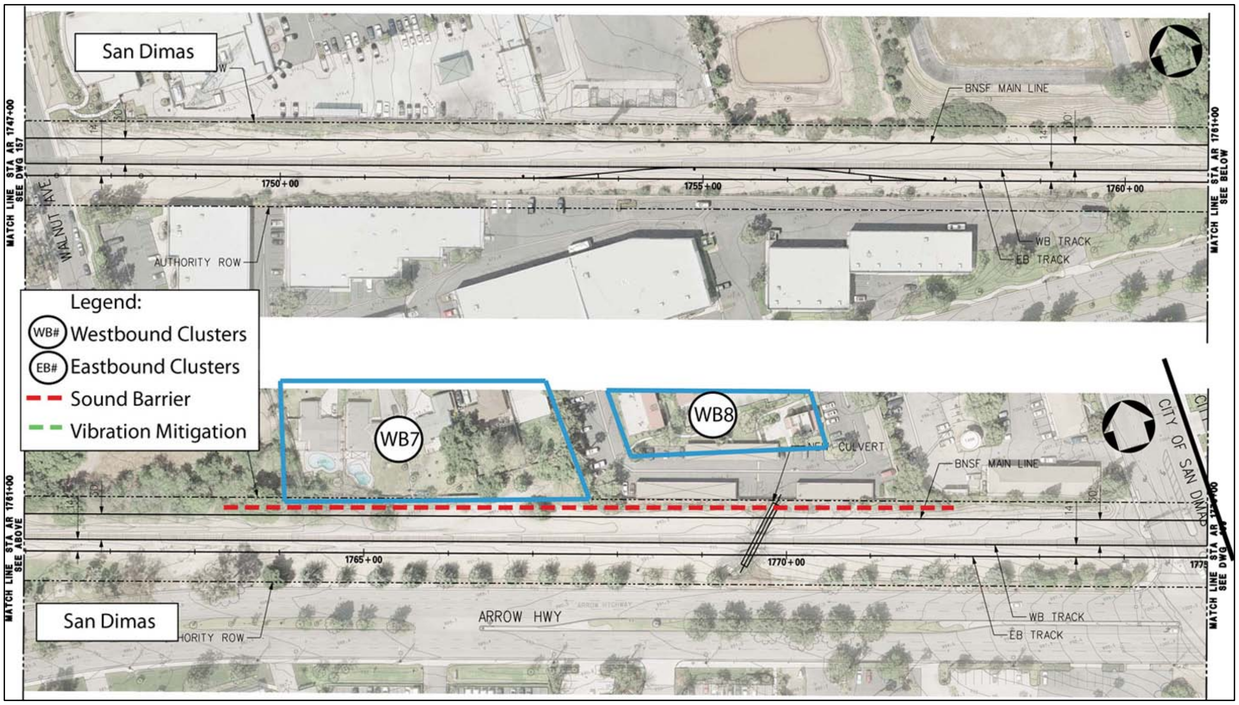
Source: ATS Consulting 2011

Figure 3.11–17. San Dimas—Clusters EB 2–3



Source: ATS Consulting 2011

Figure 3.11–18. San Dimas—Clusters WB 5–6, EB 3a



Source: ATS Consulting 2011

Figure 3.11–19. San Dimas—Clusters WB 7–8

City of La Verne

The light-rail tracks in the City of La Verne would be located in the southern portion of the right-of-way, closer to the eastbound clusters, and the BNSF track would be in the northern portion of the right-of-way. The noise predictions are presented in Table 3.11-14. Moderate impact is predicted at clusters WB2 through WB8. The light-rail tracks will be within 100 feet of the residences.

The vibration predictions are presented in Table 3.11-15. No significant vibration impact is predicted in La Verne. Predicted vibration levels are below the impact threshold because most residences would be at least 70 feet from the light-rail tracks and the vibration testing showed that vibration propagation is relatively inefficient (vibration levels decrease relatively quickly) in La Verne.

Table 3.11-14. City of La Verne—Predicted Noise Levels for Residential (Category 2) Land Uses

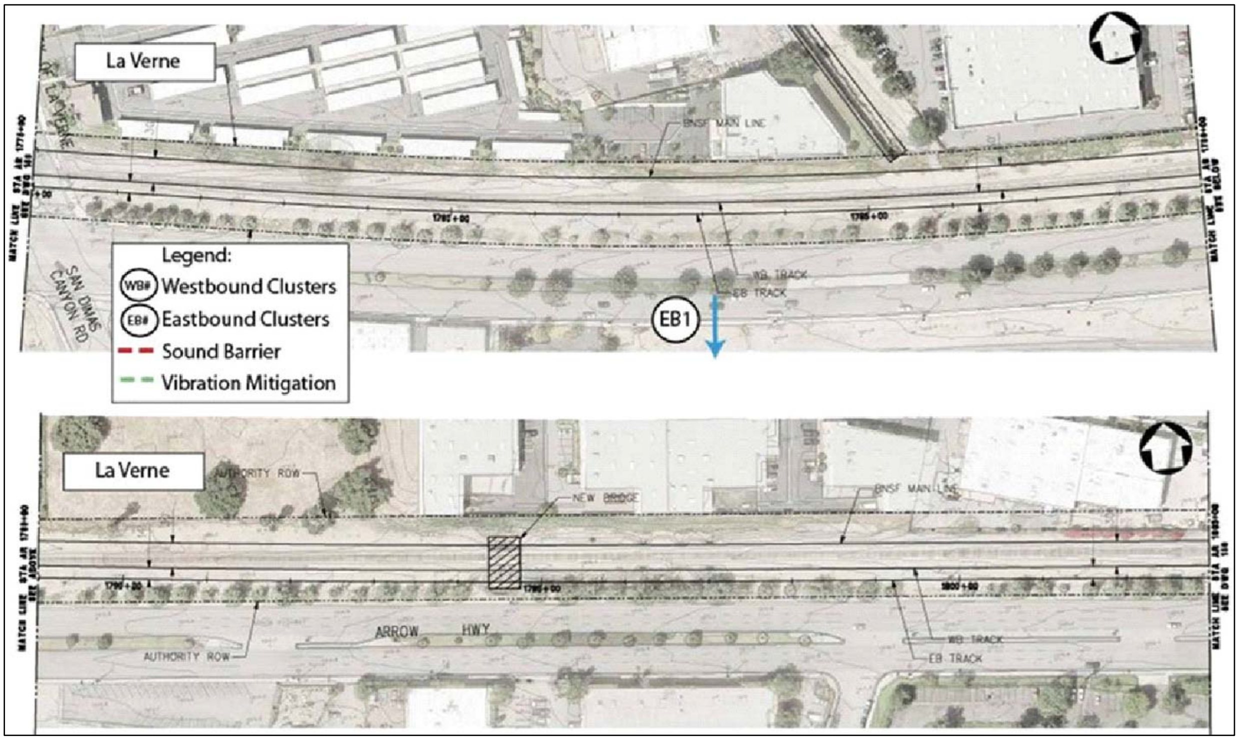
Cluster Number[1]	Cross Streets	Direction	Distance (feet)[2]	Speed (mph)	Existing L_{dn} (dBA)[3]	Predicted L_{dn} (dBA)	Threshold[4]		Impact	Number of Impacts[5]
							Moderate	Severe		
Westbound										
WB1	San Dimas Canyon Road/ Wheeler Avenue	North	142	65	60	62.0	2.0	5.0	—	—
WB2	Wheeler Avenue/Park Avenue	North	80	65	63	65.0	1.6	4.1	Moderate	5
WB3	Wheeler Avenue/Park Avenue	North	86	65	62	65.0	1.7	4.4	Moderate	5
WB4	Park Avenue/A Street	North	74	65	63	65.4	1.6	4.1	Moderate	8
WB5	A Street/B Street	North	76	65	62	65.3	1.7	4.4	Moderate	5
WB6	A Street/B Street	North	78	65	62	65.1	1.7	4.4	Moderate	4
WB7	D Street/E Street	North	98	65	62	63.8	1.7	4.4	Moderate	6
WB8	E Street/White Avenue	North	80	65	60	62.0	2.0	5.0	Moderate	5
Eastbound										
EB1	San Dimas Canyon Road/ Wheeler Avenue	South	204	65	58.9	59.7	2.2	5.4	—	—
EB2	White Avenue/Fulton Avenue	South	240	55	59	61.1	2.2	5.4	—	—
EB3	White Avenue/Fulton Avenue	South	128	65	60	61.0	2.0	5.0	—	—
EB4	White Ave/Fulton Ave	South	132	65	60	61.7	2.0	5.0	—	—
Total Moderate Impacts										**33**
Total Severe Impacts										**0**

Source: ATS Consulting 2011
[1]The cluster numbers correspond to the labels in Figure 3.11–20 through Figure 3.11–24. The clusters are labeled from west to east in ascending order. Westbound (WB) clusters are located north of the right-of-way and Eastbound (EB) clusters are located south of the right-of-way.
[2] The distance in feet from the closest sensitive receptor in the cluster to the closest proposed light-rail track.
[3] The dominant noise source in the existing L_{dn} was the BNSF horn noise. The measured existing noise level was adjusted for each cluster to account for the distance from the cluster to the existing BNSF track.
[4] The threshold is the allowable increase in noise from the existing L_{dn}. The FTA designates two threshold levels: moderate and severe.
[5] Number of dwelling units in the cluster.

Table 3.11-15. City of La Verne—Predicted Vibration Levels for Residential (Category 2) Land Uses

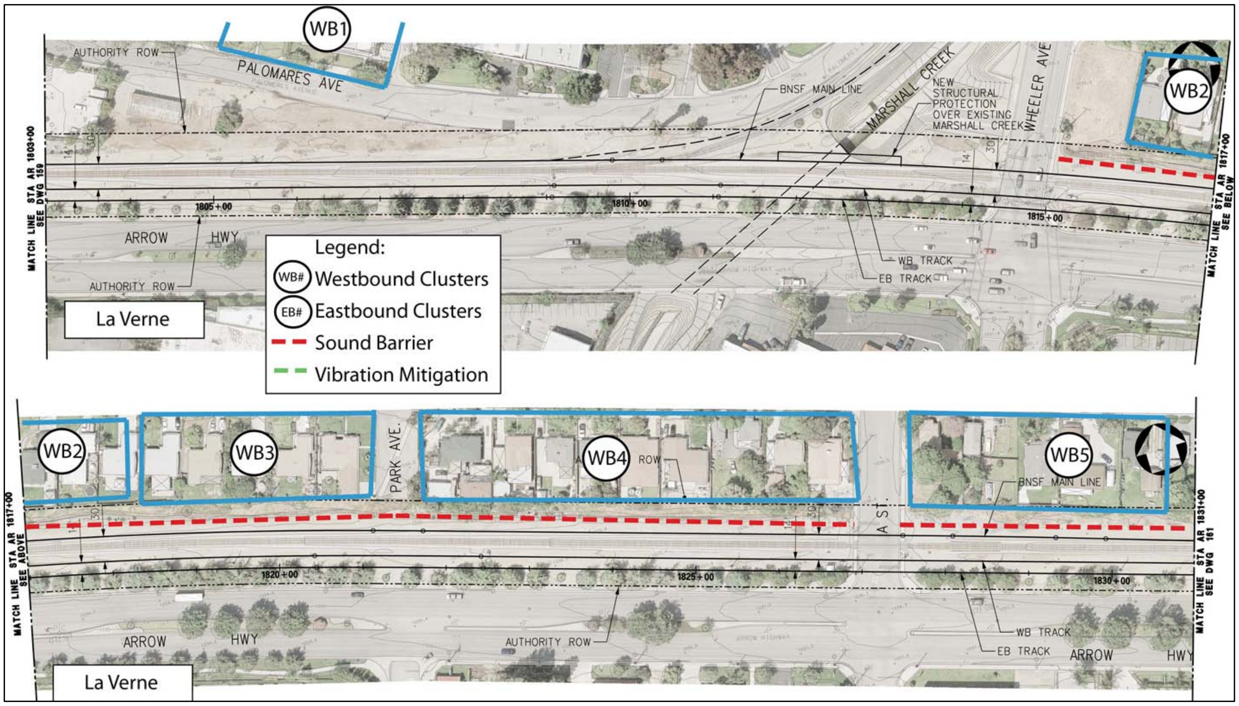
Cluster Number[1]	Cross Streets	Direction	Distance (feet[2]	Train Speed (mph)	Threshold (VdB)	Predicted Band Max (VdB)[3]	1/3 Octave Band (Hz)[4]	Impact	Number of Impacts[5]
Westbound									
WB1	San Dimas Canyon Road/ Wheeler Avenue	North	142	65	72	56	12.5	—	—
WB2	Wheeler Avenue/Park Avenue	North	80	65	72	65	31.5	—	—
WB3	Wheeler Avenue/Park Avenue	North	86	65	72	64	31.5	—	—
WB4	Park Avenue/A Street	North	74	65	72	66	31.5	—	—
WB5	A Street/B Street	North	76	65	72	66	31.5	—	—
WB6	A Street/B Street	North	78	65	72	65	31.5	—	—
WB7	D Street/E Street	North	98	65	72	62	31.5	—	—
WB8	E Street/White Avenue	North	80	65	72	65	31.5	—	—
Eastbound									
EB1	San Dimas Canyon Road/ Wheeler Avenue	South	204	65	72	54	12.5	—	—
EB2	White Avenue/Fulton Avenue	South	240	55	72	61	12.5	—	—
EB3	White Avenue/Fulton Avenue	South	128	65	72	57	31.5	—	—
EB4	White Avenue/Fulton Avenue	South	132	65	72	57	31.5	—	—
Total Impacts									**0**

Source: ATS Consulting 2011
[1] The cluster numbers correspond to the labels in Figure 3.11–20 through Figure 3.11–24. The clusters are labeled from west to east in ascending order. Westbound (WB) clusters are located north of the right-of-way and Eastbound (EB) clusters are located south of the right-of-way.
[2] The distance in feet from the closest sensitive receptor in the cluster to the closest proposed light-rail track.
[3] Maximum predicted vibration level in any one-third octave band.
[4] The one-third octave band in which the highest predicted vibration level occurs.
[5] Number of dwelling units in the cluster.



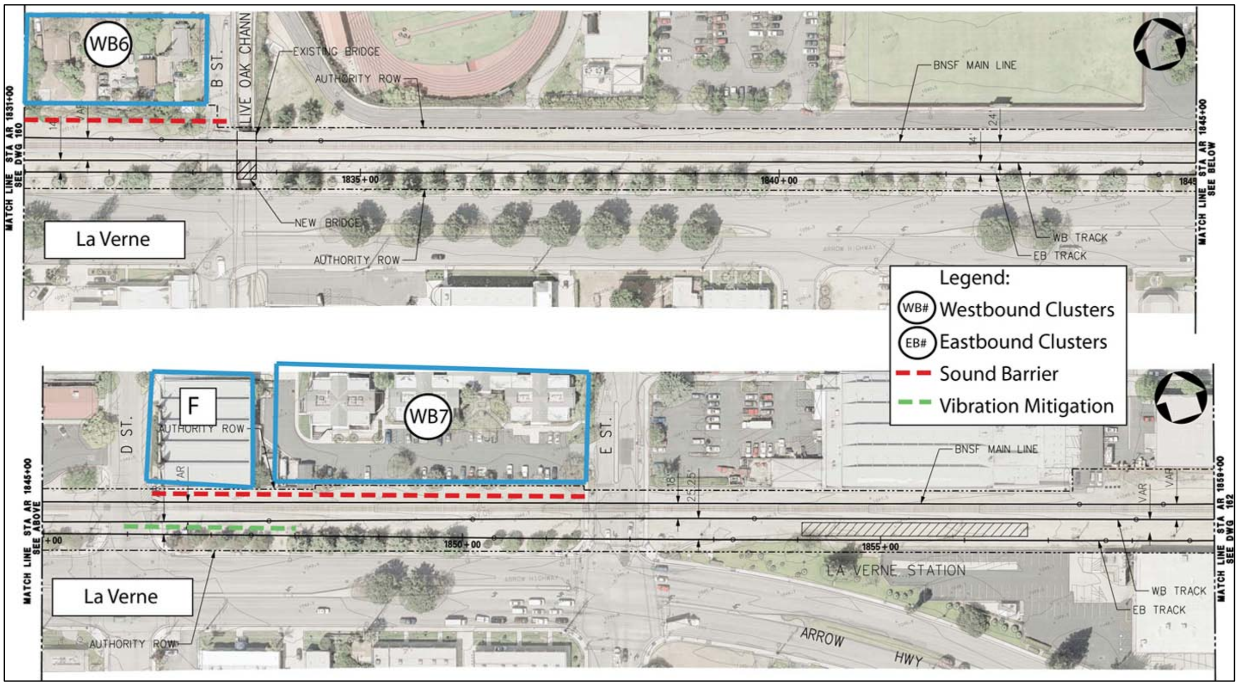
Source: ATS Consulting 2011

Figure 3.11–20. La Verne—Cluster EB 1



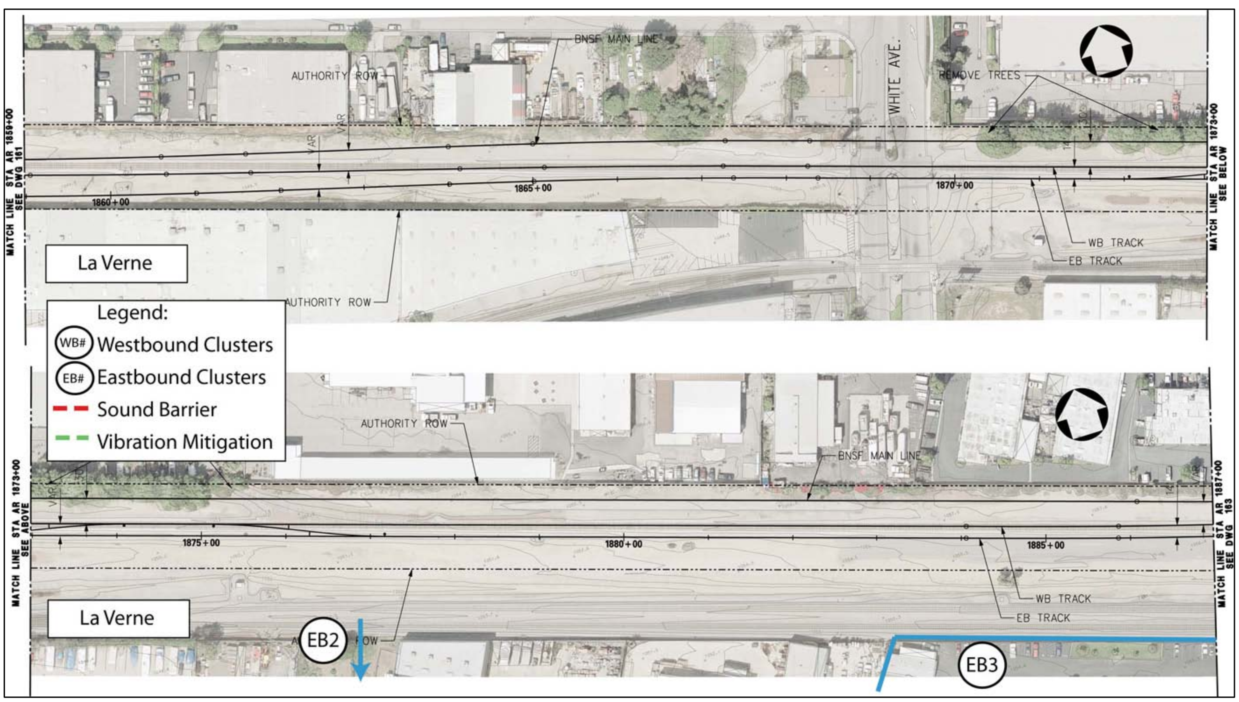
Source: ATS Consulting 2011

Figure 3.11–21. La Verne—Clusters WB 1–5



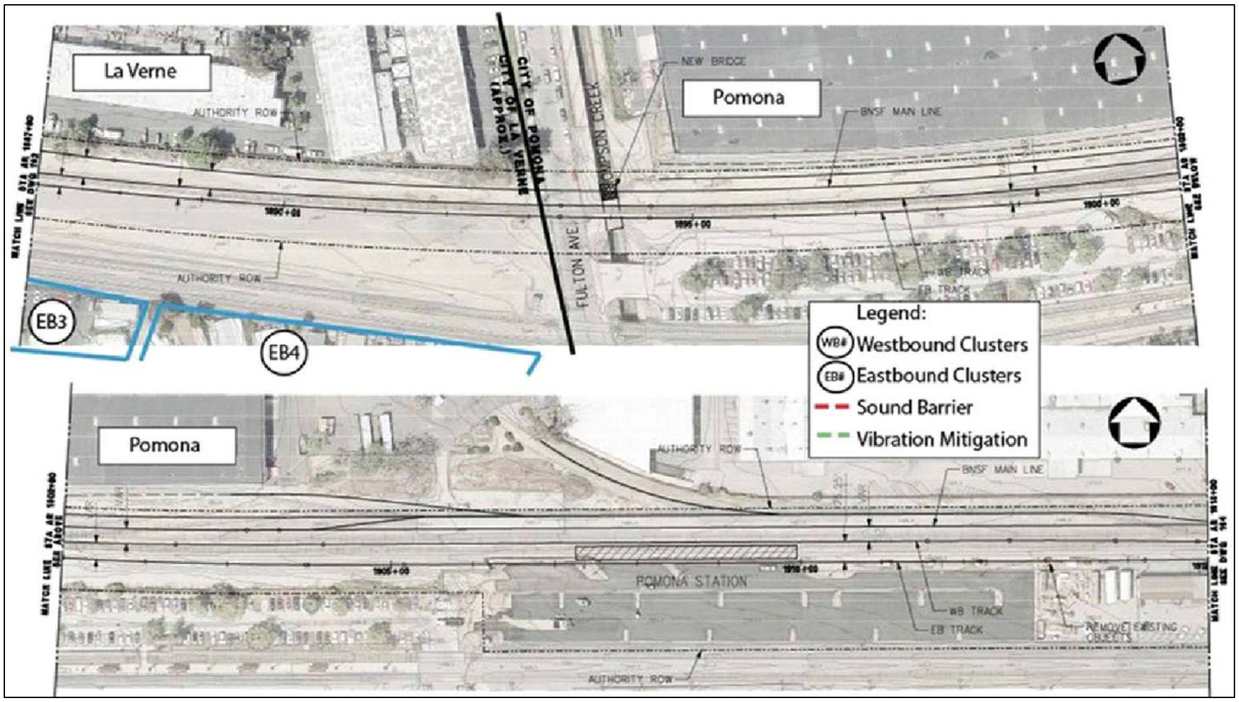
Source: ATS Consulting 2011

Figure 3.11–22. La Verne—Clusters WB 6–7



Source: ATS Consulting 2011

Figure 3.11–23. La Verne—Clusters WB 8, EB 2–3



Source: ATS Consulting 2011

Figure 3.11–24. La Verne—Clusters EB 3–4

City of Pomona

There is a proposed flyover at Towne Avenue in the City of Pomona, moving the light-rail tracks to the north side of the right-of-way. All of the noise-sensitive receptors in Pomona are located east of Towne Avenue. The noise predictions are presented in Table 3.11-16. Moderate noise impact is predicted at cluster WB2, which is 62 feet from proposed location of the nearest light-rail track. Existing noise levels in Pomona are relatively high. The dominant existing noise sources in the area are local vehicular traffic and noise from Metrolink commuter trains operating on tracks just south of the project right-of-way.

Vibration predictions are presented in Table 3.11-17. Vibration impact is predicted at cluster WB2, a multi-family residence at the Pomona/Claremont city boundaries.

Table 3.11-16. City of Pomona—Predicted Noise Levels for Residential (Category 2) Land Uses

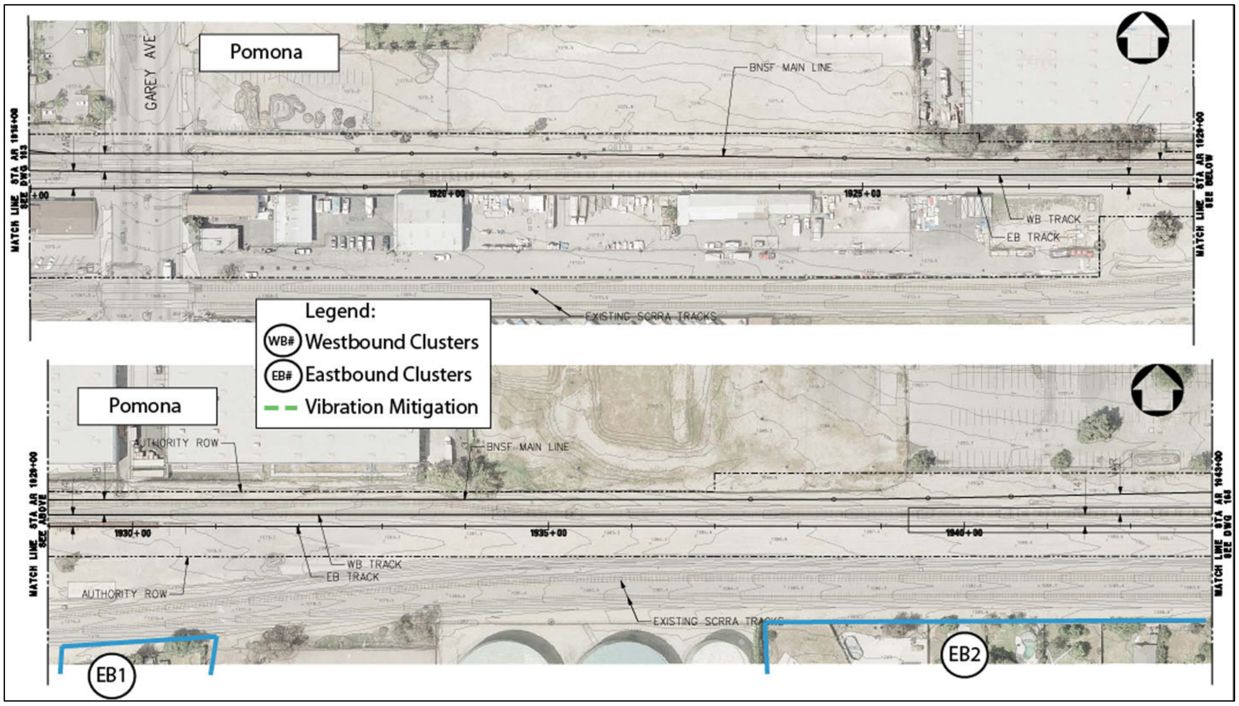
Cluster Number[1]	Cross Streets	Direction	Distance (feet)[2]	Train Speed (mph)	Existing L_{dn} (dBA)	Predicted L_{dn} (dBA)	Threshold[3]		Impact	Number of Impacts[4]
							Moderate	Severe		
Westbound										
WB1	Towne Avenue/Cambridge Avenue	North	84	65	62	63.0	1.7	4.4	—	—
WB2	Towne Avenue/Cambridge Avenue	North	64	65	62	65.3	1.7	4.4	Moderate	6
Eastbound										
EB1	Garey Avenue/Towne Avenue	South	164	65	62	63.5	1.7	4.4	—	—
EB2	Garey Avenue/Towne Avenue	South	130	65	62	63.1	1.7	4.4	—	—
EB3	Towne Avenue/Cambridge Avenue	South	218	65	62	62.7	1.7	4.4	—	—
Total Moderate Impacts										**6**
Total Severe Impacts										**0**

Source: ATS Consulting 2011
[1] The cluster numbers correspond to the labels in Figure 3.11–25 and Figure 3.11–26. The clusters are labeled from west to east in ascending order. Westbound (WB) clusters are located north of the right-of-way and Eastbound (EB) clusters are located south of the right-of-way.
[2] The distance in feet from the closest sensitive receptor in the cluster to the closest proposed light-rail track.
[3] The threshold is the allowable increase in noise from the existing L_{dn}. The FTA designates two threshold levels: moderate and severe.
[4] Number of dwelling units in the cluster.

Table 3.11-17. City of Pomona—Predicted Vibration Levels for Residential (Category 2) Land Uses

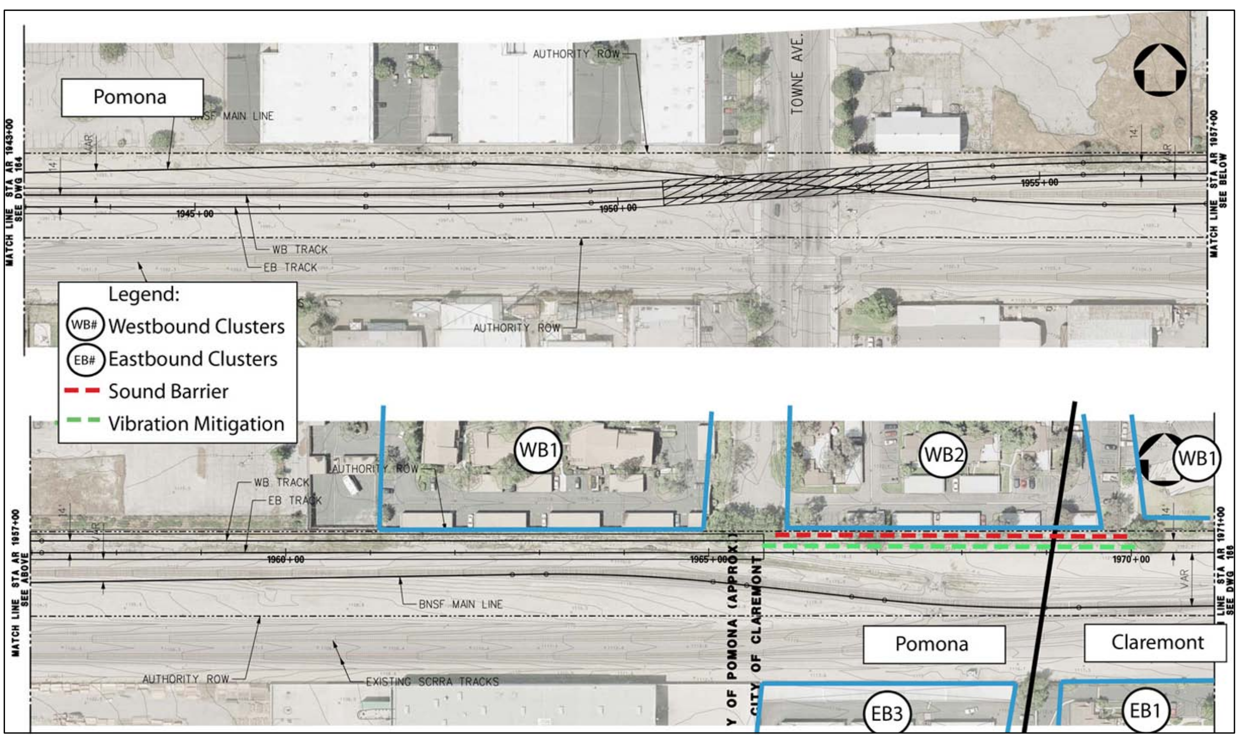
Cluster Number[1]	Cross Streets	Direction	Distance (feet)[2]	Speed (mph)	Threshold (VdB)	Predicted Band Max (VdB)[3]	1/3 Octave Band (Hz)[4]	Impact	Number of Impacts[5]
Westbound									
WB1	Towne Avenue/Cambridge Avenue	North	86	65	72	60	31.5	—	—
WB2	Towne Avenue/Cambridge Avenue	North	64	65	72	72	31.5	Yes	6
Eastbound									
EB1	Garey Avenue/Towne Avenue	South	158	65	72	67	31.5	—	—
EB2	Garey Avenue/Towne Avenue	South	136	65	72	58	31.5	—	—
EB3	Towne Avenue/Cambridge Avenue	South	238	65	72	65	31.5	—	—
Total Impacts									**6**

Source: ATS Consulting 2011
[1] The cluster numbers correspond to the labels in Figure 3.11–25 and Figure 3.11–26. The clusters are labeled from west to east in ascending order. Westbound (WB) clusters are located north of the right-of-way and Eastbound (EB) clusters are located south of the right-of-way.
[2] The distance in feet from the closest sensitive receptor in the cluster to the closest proposed light-rail track.
[3] Maximum predicted vibration level in any one-third octave band.
[4] The one-third octave band in which the highest predicted vibration level occurs.
[5] Number of dwelling units in the cluster.



Source: ATS Consulting 2011

Figure 3.11–25. Pomona—Clusters EB 1–2



Source: ATS Consulting 2011

Figure 3.11–26. Pomona—Clusters WB 1–2, EB 3; Claremont—Clusters WB1, EB1

City of Claremont

The light-rail tracks in the City of Claremont would be located in the northern half of the right-of-way, and two Southern California Regional Rail Authority (SCRRA) tracks would be relocated to the southern half of the right-of-way. Metrolink trains and BNSF trains operate on the SCRRA tracks. The noise predictions are presented in Table 3.11-18. Severe noise impact is predicted at clusters WB3 through WB6. The dominant noise source for westbound clusters would be light-rail operations. Severe noise impact is predicted at clusters EB2 through EB7. The increases in predicted noise levels at the eastbound clusters would be due to relocation of the SCRRA tracks approximately 20 feet closer to the residences. Severe noise impact at eastbound clusters was predicted only at residences located near at-grade crossings, caused by the increase in Metrolink and BNSF horn noise resulting from the proposed relocation of the SCRRA tracks, as well as the addition of LRT train noise.

The vibration predictions for light-rail operations are presented in Table 3.11-19. Vibration impact is predicted at clusters WB3, WB5, and WB6. The proposed location of the LRT tracks is within 50 feet of the nearest residence in each cluster where impact is predicted.

The vibration predictions for Metrolink operations are presented in Table 3.11-20. Vibration impact is assessed if the future predicted vibration level exceeds the current level by three dB and, at the same time, the future predicted level exceeds the 72 VdB threshold for light-rail operations. The Metrolink tracks would be relocated south from their current location, so there would be potential for impact only at eastbound clusters. At clusters EB1, EB2, and EB3, the Metrolink tracks would remain at the same location within the right-of-way, so there would be no potential for new impact. Vibration impact is predicted at clusters EB4 and EB7, multi-family residential complexes. The vibration levels at both of these clusters would exceed 72 VdB and increase by at least three dB as a result of the project.

Table 3.11-18. Claremont—Predicted Noise Levels for Residential (Category 2) Land Uses

Cluster Number[1]	Cross Streets	Direction	Distance (feet)[2]	Speed (mph)	Existing L_{dn} (dBA)	Predicted L_{dn} (dBA)	Threshold[3]		Impact	Number of Impacts[4]
							Moderate	Severe		
Westbound										
WB1	Towne Ave/Cambridge Ave[5]	North	128	65	62	61.6	1.7	4.4	—	—
WB2	Towne Ave/Cambridge Ave	North	82	65	62	63.7	1.7	4.4	—	—
WB3	Towne Ave/Cambridge Ave	North	40	65	62	69.1	1.7	4.4	Severe	5
WB4	Cambridge Ave/Indian Hill Blvd	North	96	65	62	66.8	1.7	4.4	Severe	4
WB5	Cambridge Ave/Indian Hill Blvd	North	26	65	62	69.0	1.7	4.4	Severe	12
WB6	Claremont Blvd/Monte Vista Ave	North	38	65	64	71.2	1.5	3.9	Severe	3
Eastbound										
EB1	Towne Ave/Cambridge Ave	South	170	65	62	63.4	1.7	4.4	—	—
EB2	Towne Ave/Cambridge Ave	South	146	65	62	68.0	1.7	4.4	Severe	6
EB3	Towne Ave/Cambridge Ave	South	160	65	62	67.4	1.7	4.4	Severe	3
EB4	Indian Hill Blvd/College Ave	South	94	55	64	68.7	1.5	3.9	Severe	5
EB5	College Ave/Claremont Blvd	South	110	65	64	70.0	1.5	3.9	Severe	6
EB6	College Ave/Claremont Blvd	South	108	65	64	70.1	1.5	3.9	Severe	8
EB7	Claremont Blvd/Monte Vista Ave	South	80	65	64	70.6	1.5	3.9	Severe	4
Total Moderate Impacts										**0**
Total Severe Impacts										**56**

Source: ATS Consulting 2011
[1] The cluster numbers correspond to the labels in Figure 3.11–27 through Figure 3.11–29. The clusters are labeled from west to east in ascending order. Westbound (WB) clusters are located north of the right-of-way and Eastbound (EB) clusters are located south of the right-of-way.
[2] The distance in feet from the closest sensitive receptor in the cluster to the proposed closest light-rail track.
[3] The threshold is the allowable increase in noise from the existing L_{dn}. The FTA designates two threshold levels: moderate and severe.
[4] Number of dwelling units in the cluster.
[5] The project includes relocating SCRRA/Metrolink tracks farther from the residence and thus lowering the noise level at this location.

Table 3.11-19. City of Claremont—Predicted Vibration Levels for Residential (Category 2) Land Uses

Cluster Number[1]	Cross Streets	Direction	Distance (feet)[2]	Train Speed (mph)	Threshold (VdB)	Predicted Band Max (VdB)[3]	1/3 Octave Band (Hz)[4]	Impact	Number of Impacts[5]
Westbound									
WB1	Towne Ave/Cambridge Avenue	North	128	65	72	66	50	—	—
WB2	Towne Ave/Cambridge Avenue	North	82	65	72	70	50	—	—
WB3	Towne Ave/Cambridge Avenue	North	40	65	72	77	63	Yes	5
WB4	Cambridge Ave/Indian Hill Boulevard	North	96	65	72	69	50	—	—
WB5	Cambridge Ave/Indian Hill Boulevard	North	26	65	72	81	63	Yes	12
WB6	Claremont Blvd/Monte Vista Avenue	North	38	65	72	77	63	Yes	3
Eastbound									
EB1	Towne Avenue/Cambridge Avenue	South	170	65	72	65	31.5	—	—
EB2	Towne Avenue/Cambridge Avenue	South	146	65	72	65	31.5	—	—
EB3	Towne Avenue/Cambridge Avenue	South	160	65	72	65	31.5	—	—
EB4	Indian Hill Boulevard/College Avenue	South	94	55	72	67	50	—	—
EB5	College Avenue/Claremont Boulevard	South	110	65	72	68	50	—	—
EB6	College Avenue/Claremont Boulevard	South	108	65	72	68	50	—	—
EB7	Claremont Boulevard/Monte Vista Avenue	South	80	65	72	70	50	—	—
Total Impacts									**20**

Source: ATS Consulting 2011

[1] The cluster numbers correspond to the labels in Figure 3.11–27 through Figure 3.11–29. The clusters are labeled from west to east in ascending order. Westbound (WB) clusters are located north of the right-of-way and Eastbound (EB) clusters are located south of the right-of-way.

[2] The distance in feet from the closest sensitive receptor in the cluster to the closest proposed light-rail track.

[3] Maximum predicted vibration level in any one-third octave band.

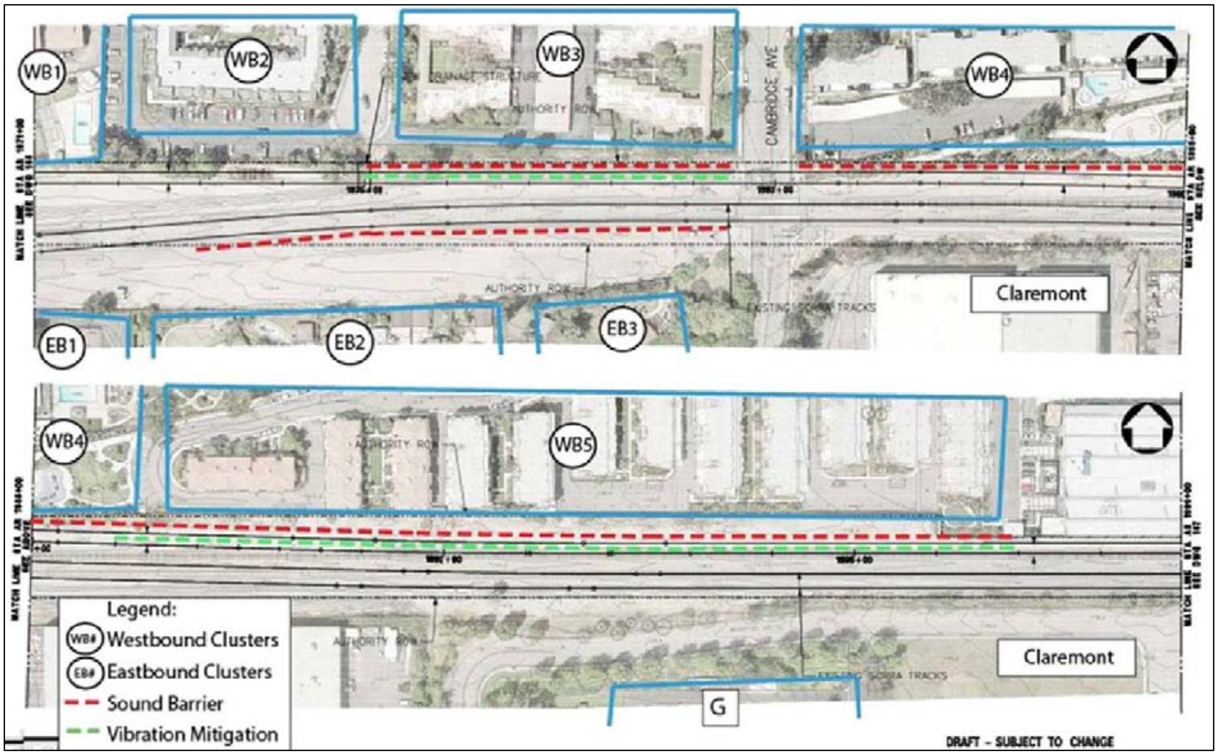
[4] The one-third octave band in which the highest predicted vibration level occurs.

[5] Number of dwelling units in the cluster.

Table 3.11-20. City of Claremont—Predicted Metrolink Vibration Levels for Residential (Category 2) Land Uses

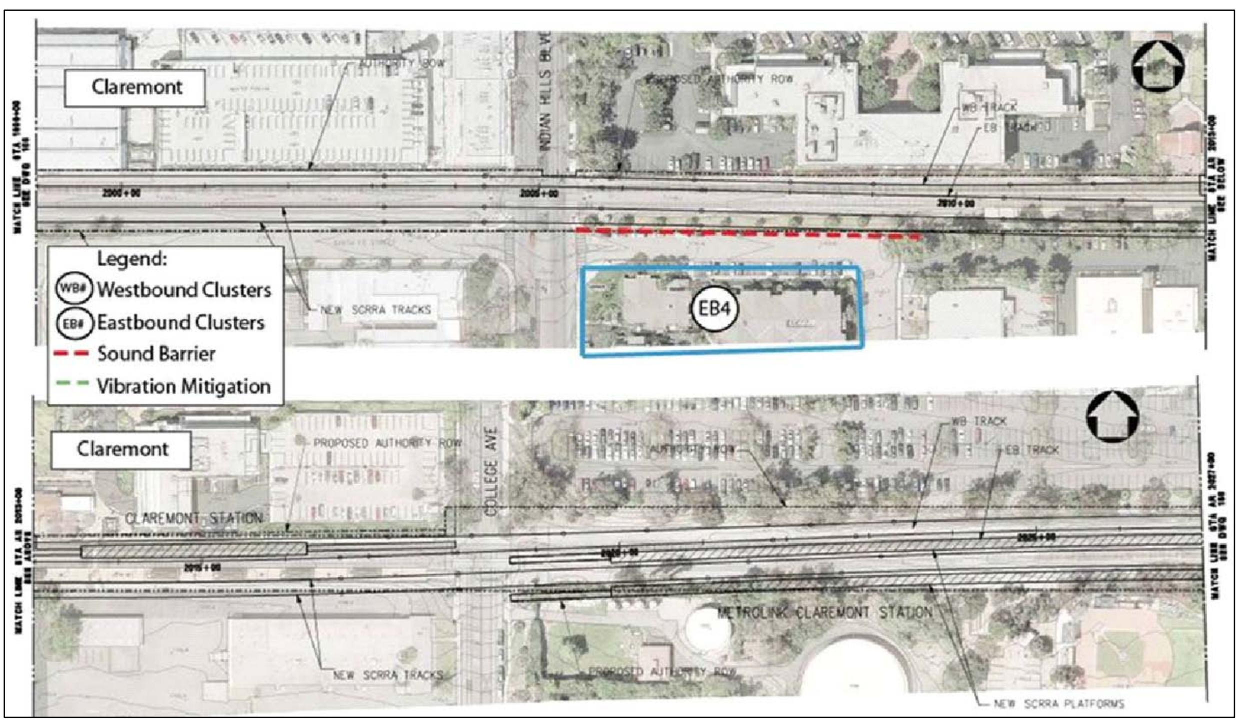
Cluster Number[1]	Cross Streets	Direction	Distance (feet)[2]	Change in Distance (feet)	Predicted Current Band Max (VdB)[3]	Predicted Future Band Max (VdB)[3]	1/3 Octave Band (Hz)[4]	Impact	Number of Impacts[5]
Eastbound									
EB1	Towne Avenue/Cambridge Avenue	South	94	0	—	—	—	—	—
EB2	Towne Avenue/Cambridge Avenue	South	100	0	—	—	—	—	—
EB3	Towne Avenue/Cambridge Avenue	South	110	0	—	—	—	—	—
EB4	Indian Hill Blvd/College Avenue	South	60	22	69	72	50	Yes	5
EB5	College Avenue/Claremont Boulevard	South	74	20	67	70	50	—	—
EB6	College Avenue/Claremont Boulevard	South	72	20	67	70	50	—	—
EB7	Claremont Boulevard/Monte Vista Avenue	South	46	20	71	75	50	Yes	4
Total Impacts									**9**

Source: ATS Consulting 2011
[1] The cluster numbers correspond to the labels in Figure 3.11–27 through Figure 3.11–29. The clusters are labeled from west to east in ascending order. Westbound (WB) clusters are located north of the right-of-way and Eastbound (EB) clusters are located south of the right-of-way.
[2] The distance in feet from the closest sensitive receptor in the cluster to the closest proposed Metrolink track.
[3] Maximum predicted vibration level in any one-third octave band.
[4] The one-third octave band in which the highest predicted vibration level occurs.
[5] Number of dwelling units in the cluster.



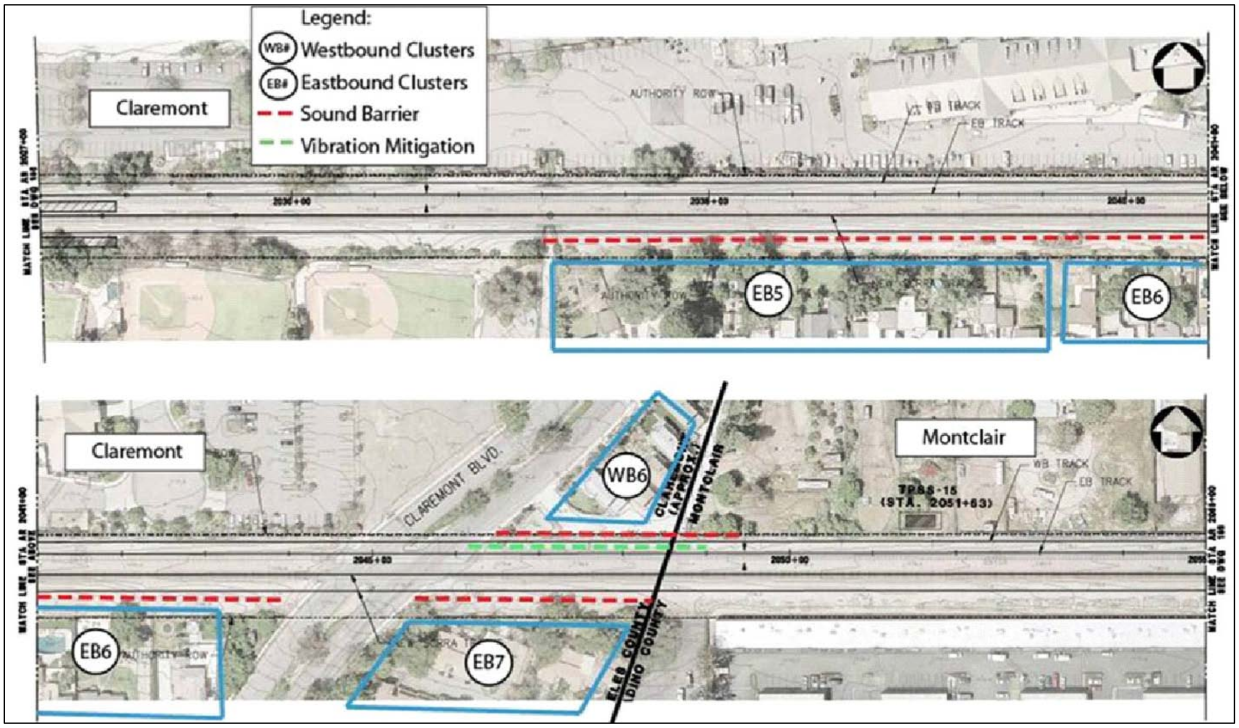
Source: ATS Consulting 2011

Figure 3.11–27. Claremont—Clusters WB 1–5, EB 1–3



Source: ATS Consulting 2011

Figure 3.11–28. Claremont—Cluster EB 4



Source: ATS Consulting 2011

Figure 3.11–29. Claremont—Clusters EB 5–7, WB 6

City of Montclair

There are no noise or vibration sensitive receptors identified in this segment of the alignment; therefore, the project would not result in any noise or vibration impacts on sensitive receptors.

Institutional Land Uses

Similar to the Category 2 (residential) analysis, an assessment was conducted of noise and vibration impact for Category 3 (institutional) receptors. The main difference in the assessment of Category 2 and Category 3 land uses is that different impact thresholds are used. As discussed in Section 3.11.6.4, noise exposure for Category 3 land uses is based on the maximum one-hour L_{eq}, while noise exposure for Category 2 land uses is the 24-hour L_{dn}. The L_{eq}, or equivalent sound level, is as time-averaged sound level. The 24-hour L_{dn}, or day-night level, includes an adjustment to weight nighttime noise more heavily.

Because freight trains in the corridor run infrequently (about twice a day), but their horns are a major contribution to the noise environment, two predictions have been made for the Category 3 land uses near grade crossings: 1) the 1-hour L_{eq} with only LRT trains and 2) the 1-hour L_{eq} with LRT trains and one freight train with horn noise. The existing hourly L_{eq} with one freight train operation are based on the measured one-hour L_{eq} between 5:00 p.m. and 6:00 p.m. at long-term site 25 (1736 Park Street, La Verne), which included a freight train sounding the horn. The measured horn noise at this site was comparable to the noise level mandated by the FRA for freight trains, so it was considered representative of horn noise levels throughout the corridor. The existing L_{eq}s without freight trains are based on the short-term measurement closest to the sensitive receiver.

The predicted noise levels for Category 3 land uses are shown in Table 3.11-21. Noise impact is predicted at the University of La Verne Arts and Communications building north of the right-of-way at the intersection of D Street and Arrow Highway in La Verne. The proposed location for the relocated freight tracks is 18 feet from the building, and freight train horns are sounded at the intersection with D Street. The primary noise source at the university building would be the freight train horns.

The predicted vibration levels for Category 3 land uses are shown in Table 3.11-22. Vibration impact is predicted at the University of La Verne Arts and Communications building. The building is located 34 feet from the nearest light-rail track.

The Keck Graduate Institute is the only institutional land use where Metrolink tracks are relocated closer to the building; however, the predicted vibration levels at the Keck Graduate Institute do not exceed the vibration impact threshold.

Table 3.11-21. Predicted Noise Levels for Institutional (Category 3) Land Uses

City	Land Use	Direction[1]	Cluster[2]	Distance (feet)[3]	Train Speed (mph)	1-hr L_{eq}, dBA		Threshold[4]		Impact
						Existing	Predicted	Moderate	Severe	
Glendora	Calvary Lutheran Church	EB	A	136	65	50	57.0	8.9	14.7	—
Glendora	Presbyterian Hospital	EB	B	68	45	61	63.2	4.3	8.6	—
Glendora	Foothill Christian Preschool (No freight)	EB	C	100	55	50	56.5	8.9	14.7	—
Glendora	Foothill Christian Preschool (with Freight)[5]	EB	C	100	55	75	73.9	1.2	4.9	—
Glendora	Woodglen Medical Institute (no freight)	EB	D	78	55	50	57.8	8.9	14.7	—
Glendora	Woodglen Medical Institute (with freight)	EB	D	78	55	75	75.8	1.2	4.9	—
San Dimas	Pioneer Park (no freight)	EB	E	260	55	58	58.5	5.3	9.9	—
San Dimas	Pioneer Park (with freight)	EB	E	260	55	75	65.4	1.2	4.9	—
La Verne	University of La Verne (no freight)	WB	F	32	35	57	60.5	5.6	10.4	—
La Verne	University of La Verne (with freight)	WB	F	32	35	75	84.3	1.2	4.9	Severe
Claremont	Keck Graduate Institute	EB	G	198	65	58	59.4	5.3	9.9	—

Source: ATS Consulting 2011
[1] Eastbound (EB) clusters are located south of the right-of-way, and westbound (WB) clusters are located north of the right-of-way.
[2] The cluster labels are used to identify the building in the figures presented in Figure 3.11–7 through Figure 3.11–29
[3] The distance in feet from the closest sensitive receptor in the cluster to the closest proposed light-rail track.
[4] The threshold is the allowable increase in noise from the existing Ldn. The FTA designates two threshold levels: moderate and severe.
[5] The project includes relocating SCRRA/Metrolink tracks farther from the residence and thus lowering the noise level at this location.

Table 3.11-22. Predicted Vibration Levels for Institutional (Category 3) Land Uses

City	Land Use	Direction[1]	Cluster[2]	Distance (feet)[3]	Train Speed (mph)	Threshold (VdB)	Predicted Band Max[4] (VdB)	1/3 Octave Band (Hz)[5]	Impact
Glendora	Calvary Lutheran Church	EB	A	136	65	75	69	31.5	—
Glendora	Presbyterian Hospital	EB	B	68	45	75	71	31.5	—
Glendora	Foothill Christian Preschool	EB	C	100	55	75	70	31.5	—
Glendora	Woodglen Medical Institute	EB	D	78	55	75	72	31.5	—
San Dimas	Pioneer Park	EB	E	260	55	75	63	31.5	—
La Verne	University of La Verne	WB	F	32	35	75	78	50	Yes
Claremont	Keck Graduate Institute	EB	G	198	65	75	67	31.5	—

Source: ATS Consulting 2011
[1] Eastbound (EB) clusters are located south of the right-of-way, and westbound (WB) clusters are located north of the right-of-way.
[2] The cluster labels refer to the same sensitive receptors used for the noise analysis. The locations of the clusters are presented in the figures in sections for the respective cities.
[3] The distance in feet from the closest sensitive receptor in the cluster to the closest proposed light-rail track.
[4] Maximum predicted vibration level in any 1/3 octave band.
[5] The one-third octave band in which the maximum predicted vibration level occurs.

Ancillary Equipment

The Traction Power Supply Substation (TPSS) units are the only ancillary equipment associated with the project with the potential for causing noise impacts. There is no ancillary equipment with the potential for causing vibration impacts. There are 11 proposed TPSS units distributed along the alignment. Several of the selected sites are adjacent to residential land uses.

The TPSS units would be designed to comply with the Metro Rail Design Criteria for noise from a transit system ancillary facility. The Metro design levels ensure that noise from the units would not exceed the FTA Noise Impact Criteria at any noise-sensitive receivers. The Metro Rail Design Criteria are presented in Table 3.11-23. The residential areas near any proposed TPSS locations for the project are considered average residential density. The TPSS units are assumed to run continuously. At the residential locations, the TPSS units would be designed not to exceed a maximum noise level of 45 dBA at a distance of 50 feet from the unit or at the facade of the nearest building, whichever is closer.

Table 3.11-23. Metro Rail Design Criteria for Noise for Traction Power Supply Substations

Community Area	Maximum Noise Level (dBA)[1]	
	Transient	Continuous
Low Density Residential	50	40
Average Residential	55	45
High-density residential	60	50
Commercial	65	55
Industrial/highway	75	65

Source: Los Angeles County Metropolitan Transportation Authority 2010
[1]Maximum noise level at a distance of 50 feet, or at the setback line of the nearest building, whichever is closer.

The estimated TPSS unit noise levels over a 24-hour period (L_{dn}) are presented in Table 3.11-24 along with the measured existing noise levels and the FTA Noise Impact Criteria. Assuming a maximum noise level of 45 dBA at the residence, the 24-hour noise level (L_{dn}) from a continuously running TPSS unit is 51 dBA. The predicted TPSS noise does not exceed the FTA threshold at any of the proposed locations.

Table 3.11-24. Predicted Traction Power Supply Substations Noise Levels

City	TPSS	Nearest Cluster	Distance (feet)[1]	Measured Existing Noise Level L_{dn} (dBA)	Estimated TPSS Noise Level L_{dn} (dBA)[2]	FTA Criteria L_{dn} (dBA)	Significant Impact
Glendora	B1	WB2	64	58	51	57	No
Glendora	B2	WB11	82	56	51	56	No
Glendora	B3	No noise-sensitive receivers near this TPSS location.					
San Dimas	B4	EB1	50	60	51	58	No
San Dimas	B5	EB3a	90	60	51	58	No
La Verne	B6	WB1	88	64	51	61	No
La Verne	B7	No noise-sensitive receivers near this TPSS location.					
Pomona	B8	EB1	116	62	51	59	No
Claremont	B9	EB3	50	62	51	59	No
Claremont	B10	No noise-sensitive receivers near this TPSS location.					
Montclair	B11	No noise-sensitive receivers near this TPSS location.					

Source: ATS Consulting 2011
[1] The distance in feet from the closest sensitive receptor in the cluster to the proposed light-rail track.
[2] The estimated level is based on the Metro design criteria of 45 dBA at the nearest residence.

3.11.8 Cumulative Impacts

No major transportation infrastructure improvements within the corridor area, other than the proposed Metro Gold Line Extension to Montclair project, are considered in the Southern California Association of Governments (SCAG) *2012-2035 Regional Transportation Plan/Sustainable Communities Strategy* (RTP/SCS). However, some future development may occur within the cities in the corridor area consistent with each City's land use plans and zoning designations, during the time when the project is under construction. Therefore, there is a potential for a short-term significant cumulative construction noise and vibration impacts. The proposed project would not result in a long-term significant cumulative impact.

3.11.9 Mitigation Measures for Noise

3.11.9.1 Short-term Construction Mitigation Measures

Noise

In compliance with the Construction Authority's policy, construction of the project would conform to the noise requirements of each City in the corridor area. These requirements generally limit construction activities to daytime hours (typically from 7 a.m. to 6 p.m.) and certain days of the week (e.g., construction is often precluded on Sundays and national holidays without a variance from the local jurisdiction). Some local noise requirements may also include equipment or property line limits.

In addition to the noise reduction that would result from voluntary compliance with these requirements, the following measures will be implemented:

- **N-1—**Construction shall proceed in accordance with the construction specifications for this project, including, but not limited to, the following:
  - **Noise and Vibration Control Plan**—A Noise and Vibration Control Plan shall be developed that demonstrates how the appropriate noise limits will be achieved. The plan shall include measurements of existing noise, a list of the major pieces of construction equipment that will be used, and predictions of the noise levels at the closest sensitive receptors (including residences, hotels, schools, churches, temples, and similar facilities). The noise and vibration control plan shall include measures to minimize vibration impacts during construction. Appropriate vibration mitigation measures include minimizing the use of tracked vehicles, avoiding vibratory compaction; and monitoring vibration near residences to ensure thresholds are not exceeded. The noise and vibration control plan shall be approved by the Construction Authority prior to initiating construction, and implemented during construction.
  - **Alternative Construction Procedures**—Where construction cannot be performed in accordance with the requirement of the noise limits, the Construction Authority shall investigate and implement alternative construction measures that would result in lower sound levels.
  - **Noise Monitoring—**The Construction Authority shall conduct noise monitoring to demonstrate compliance with contract noise limits.
  - **Best Management Practices**—The Construction Authority shall use the following best management practices for noise abatement wherever practical:
    - Use specialty equipment with enclosed engines and/or high performance mufflers when feasible.
    - Locate equipment and staging areas as far as possible from noise-sensitive receptors.
    - Limit unnecessary idling of equipment.
    - Install temporary noise barriers as needed and where feasible.
    - Reroute construction-related truck traffic away from residential streets to the extent permitted by the relevant municipality.
    - Avoid impact pile driving where possible. Where geological conditions permit, use quieter alternatives, such as drilled piles or a vibratory pile driver.
- **N-2—**The Construction Authority shall implement complaint resolution procedures, including designating a contact person and telephone number, to rapidly resolve any construction noise problems.

Vibration

It is unlikely that vibration from construction activities will exceed the thresholds for minor cosmetic damage to buildings. In the event that equipment may approach those limits, the noise and vibration control plan would also include measures to minimize vibration impacts during construction. Also, representatives from the Construction Authority would be available to discuss vibration-related complaints and take appropriate action to minimize the intrusion. Appropriate vibration mitigation measures include:

- Minimizing the use of tracked vehicles
- Avoiding vibratory compaction
- Monitoring vibration near residences to ensure thresholds are not exceeded

3.11.9.2 Long-term Mitigation Measures

Noise

- **N-3—**The Construction Authority shall employ noise reduction strategies to reduce noise, including erecting noise barriers, employing building sound insulation, and modifying at-grade audible warning devices and operations (subject to California Public Utilities Commission approval). Final design, locations, and extent of implementation of each of these noise-reducing strategies shall be determined during final design of the project such that the Federal Transit Administration (FTA) noise abatement criteria are most effectively achieved.

  The noise reduction measures include:

  - **Noise Barriers**—This is a common approach to reduce noise impacts from surface transportation sources. The primary requirements for an effective noise barrier are (1) the barrier must be high enough and long enough to break the line of sight between the sound source and the receiver; (2) the barrier must be of an impervious material with a minimum surface density of 4 lb/sq ft; and (3) the barrier must not have any gaps or holes between the panels or at the bottom. Because numerous materials meet these requirements, the selection of materials for noise barriers is usually dictated by aesthetics, durability, cost, and maintenance considerations.
  - **Building Sound Insulation**—Sound insulation in residences and institutional buildings improves the outdoor-to-indoor noise reduction. Although this approach has no effect on noise in exterior areas, it may be the best choice for sites where noise barriers are not feasible or desirable, for buildings where indoor sensitivity is of most concern, or where train horn noise dominates the noise environment. Substantial improvements in building sound insulation (approximately five (5) to 10 dBA) can often be achieved by adding an extra layer of glazing to the windows, by sealing any holes in exterior surfaces that act as sound leaks, and by providing forced ventilation and air-conditioning so windows do not need to be opened.
  - **Train Horns**—The Federal Railroad Administration (FRA) regulations require all trains operating on the national rail system to sound horns as they approach at-grade rail/roadway crossings. In 2005, the FRA finalized a horn rule that provides the opportunity to mitigate the effects of train horn noise by establishing “quiet zones.” The FRA may permit a quiet zone if the affected jurisdiction agrees to implement supplemental safety measures such as four-quadrant gates. If the application is approved, freight and Metrolink trains would not be required to sound their horns as they approach these crossings. In some areas, the elimination of existing horn noise would result in a significant reduction in noise that may be sufficient to decrease the noise level to below the Moderate Impact threshold. The proposed project would use four-quadrant gates and would be “quiet zone” eligible.

Impact predictions and proposed mitigation are based on October 2011 designs that are subject to further refinement. During final design, data that affect the impact predictions may change, such as the precise location and grade of rails, switch locations, the placement of grade crossing warning devices, and train speeds. Accordingly, the impacts and mitigation measures also are subject to refinement. In particular, the heights of the noise barriers and locations where sound insulation is recommended would change. If quiet zones were approved by the FRA for at-grade crossings the heights of the noise barriers and locations where sound insulation is recommended at those location would also change.

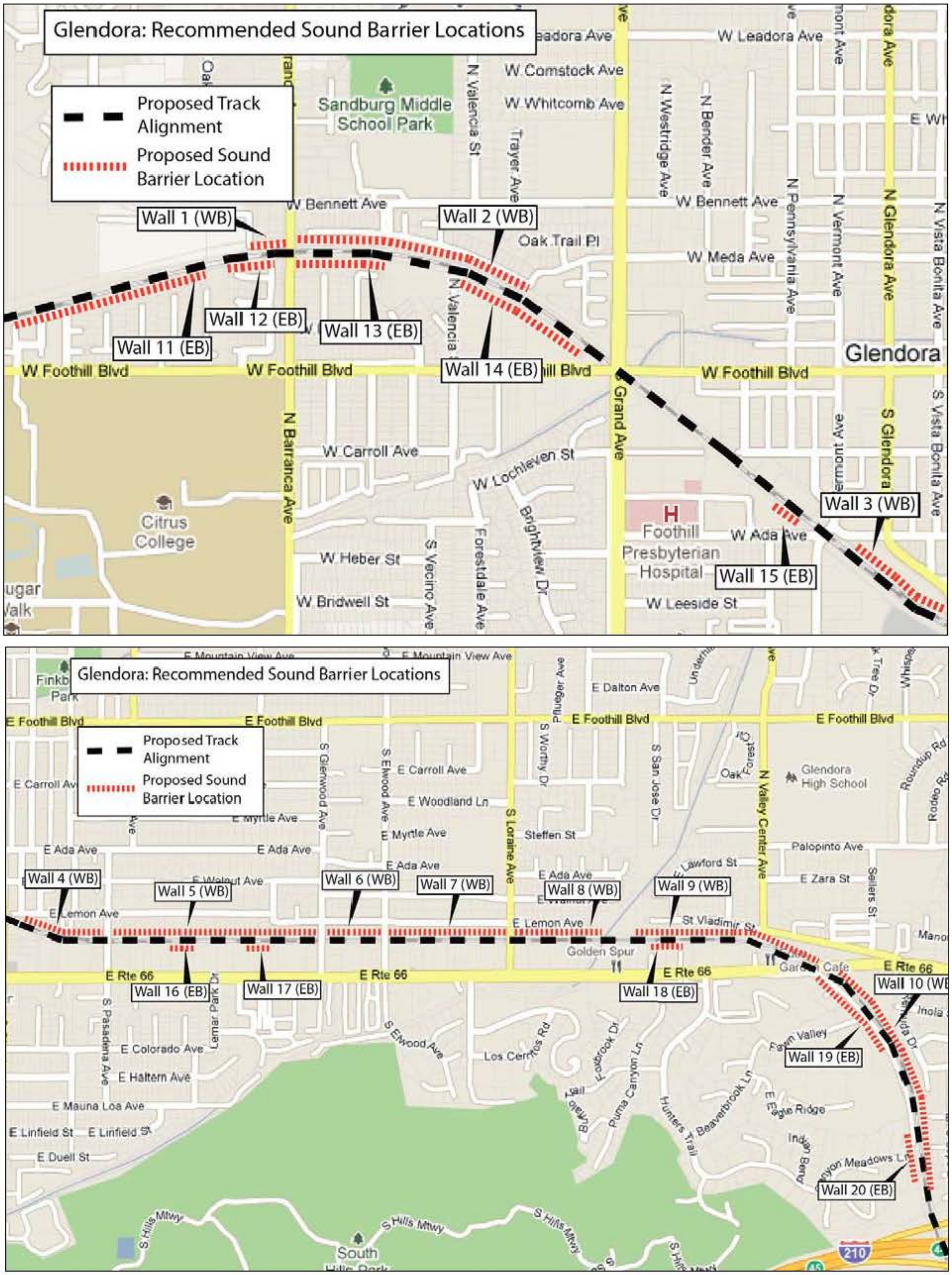
Table 3.11-25 indicates the approximate noise barrier lengths, side of track, and the clusters they would mitigate. The general locations of the barriers are indicated in Figure 3.11-30 through Figure 3.11-33. The heights for the sound barriers assume that building insulation would be applied to any second-story windows at residences where noise impact is predicted and that the source height of BNSF horn noise is 10 feet.

Sound walls must stop at intersections, reducing their effectiveness at-grade crossings because of noise leaks around the ends of the walls. In addition, it is neither feasible nor cost-effective for noise barriers to protect some second floors of noise-sensitive receivers. The recommended mitigation measure in these instances is sound insulation of the building. Table 3.11-26 indicates the locations for sound insulation for second stories; sound insulation is considered for all second-story windows facing the tracks within the identified clusters.

Table 3.11-25. Proposed Locations for Sound Barriers

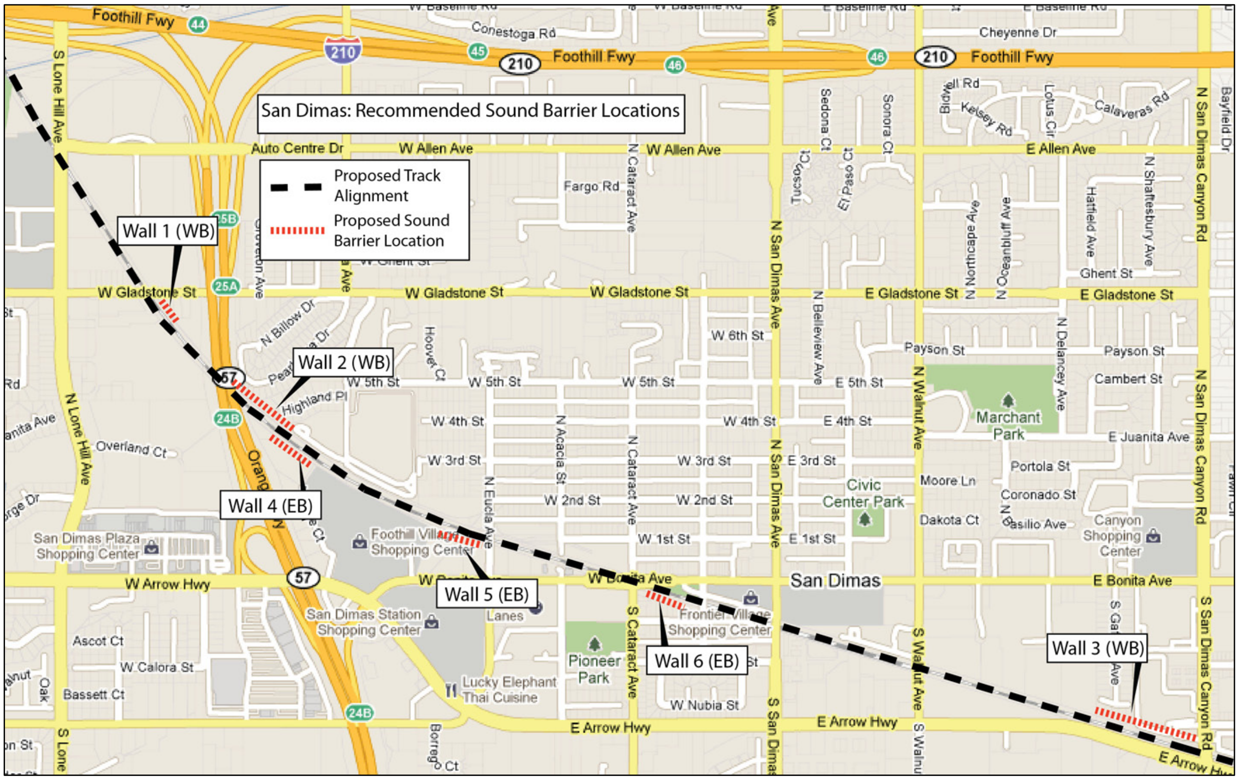
City	Wall Number	Direction[1]	Length (feet)	Height[2] (feet)	Clusters Mitigated
Glendora	1	WB	250	6	WB1
Glendora	2	WB	2,750	8	WB1a, 1b, 1c, 1d
Glendora	3	WB	1,150	8	WB3a
Glendora	4	WB	975	8	WB 4, 5
Glendora	5	WB	2,200	8	WB 6, 7, 8
Glendora	6	WB	650	8	WB 9, 10
Glendora	7	WB	1,250	10	WB 11, 12, 13
Glendora	8	WB	900	6	WB 14, 15
Glendora	9	WB	1,850	6	WB 16, 17, 18
Glendora	10	WB	2,100	12	WB 19, 20
Glendora	11	EB	1,800	6	EB 1, 2
Glendora	12	EB	450	12	EB3
Glendora	13	EB	925	12	EB 4, 5
Glendora	14	EB	1,400	12	EB5a
Glendora	15	EB	175	12	EB6
Glendora	16	EB	200	6	EB7
Glendora	17	EB	250	6	EB8
Glendora	18	EB	250	6	EB9
Glendora	19	EB	800	6	EB10
Glendora	20	EB	400	8	EB11
Total Length, Glendora (feet)			**20,725**		
San Dimas	1	WB	300	12	WB1
San Dimas	2	WB	500	6	WB2, 3
San Dimas	3	WB	850	6	WB 7, 8
San Dimas	4	EB	600	6	EB1
San Dimas	5	EB	250	6	EB3
San Dimas	6	EB	400	6	EB3a
Total Length, San Dimas (feet)			**2,900**		
La Verne	1	WB	1,175	6	WB 1, 2, 3, 4
La Verne	2	WB	625	6	WB 5, 6
La Verne	3	WB	500	14	WB7, F (Cat. 3)
Total Length, La Verne (feet)			**2,450**		
Claremont	1	WB	450	8	WB3
Claremont	2	WB	1,725	8	WB 4, 5
Claremont	3	WB	300	8	WB6
Claremont	4	EB	850	12	EB 2, 3
Claremont	5	EB	400	12	EB4
Claremont	6	EB	1,050	12	EB 5, 6
Claremont	7	EB	350	12	EB7
Total Length, Claremont (feet)			**5,125**		
Total Length, All Cities (feet)			**31,200**		

Source: ATS Consulting 2011
Note: Heights and lengths of the sound walls are subject to design refinements. Heights will be altered if quiet-zone waivers are granted for at-grade crossings.
[1] EB = toward Montclair (south side of tracks); WB = toward Azusa (north side of tracks)
[2] Height above the top-of-rail



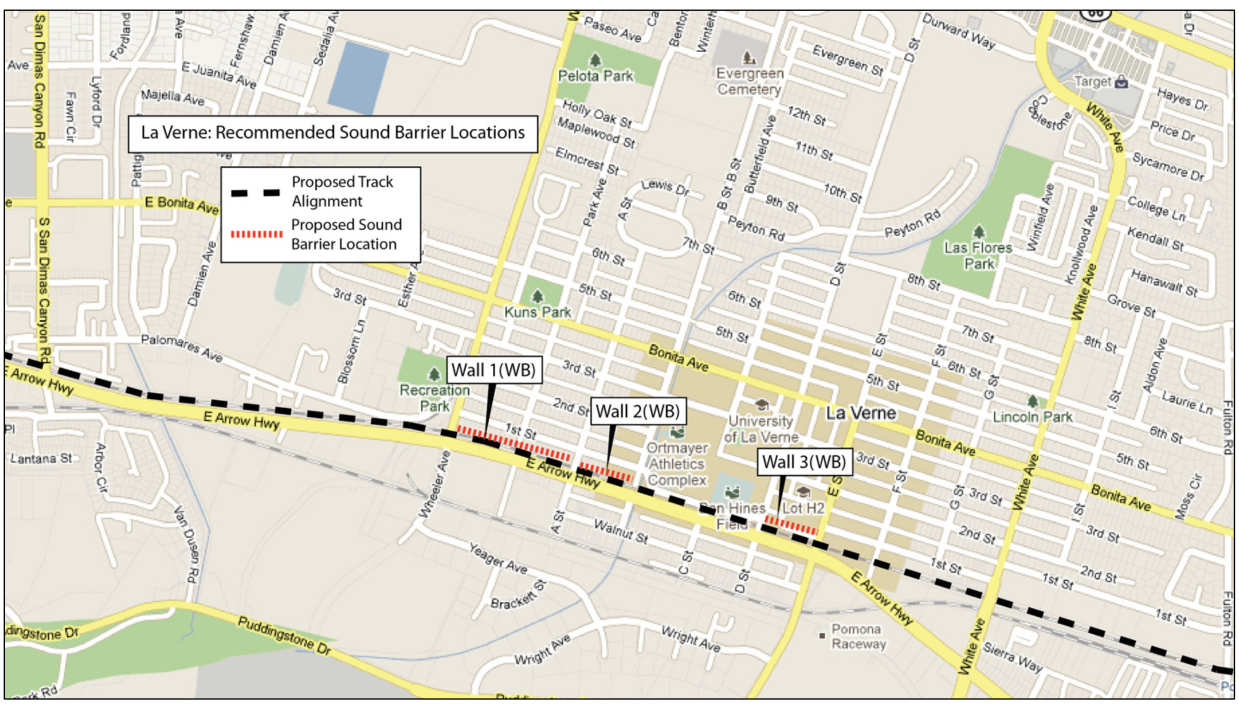
Source: ATS Consulting 2011

Figure 3.11-30. Glendora—Sound Barriers Location



Source: ATS Consulting 2011

Figure 3.11-31. San Dimas—Sound Barriers Location



Source: ATS Consulting 2011

Figure 3.11-32. La Verne—Sound Barriers Location

Source: ATS Consulting 2011

Figure 3.11-33. Claremont—Sound Barriers Location

Table 3.11-26. Proposed Locations for Sound Insulation of Second Stories

City	Cluster
Glendora	WB4
Glendora	WB6
Glendora	WB9
Glendora	WB10
Glendora	WB20
Glendora	EB1
Glendora	EB3
Glendora	EB4
Glendora	EB7
San Dimas	EB1
San Dimas	EB3
Claremont	WB5
Claremont	WB6
Claremont	EB4
Claremont	EB6
Claremont	EB7

Source: ATS Consulting 2011
Note: Sound insulation includes all second-story windows within the identified cluster.

Table 3.11-27 indicates the locations where noise mitigation is needed for sensitive receivers near at-grade crossings. One mitigation approach is improved sound insulation for windows and doors that would be affected by the "sound leak" around the ends of sound barriers at intersections. An alternative approach for noise mitigation at a grade crossing is to use transparent panels for the sound wall. This approach has been used in Phase 1 of the Metro Exposition Corridor project to mitigate noise impacts with a barrier while maintaining a visual line of sight.

Table 3.11-27. Proposed Locations for Sound Insulation near Grade Crossings

City	Cluster	Cross Street
Glendora	WB5	Pasadena Avenue
Glendora	WB6	Pasadena Avenue
Glendora	WB8	Glenwood Avenue
Glendora	WB9	Glenwood Avenue
Glendora	WB10	Elwood Avenue
Glendora	WB11	Elwood Avenue
Glendora	WB13	Lorraine Avenue
Glendora	WB14	Lorraine Avenue
Glendora	EB3	Barranca Avenue
Glendora	EB4	Barranca Avenue
San Dimas	WB1	Gladstone Street
La Verne	WB2	Wheeler Avenue
La Verne	WB3	Wheeler Avenue
La Verne	WB4	A Street
La Verne	F (Category 3)	D Street
Claremont	WB3	Cambridge Avenue
Claremont	WB4	Cambridge Avenue
Claremont	EB3	Cambridge Avenue
Claremont	EB4	Indian Hill

Source: ATS Consulting 2011
Note: The engineering station identifies the cluster at the intersection, not the particular building where insulation should be applied.

Policies for the implementation of residential sound insulation can be based on policies that have been used by other transit systems including TriMet in Portland, Oregon and Sound Transit in Seattle. The approach in Portland and Seattle was to consider sound insulation for residences where the interior noise levels exceeded the US Department of Housing and Urban Development (HUD) maximum allowable interior noise level of 45 dBA L_{dn}; the improvements resulted in at least 5 decibels of noise reduction. The implementation of the policy would include indoor noise testing and analysis to determine the appropriate improvements for each residence. However, implementation of sound insulation requires permission of property owners to allow access to the interior of their properties for both noise measurements and improvements.

Implementing a quiet zone requires cooperation by all jurisdictions involved with the grade crossing and is contingent upon FRA approval. Requirements for a quiet-zone waiver include installation of supplemental safety measures such as four-quadrant gates that may already be included as part of the project. If quiet zones were approved, it would eliminate the need for some of the sound walls listed in

Table 3.11-26 and some of the sound insulation shown in Table 3.11-27. The at-grade crossings for petition for quiet-zone status are presented in Table 3.11-28.

Table 3.11-28. At-Grade Crossings to Petition for Quiet Zone

City	Cross Street	Clusters Mitigated
Glendora	Barranca Avenue	EB 3, 4
Glendora	Pasadena Avenue	WB 5, 6
Glendora	Glenwood Avenue	WB 8, 9
Glendora	Elwood Avenue	WB 10, 11
Glendora	Lorriane Avenue	WB 13, 14
San Dimas	Gladstone Street	WB1
La Verne	Wheeler Avenue	WB 2, 3
La Verne	A Street	WB5
La Verne	D Street	F (Category)
Claremont	Cambridge Avenue	WB3, WB4, EB3
Claremont	Indian Hill Boulevard	EB4
Claremont	Claremont Boulevard	WB6, EB6, EB7

Source: ATS Consulting 2011
Note: Freight trains begin sounding their horns one-fourth mile before an intersection; a quiet zone will improve the noise environment at all clusters within a one-fourth mile of an at-grade crossing.

A number of residential areas along the right-of-way have existing barriers or privacy walls that act as sound barriers. The noise impact analysis assumed that these existing walls would not provide any noise reduction because it was not possible to assess the effectiveness of each wall without individual site visits and surveys. Many of the walls may not be effective as noise barriers due to construction, height, or gaps in the wall. During the Final Design of the project, the effectiveness of the existing barriers/privacy walls would be assessed and taken into account when determining final wall dimensions and configurations. It may be determined that a number of the existing barriers are effective sound walls, or that some need to be repaired or raised slightly to provide the appropriate level of noise reduction.

Vibration

- **N-4**—The Construction Authority shall employ vibration reductions strategies such as ballast mats, shredded tire or recycled rubber chip underlay, relocation of crossovers, and special trackwork. Final design, location, and extent of implementation of each of these vibration-reducing strategies shall be determined during Final Design of the project such that FTA criteria are most effectively achieved.

  The vibration reduction measures include the following:

  - **Ballast Mats—**A ballast mat consists of a pad made of rubber or rubber-like material placed on the sub-ballast with normal ballast, ties, and rail on top. The reduction in groundborne vibration provided by a ballast mat is strongly dependent on the frequency content of the vibration and the design and support of the mat. Depending on the soil properties, an asphalt or concrete layer under the ballast may be required.
  - **Tire Derived Aggregate (TDA)—**TDA consists of a resilient layer of shredded tires or recycled rubber chips placed beneath the sub-ballast layer of standard open ballast and tie track. This mitigation method provides results similar to ballast mats and would be strongly dependent on the frequency content of the vibration. This is a relatively new vibration mitigation approach that has

been successfully implemented by Denver's Regional Transportation District and the Santa Clara Valley Transportation Authority. In both Santa Clara Valley and Denver, 12-inch layers of TDA were installed.

– **Relocation of Crossovers or Special Trackwork—**The special trackwork at crossover locations increases vibration by about 10 dB. Crossovers are relocated away from residential areas wherever possible to eliminate impacts. If crossovers cannot be relocated away from residential areas, specially designed "low-impact" frogs could be used in place of standard rigid frogs. Examples of low-impact frogs include flange-bearing, spring-rail, and moveable point frogs.

In some instances a floating-slab track may be considered, where the track is constructed on a concrete slab that is supported by resilient elements (either 8- to 12-inch-thick pads or a continuous resilient mat). This type of track construction is very expensive and is typically used only where substantial vibration mitigation is needed.

Mitigation is considered for all clusters where the predicted band maximum vibration level exceeds the FTA impact threshold for a Detailed Vibration Impact Assessment. Table 3.11-29 presents the vibration mitigation types and lengths for the Azusa to Montclair corridor. Figure 3.11-34 to Figure 3.11-37 show the locations for mitigation. The majority of the vibration mitigation would be in Glendora (15,900 feet). The residences along Lemon Avenue in Glendora (between Pasadena Avenue and Lone Hill Avenue) are located close to the LRT tracks, often within 50 feet.

Implementation of the mitigation in Table 3.11-29 would provide sufficient vibration attenuation to eliminate vibration impacts.

Vibration impact was also identified from the relocation of the Metrolink tracks at the Claremont EB4 and EB7 clusters. A mitigation measure is the installation of ballast mat or TDA under both Metrolink tracks. The location for the mitigation is shown on Figure 3.11-37.

The mitigations in Table 3.11-29 and Table 3.11-30 will reduce the predicted vibration levels to below the FTA impact threshold at all but three of the sensitive receivers. Additional mitigation measures are identified at these locations and are presented in Table 3.11-31.

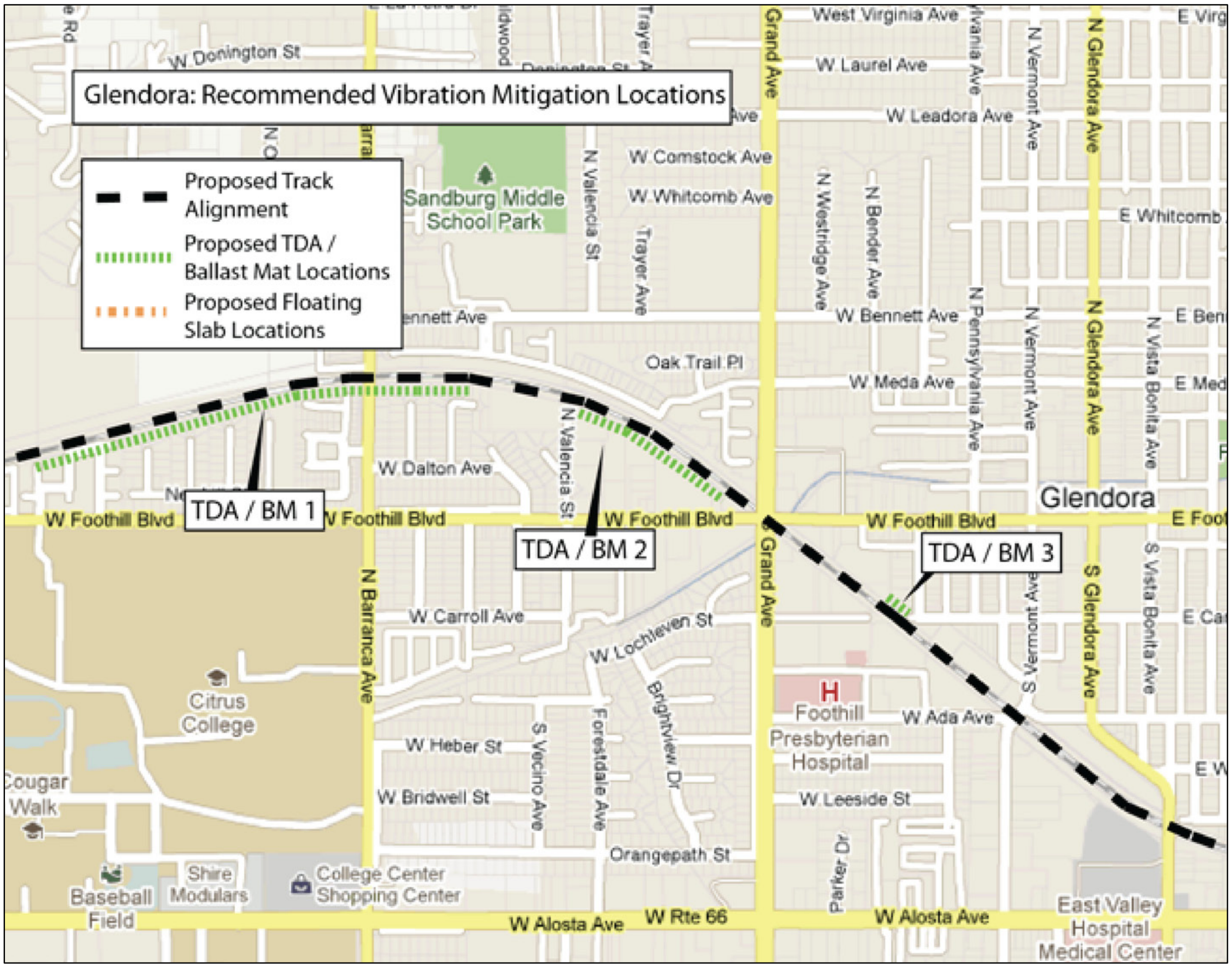
Two of the sensitive receivers with residual impact (Glendora WB6 and San Dimas EB1) are located within 15 feet of the proposed light-rail tracks. Even with the installation of a floating slab, the predicted vibration levels at these locations with the train travelling at 65 mph would exceed FTA thresholds. For these locations, an additional mitigation measure addresses a reduced train speed to reduce vibration levels.

The predicted vibration levels with a train travelling at 65 mph at Glendora WB18 is equal to the FTA impact threshold of 72 VdB with mitigation from TDA or ballast mat. At this location, either a TDA, ballast mat, or a floating slab would be installed based on final design information that would reduce vibration levels below 72 VdB.

Table 3.11-29. Locations for Vibration Mitigation

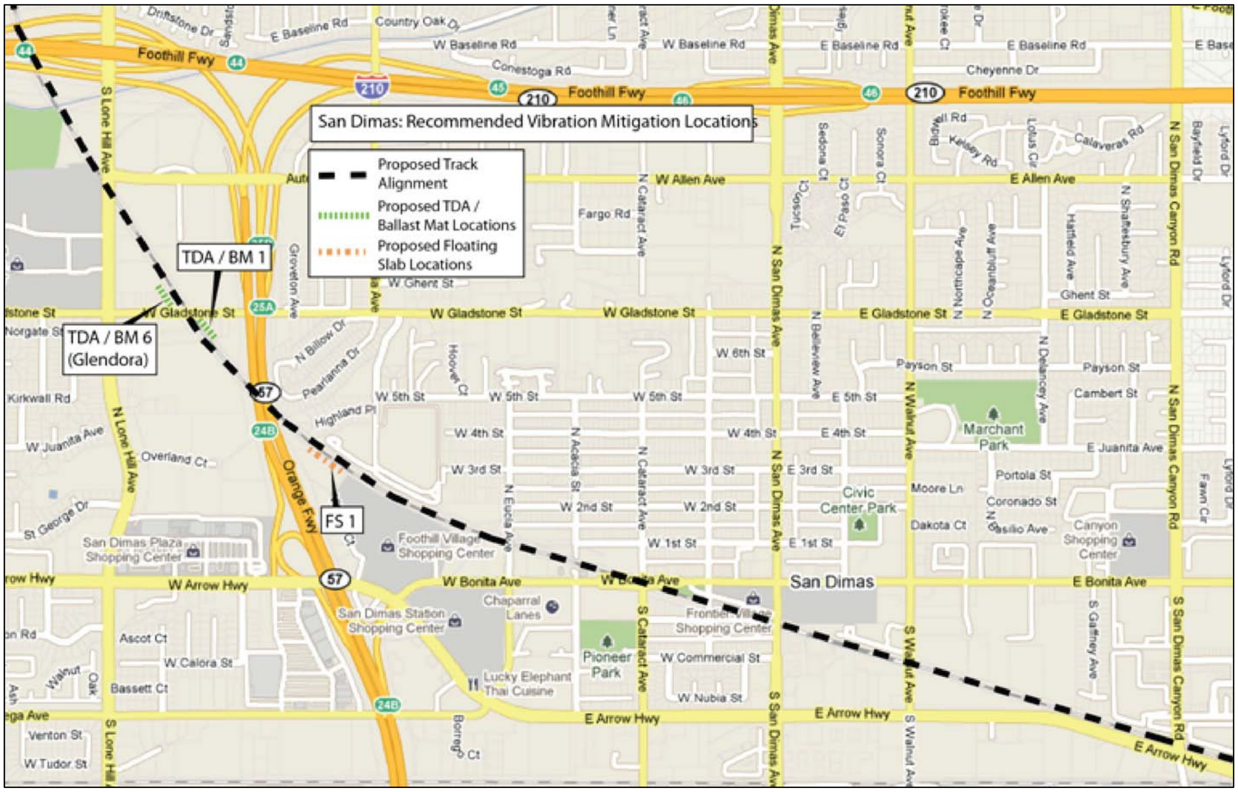
City	Label	Length (feet)	Mitigation Type	Clusters Mitigated
Glendora	TDA/BM 1	3,350	Ballast Mat/TDA	EB 1-5
Glendora	TDA/BM 2	1,400	Ballast Mat/TDA	EB5a
Glendora	TDA/BM 3	200	Ballast Mat/TDA	WB2
Glendora	FS 1	6,100	Floating Slab and Low Impact Frogs at Crossovers	WB 4-15, EB7
Glendora	TDA/BM 4	1,800	Ballast Mat/TDA	WB 16-18, EB9
Glendora	TDA/BM 5	2,800	Ballast Mat/TDA	WB 19-20, EB 10-11
Glendora	TDA/BM 6	250	Ballast Mat/TDA	EB12
Total Length Glendora (feet)		**15,900**		
San Dimas	TDA/BM 1	300	Ballast Mat/TDA	WB1
San Dimas	FS 2	600	Ballast Mat/TDA	EB1
Total Length San Dimas (feet)		**900**		
Pomona	TDA/BM 1	450	Ballast Mat/TDA	WB2
Total Length Pomona (feet)		**450**		
La Verne	TDA/BM 1	250	Ballast Mat/TDA	F
Total Length La Verne (feet)		**250**		
Claremont	TDA/BM 1	450	Ballast Mat/TDA	WB3
Claremont	TDA/BM 2	1,150	Ballast Mat/TDA	WB5
Claremont	TDA/BM 3	300	Ballast Mat/TDA	WB6
Total Length Claremont (feet)		**1,900**		
Total Ballast Mat/TDA (all cities):		**12,450**		
Total Floating Slab (all cities):		**6,700**		

Source: ATS Consulting 2011
Note: It is assumed that mitigation would be placed under both near and far tracks.



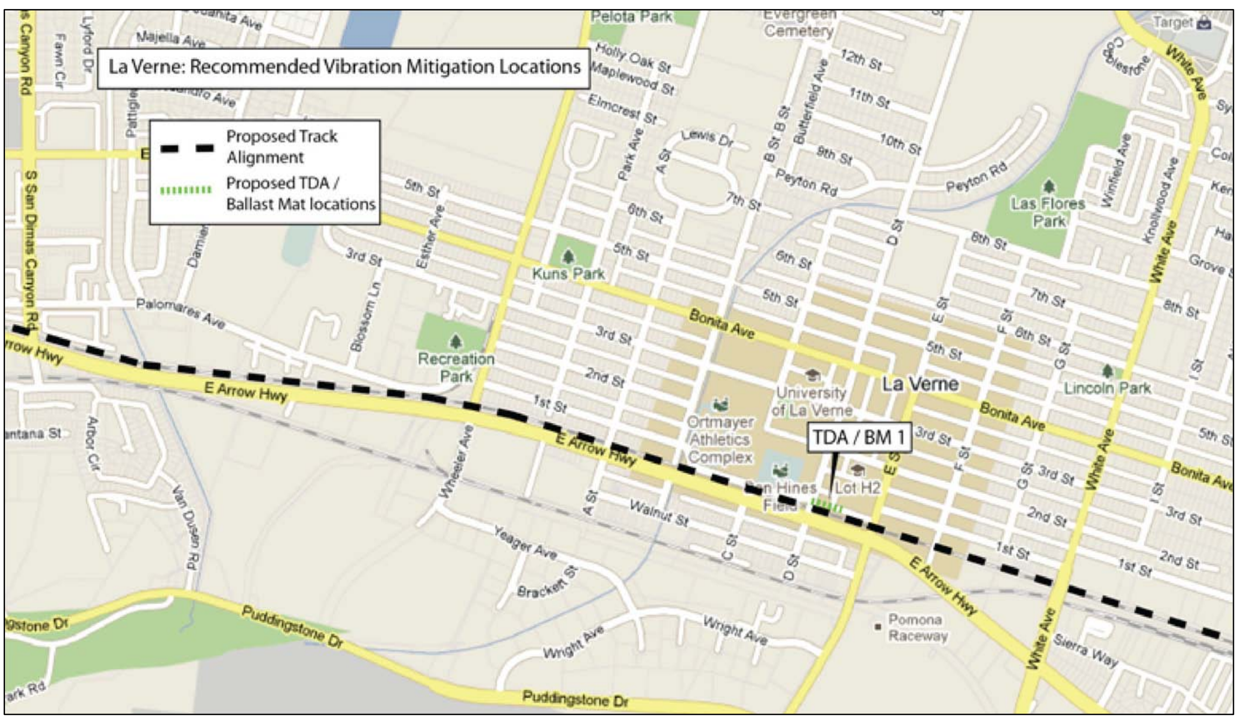
Source: ATS Consulting 2011

Figure 3.11-34. Glendora—Vibration Mitigation Location



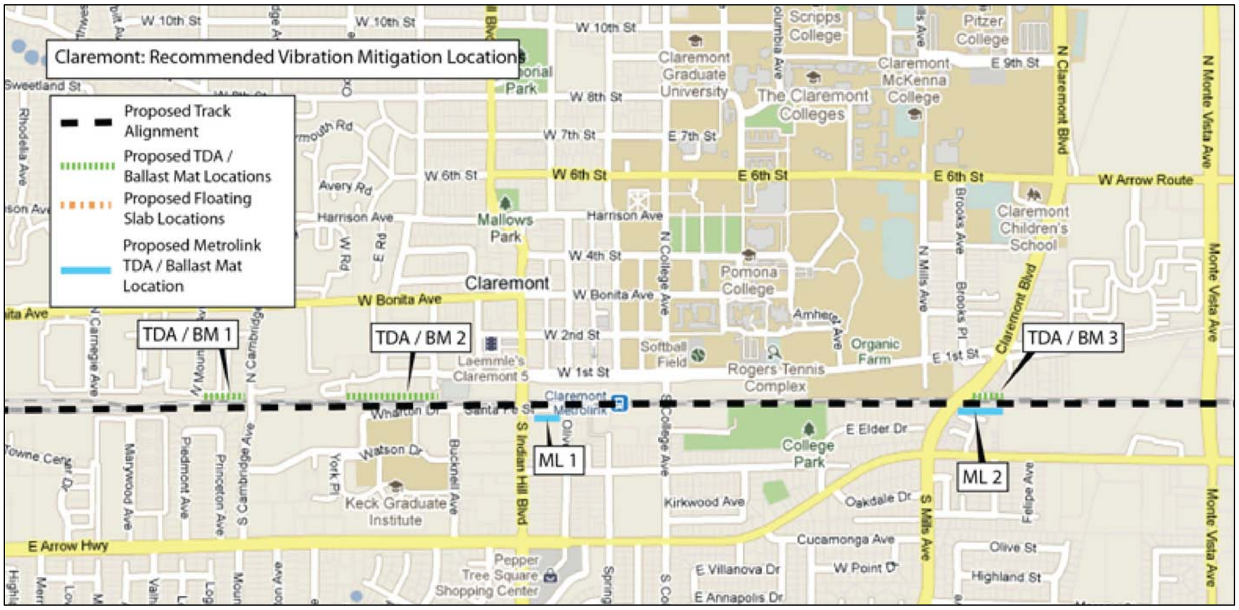
Source: ATS Consulting 2011

Figure 3.11-35. San Dimas—Vibration Mitigation Location



Source: ATS Consulting 2011

Figure 3.11-36. La Verne—Vibration Mitigation Location



Source: ATS Consulting 2011

Figure 3.11-37. Claremont—Vibration Mitigation Location

Table 3.11-30. Recommended Locations for Vibration Mitigation, Metrolink Tracks

City	Label	Length (ft)	Mitigation Type	Clusters Mitigated
Claremont	ML 1	400	Ballast Mat/TDA	EB4
Claremont	ML 2	350	Ballast Mat/TDA	EB7

Source: ATS Consulting 2011
Notes: It is assumed that mitigation will be placed under both the near and far tracks. Mitigation for Claremont EB4 and EB7 is for the SCRRA tracks, not LRT Tracks

Table 3.11-31. Residual Vibration Impacts

City	Cluster	Distance (ft)	Mitigation Type	Predicted Level with Mitigation
Glendora	WB6	12	Floating Slab/ Reduced train speed	<76 VdB at 50 Hz
Glendora	WB18	44	TDA/Ballast Mat/ Floating Slab	<72 VdB at 31.5 Hz
San Dimas	EB1	14	Floating Slab/ Reduced train speed	<78 VdB at 31.5 Hz

Source: ATS Consulting 2011, Parsons Brinckerhoff 2012

There are several locations in the corridor where mitigation is recommended, but the predicted vibration level only slightly exceeds the FTA vibration impact threshold. During final design, the vibration predictions at these locations would be revisited to ensure that vibration mitigation is necessary. In addition, the vibration predictions at the institutional land use in La Verne and vibration impact from the Metrolink tracks in Claremont would also be revisited to ensure the vibration mitigation is necessary. The locations recommended for verification during final design are presented in Table 3.11-32.

Table 3.11-32. Vibration Impacts to be Verified

City	Cluster	Distance (ft)	Mitigation Type	Predicted Level without Mitigation
Glendora	EB5a	75	TDA/Ballast Mat	74 VdB at 31.5 Hz
Glendora	EB10, EB12	94	TDA/Ballast Mat	72 VdB at 31.5 Hz
Glendora	EB11	84	TDA/Ballast Mat	73 VdB at 31.5 Hz
San Dimas	WB1	50	TDA/Ballast Mat	73 VdB at 31.5 Hz
La Verne	F	34	TDA/Ballast Mat	78 VdB at 50 Hz
Pomona	WB2	64	TDA/Ballast Mat	72 VdB at 31.5 Hz
Claremont	EB4	60	TDA/Ballast Mat for Metrolink	72 VdB at 50 Hz
Claremont	EB7	44	TDA/Ballast Mat for Metrolink	75 VdB at 50 Hz

Source: ATS Consulting 2011

3.11.10 Level of Impact after Mitigation

Implementation of the identified mitigation measures would reduce the short-term construction impacts vibration. However, even with the implementation of the identified mitigation measures, the short-term noise impacts could remain significant and unavoidable at some locations closest to the alignment.

The implementation of the identified mitigation measures would reduce the long-term noise impacts to a less than significant level. The implementation of the identified mitigation measures would reduce the long-term vibration impacts to a less than significant level at the identified impacted locations, except for two locations. These locations are one single family residence in Glendora (cluster WB6) and the Red Roof Inn in San Dimas (cluster EB1)—where the vibration impact could exceed 72 VdB threshold even with the combined mitigation that includes both the installation of floating slabs and reduced train speeds. Therefore, the vibration impacts at these two locations is considered significant and unavoidable.