

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

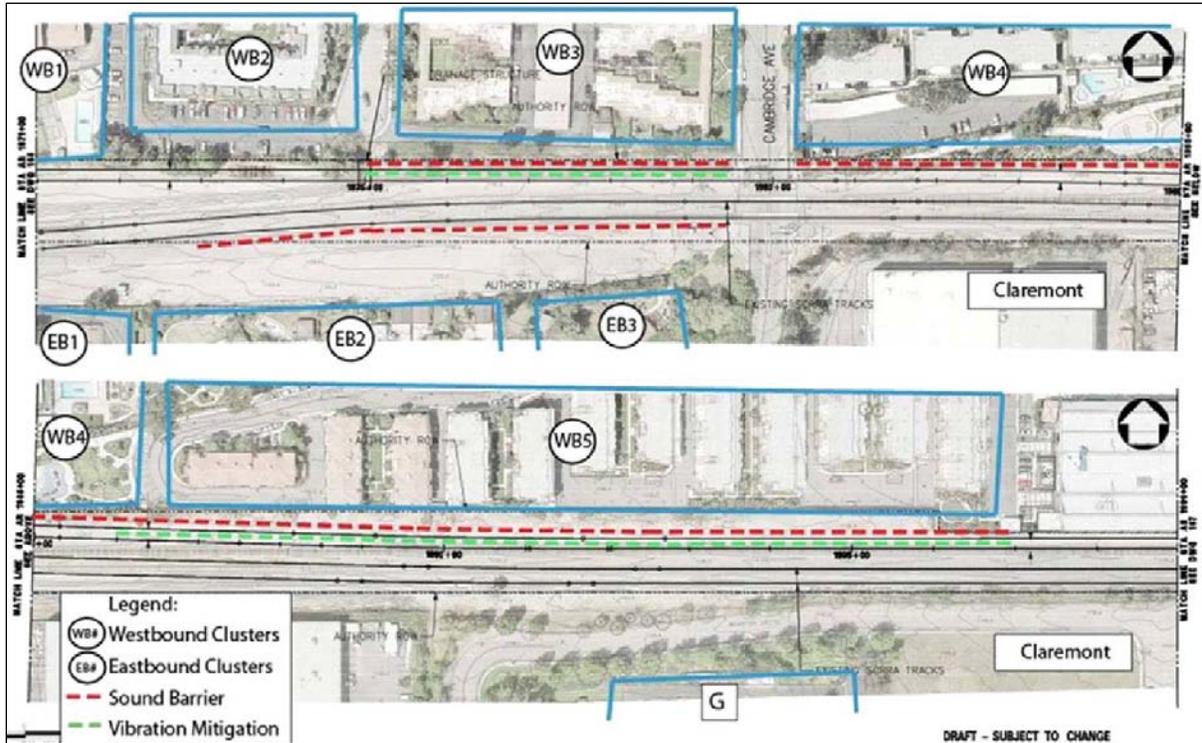
Cluster Number ¹	Cross Streets	Direction	Distance (feet) ²	Change in Distance (feet)	Predicted Current Band Max (VdB) ³	Predicted Future Band Max (VdB) ³	1/3 Octave Band (Hz) ⁴	Impact	Number of Impacts ⁵
Eastbound									
EB1	Towne Avenue/Cambridge Avenue	South	94	0	—	—	—	—	—
EB2	Towne Avenue/Cambridge 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.

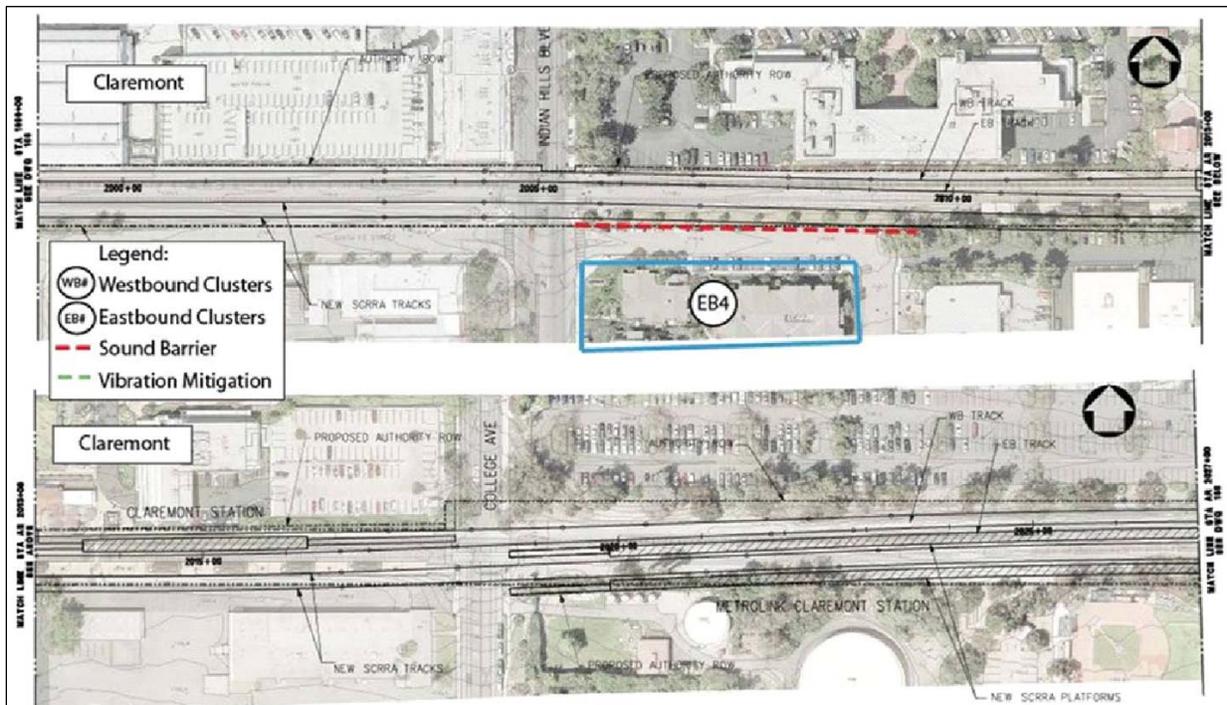
Westbound (WB) clusters are located north of the right-of-way and Eastbound (EB) clusters are located south of the right-of-way.

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.



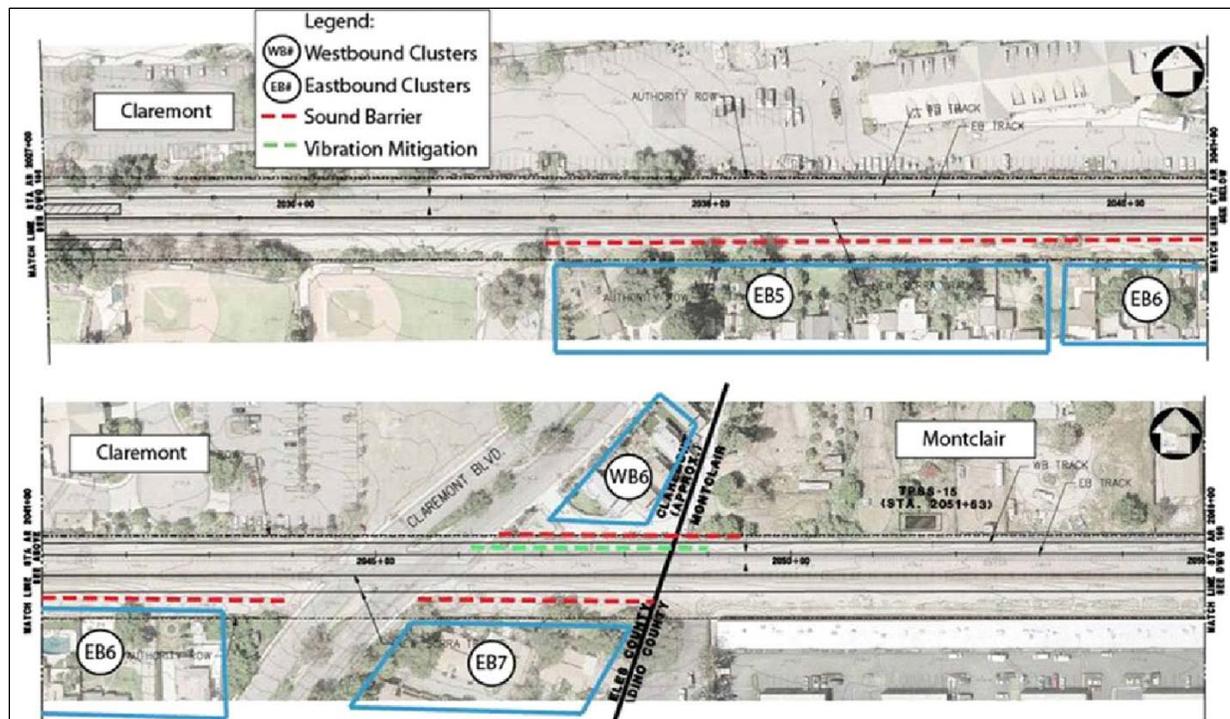
Source: ATS Consulting 2011

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 3.11–29³ 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 SCRR/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

¹Maximum 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

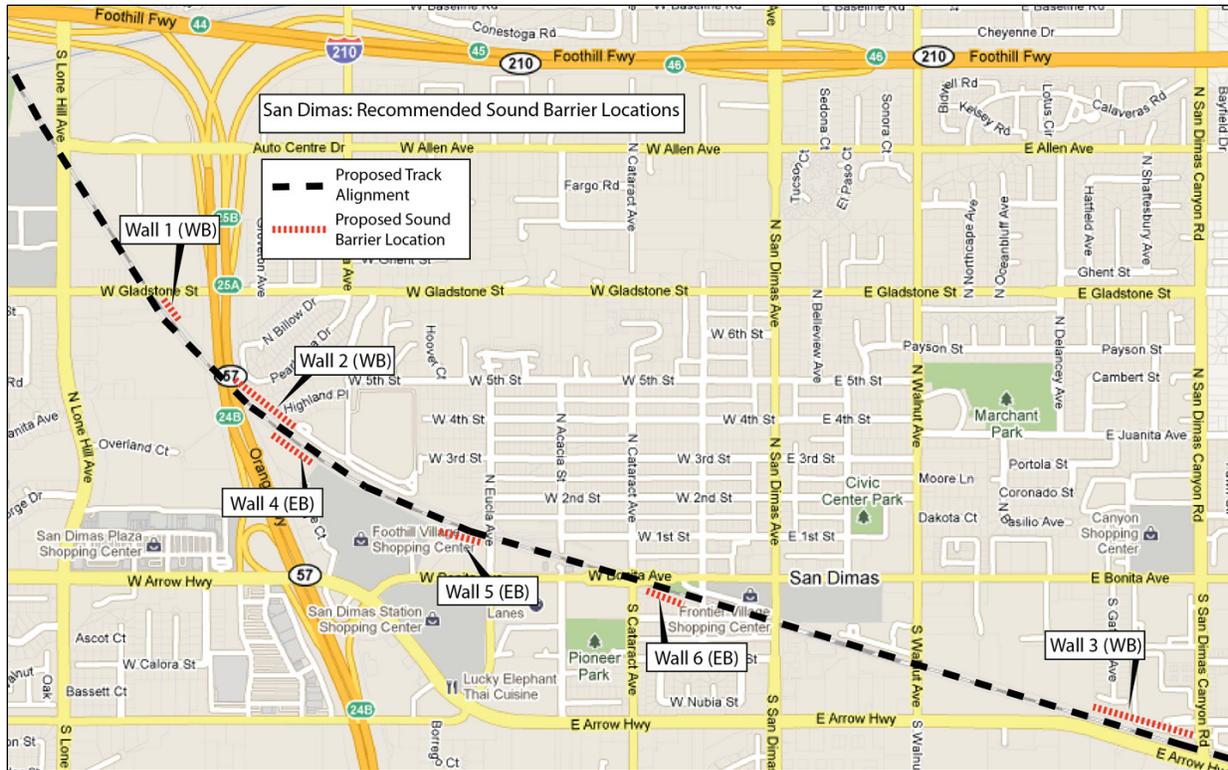
Note: Heights and lengths of the sound walls are subject to design refinements. Heights will be altered if quiet-zone waivers are granted for at-grade crossings.

¹ EB = toward Montclair (south side of tracks); WB = toward Azusa (north side of tracks)² Height above the top-of-rail



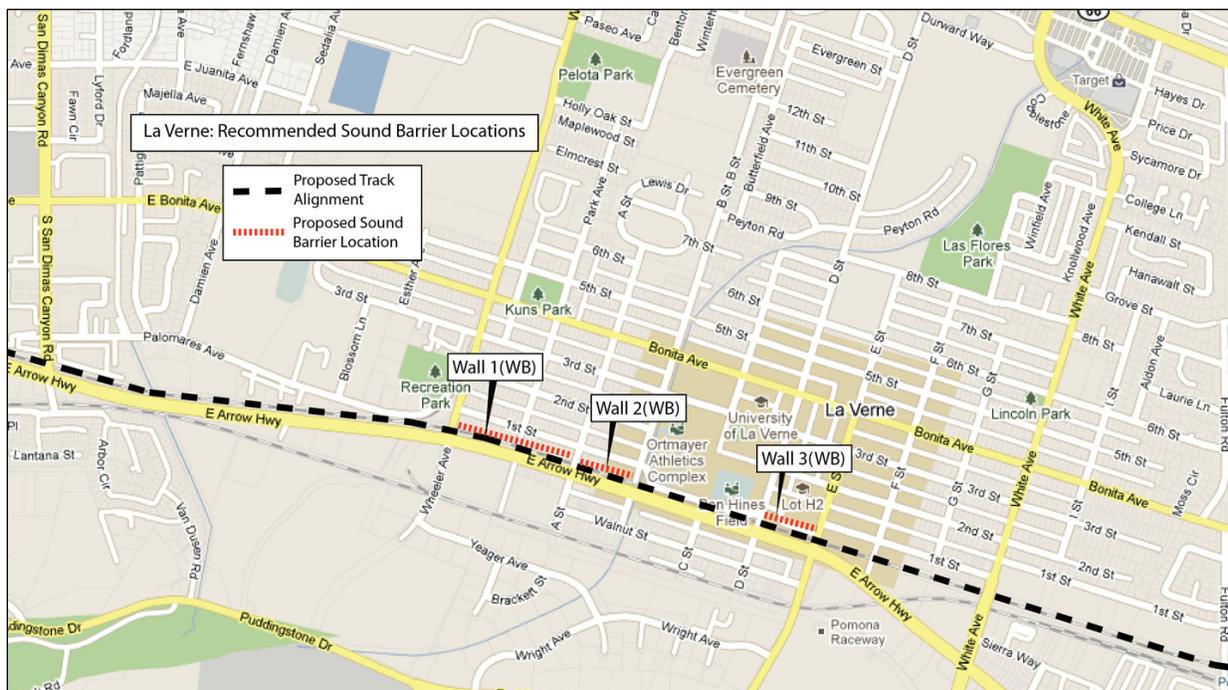
Source: ATS Consulting 2011

Figure 3.11-30. Glendora—Sound Barriers Location



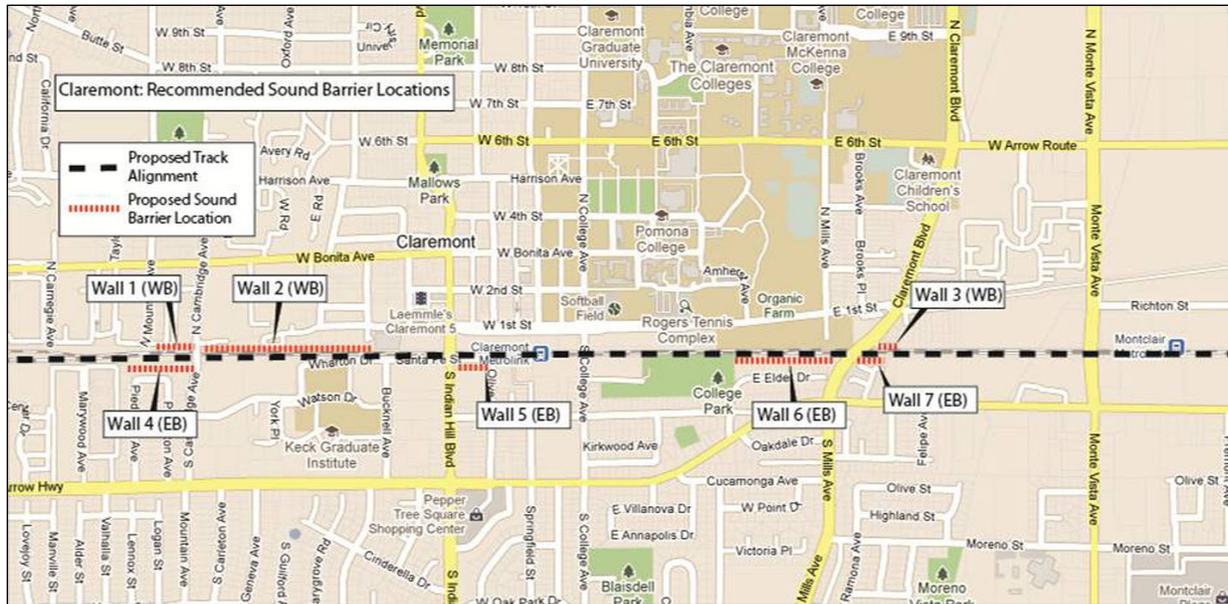
Source: ATS Consulting 2011

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.

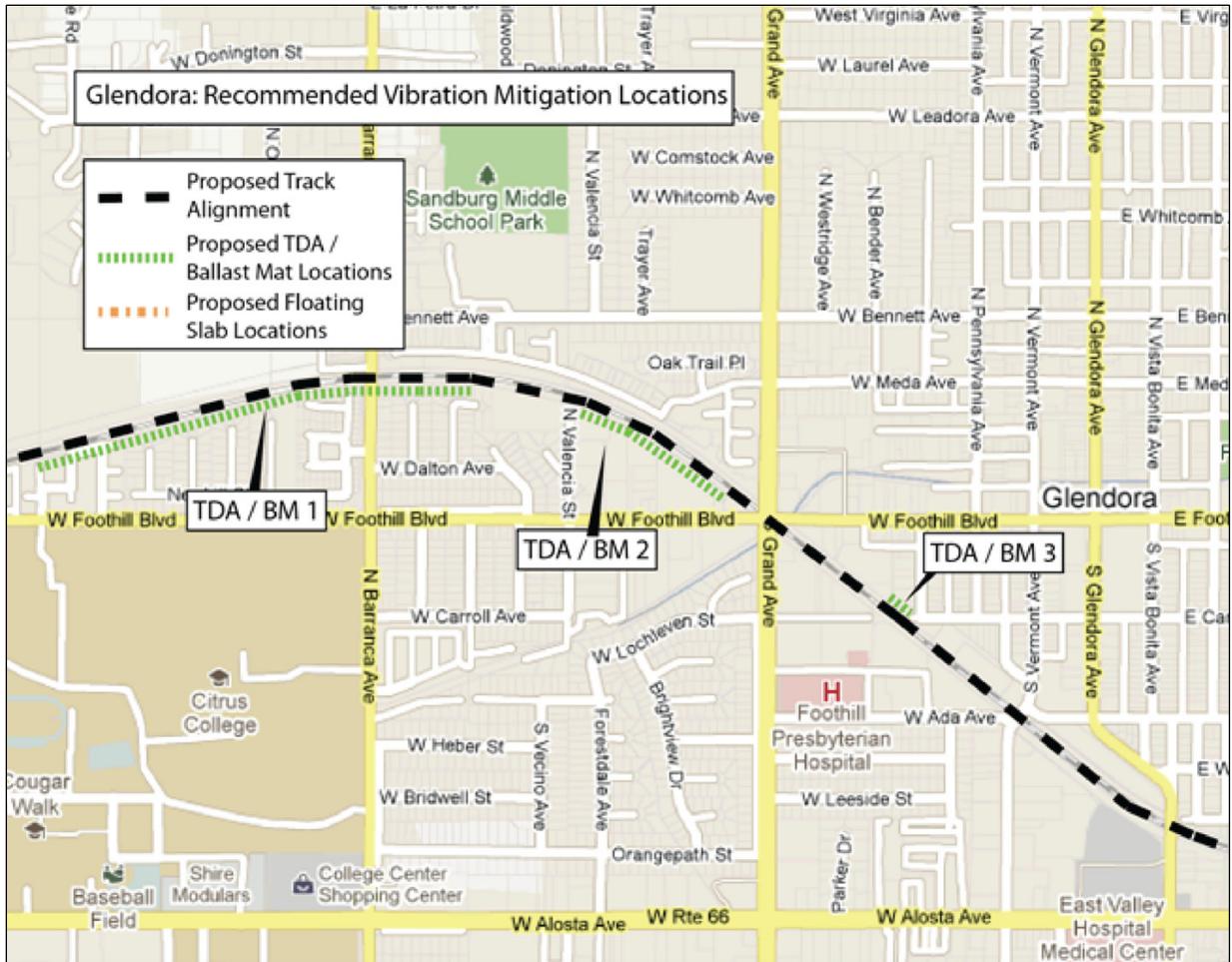
The predicted vibration levels with a train travelling at 65 mph at Glendora WB18 is equal to the FTA impact threshold of 72 VdB with mitigation from TDA or ballast mat. At this location, either a TDA, ballast mat, or a floating slab would be installed based on final design information that would reduce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

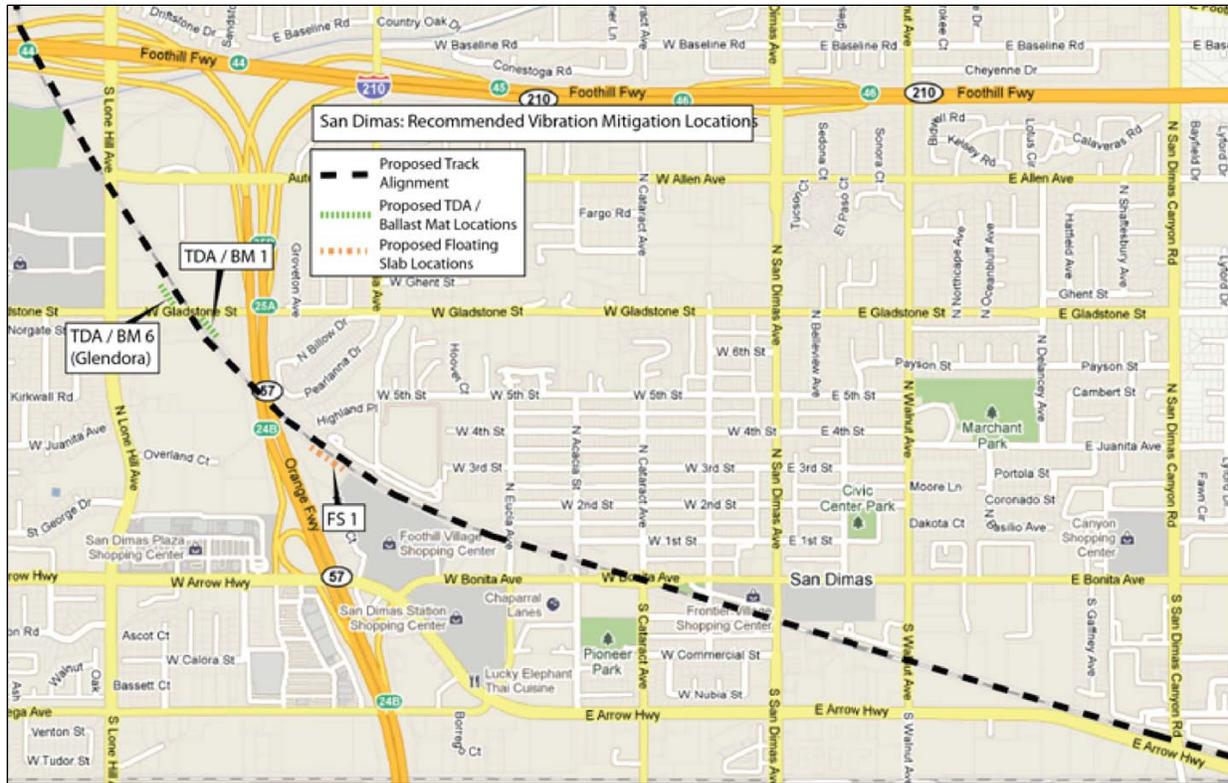
Source: ATS Consulting 2011

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



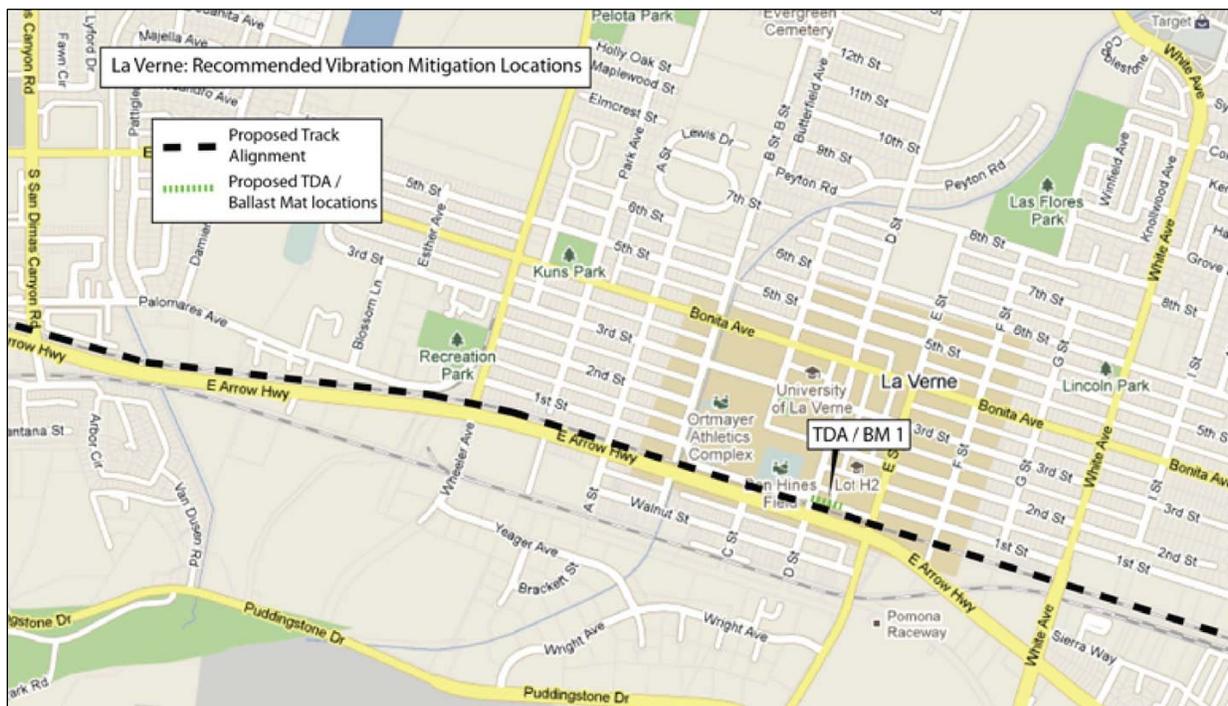
Source: ATS Consulting 2011

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