

### **3.14 NOISE AND VIBRATION**

#### **1. The Noise section of the CEQA Evaluation (Section 4.2.12 of the DEIR/DEIS) fails to identify the significant noise impact from the operation of the LRT maintenance yard.**

Noise from the LRT Maintenance Yard/Shop would result in a substantial permanent increase in ambient noise levels in the project vicinity. As shown in Table 4.2 on page 4-71 of the DEIR/DEIS, peak hour noise without the project is 56 dB at residences southeast of the maintenance yard. The table shows that the noise levels from the maintenance yard activities without mitigation would be 71.5 dB and noise levels with the planned sound wall would be 63.2 dB at these residences. According to the table, the LRT Maintenance Yard would result in an increase of 7.2 dB at residences southeast of the maintenance yard with mitigation.

**TABLE 4.2:  
LRT Maintenance Yard/Shop Noise Analysis**

Receptor	Peak-Hour Noise Level Without Project (dBA)	Maintenance Yard Reference Noise Level (dBA) <sup>1</sup>	Center of Activities Distance to Barrier (ft)	Center of Activities Distance to Receptor (ft)	Maintenance Yard Unmitigated Noise Level (dBA)	Barrier Height (ft)	LRT Noise Level With Barrier (dBA)
Northeast Residential	59.0	82.4	195	200	70.4	8	60.4
Southeast Residential	56.0	82.4	60	175	71.5	8	63.2
Southwest Residential	66.0	82.4	130	325	66.1	8	54.2

<sup>1</sup> LSA Associates, Inc. (2014).

dBA = A-weighted decibels

ft = foot/feet

LRT = Light Rail Transit

Table 3.14.2 of Appendix N contains noise levels defining impact for transit project. When the existing noise exposure is 56 dB, an increase to greater than 62 dB would result in a severe noise impact at category 1 or 2 sites (residences are category 2 sites). Activities at the LRT maintenance yard would generate noise levels of 63.2 dB at residences southeast of the yard with mitigation. Noise from the maintenance yard would result in a substantial permanent increase in ambient noise levels at residences southeast of the maintenance yard and result in a significant impact. Section 4.2.12 of the CEQA evaluation should be revised to address this significant impact pursuant to Section 21081 of the CEQA Guidelines. Another concern at this location would be the potential for nighttime noise to similarly affect the residences southeast of the yard (in addition to the significant impact that occurs during the peak-hour as described above). Nighttime noise would have a greater impact on sensitive receptors and routine and emergency maintenance is often accomplished for mass transit systems during the night.

TABLE 3.14.2:  
**Noise Levels Defining Impact for Transit Projects**

Existing Noise Exposure $L_{eq}(h)$ or $L_{dn}$ (dBA) <sup>1</sup>	Project Noise Impact Exposure, <sup>1</sup> $L_{eq}(h)$ or $L_{dn}$ (dBA)					
	Category 1 or 2 Sites			Category 3 Sites		
	No Impact	Moderate Impact	Severe Impact	No Impact	Moderate Impact	Severe Impact
<43	<Ambient + 10	Ambient + 10-15	>Ambient + 15	<Ambient + 15	Ambient + 15-20	>Ambient + 20
43	<52	52-58	>58	<57	57-63	>63
44	<52	52-58	>58	<57	57-63	>63
45	<52	52-58	>58	<57	57-63	>63
46	<53	53-59	>59	<58	58-64	>64
47	<53	53-59	>59	<58	58-64	>64
48	<53	53-59	>59	<58	58-64	>64
49	<54	54-59	>59	<59	59-64	>64
50	<54	54-59	>59	<59	59-64	>64
51	<54	54-60	>60	<59	59-65	>65
52	<55	55-60	>60	<60	60-65	>65
53	<55	55-60	>60	<60	60-65	>65
54	<55	55-61	>61	<60	60-66	>66
55	<56	56-61	>61	<61	61-66	>66
56	<56	56-62	>62	<61	61-67	>67
57	<57	57-62	>62	<62	62-67	>67
58	<57	57-62	>62	<62	62-67	>67
59	<58	58-63	>63	<63	63-68	>68
60	<58	58-63	>63	<63	63-68	>68
61	<59	59-64	>64	<64	64-69	>69
62	<59	59-64	>64	<64	64-69	>69
63	<60	60-65	>65	<65	65-70	>70
64	<61	61-65	>65	<66	66-70	>70
65	<61	61-66	>66	<66	66-71	>71
66	<62	62-67	>67	<67	67-72	>72
67	<63	63-67	>67	<68	68-72	>72
68	<63	63-68	>68	<68	68-73	>73
69	<64	64-69	>69	<69	69-74	>74
70	<65	65-69	>69	<70	70-74	>74
71	<66	66-70	>70	<71	71-75	>75
72	<66	66-71	>71	<71	71-76	>76
73	<66	66-71	>71	<71	71-76	>76
74	<66	66-72	>72	<71	71-77	>77
75	<66	66-73	>73	<71	71-78	>78
76	<66	66-74	>74	<71	71-79	>79
77	<66	66-74	>74	<71	71-79	>79
>77	<66	66-75	>75	<71	71-80	>80

Source: Noise Study Report (2014).

<sup>1</sup>  $L_{dn}$  is used for land use where nighttime sensitivity is a factor;  $L_{eq}$  during the hour of maximum transit noise exposure is used for land use involving only daytime activities.

dBA = A-weighted decibels

$L_{dn}$  = day-night average sound level

$L_{eq}(h)$  = 1-hour A-weighted equivalent continuous sound level

**2. The CEQA Noise Evaluation of Long-Term Stationary Noise Impacts (Page 4-70 to 4-71 of Section 4.2.12 of the DEIR/DEIS) does not provide noise criteria for the measurements, standards, or estimates included in the analysis.**

The Noise Evaluation should specify the criteria for each noise level (CNEL,  $L_{dn}$ ,  $L_{max}$ , hourly  $L_{eq}$ , etc.) to ensure that impacts are analyzed using proper comparisons. The evaluations would be very different if the noise levels are meant to be  $L_{max}$  as opposed to an hourly average  $L_{eq}$  or a

day/night average ( $L_{dn}$ ). It is impossible to review the analyses without knowing what noise criteria are intended for these standards.

**3. The CEQA Noise Evaluation (Section 4.2.12 of the DEIR/DEIS) fails to address noise from LRT Alternative and Freeway Tunnel Alternative ventilation systems.**

The Freeway Tunnel Alternative includes a ventilation system with two exhaust fans at each portal, an exhaust duct along the entire length of the tunnel, jet fans, and ventilation structures. The LRT Alternative also includes a ventilation system within the LRT tunnel. The noise impacts of these ventilation systems are not discussed in section 4.2.12 and should be included in the CEQA Noise Evaluation. What are the noise levels and reference distances of each of the ventilation structures and what is the noise level from the structures at the nearest sensitive receptors? Since ventilation is needed 24/7, these continuous noise levels need to be analyzed in comparison to lower nighttime standards.

**4. The DEIR/DEIS fails to substantiate purported noise reductions.**

The Draft EIR/EIS Volume 1, page 3.1-49, references “Policy 2c: The City will encourage the use of alternative transportation modes as stipulated in the Mobility Element (walking, bicycling, transit use, electric vehicles) to minimize traffic noise in the City”. The document states “The Freeway Tunnel Alternative would reduce noise pollution by increasing the availability of alternative transportation modes in the study area. Therefore, the Freeway Tunnel Alternative would be consistent with Policy 2c.”

The above consistency determination is not substantiated because the document fails to analyze and substantiate how noise pollution would be reduced and fails to consider whether local noise increases related to increased regional traffic and noise amplification related to the tunnel portals would negate reductions in noise pollution. In addition, this consistency determination is ingenuous at best. The tunnel and the availability of alternative transportation modes are not a cause-and-effect relationship and are not symbiotic.

**5. The DEIR/DEIS fails to recognize Ambassador Auditorium as a sensitive receptor, or assess construction and long-term noise and vibration impacts against the appropriate thresholds for a concert hall.**

The Draft EIR/EIS does not acknowledge that Ambassador Auditorium is a historic, world-class concert hall with a lower threshold for impact levels. Throughout the report, receptor, FR-121 is classified as a ‘church’ without recognizing that it has a dual use. Ambassador Auditorium is a prized cultural and historic landmark for both the City of Pasadena and the San Gabriel Valley. As stated on the concert hall’s website,

*“Its magnificent walls have reverberated with the sound of applause from 2.5 million concertgoers at over 2,500 concerts, while achieving a world-renowned reputation as one of the world's finest performance halls. Since opening in 1974 when the Vienna Symphony Orchestra performed at its inauguration, the acoustically perfect auditorium hosted such famed performers as Luciano Pavarotti, Pearl Bailey, Yo-Yo Ma, and*

*Vladimir Horowitz. After playing the auditorium, many of these artists concluded the acoustics exceeded those of Carnegie Hall. During its heyday, advertisements proclaimed, "The stars shine brighter at Ambassador." Among that talented constellation of performers were Emmylou Harris, Roy Clark, Ella Fitzgerald, Hal Holbrook, Dave Grusin, Placido Domingo, Leontyne Price, Jessye Norman, Bob Hope, Gene Kelly, Ray Charles, the Dance Theater of Harlem, the Vienna Boys Choir, Peking Acrobats, American Indian Dance Company and so many others."*

As such, it meets the criteria for 'Special Land Use' with lower vibration and noise impact levels as shown in Appendix N. Table 3.14.5.

**TABLE 3.14.5:  
 Criteria for Special Land Use Categories**

Type of Building or Room	Ground-Borne Vibration Impact Levels (VdB re: 1 micro-inch/second)		Ground-Borne Noise Impact Levels (dB re: 20 micro-Pascals)	
	Frequent Events <sup>1</sup>	Occasional or Infrequent Events <sup>2</sup>	Frequent Events <sup>1</sup>	Occasional or Infrequent Events <sup>2</sup>
Concert Halls	65 VdB	65 VdB	25 dBA	25 dBA
Television Studios	65 VdB	65 VdB	25 dBA	25 dBA
Recording Studios	65 VdB	65 VdB	25 dBA	25 dBA
Auditoriums	72 VdB	80 VdB	30 dBA	38 dBA
Theaters	72 VdB	80 VdB	30 dBA	43 dBA

Source: *Groundborne Noise and Vibration Impacts Report* (2014).

Note: If the building will rarely be occupied when trains are operating, there is no need to consider impact. As an example, consider locating a commuter rail line next to a concert hall. If no commuter trains will operate after 7:00 p.m., it should be rare that the trains will interfere with the use of the hall.

<sup>1</sup> "Frequent Events" is defined as more than 70 vibration events of the same source per day. Most rapid transit projects fall into this category.

<sup>2</sup> "Occasional or Infrequent Events" is defined as fewer than 70 vibration events per day. This category includes most commuter rail systems.

dB = decibels

dBA = A-weighted decibels

VdB = vibration velocity decibels

Ambassador Auditorium is approximately 200 feet from the north portal construction site and proposed freeway, and very close to the tunnel exit. The concert hall stage is immediately adjacent to Saint John Avenue. Both construction and long-term vibration and noise effects could impact sound quality during performances and recordings of performances in the auditorium. The DEIR/DIES should analyze both the construction and long-term effects of vibration and noise that could occur at this sensitive receptor to determine if they exceed acceptable criteria.

In Sec. 3.3 Community Impacts, page 3.3-34, the DEIR/DEIS lists community facilities that could experience long-term noise effects from the Freeway Tunnel Alternative. It lists Maranatha High School, located immediately south of Ambassador Auditorium, but omits any discussion of Ambassador Auditorium. However, Ambassador Auditorium is mentioned as part of the Ambassador West Cultural Landscape Historic District in Section 3.7, Cultural Resources. In Table 3.7.4, 'Effects of the Non-Tunnel Segments of the Freeway Tunnel Alternative on Historical Properties in the Area of Potential Effects', it is stated,

*The Freeway Tunnel Alternative may introduce visual or audible elements that may diminish the integrity of the significant historic features of this Historic District. In the long term, the visual and audible elements would be associated with traffic traveling into/out of the tunnels. Based on the Noise Study Report, the noise level in the east part of this Historic District along South St. John Avenue, which is the area that would be nearest the North Portal and the closest to noise related to traffic entering and leaving the tunnel(s), would increase 11 dB from both the Existing and Future No Build noise level of 61 dB (i.e., up to 72 dB).*

*The indirect changes to noise levels and visual effects as a result of increased traffic along the eastern boundary of this Historic District would not detract from the essential physical features or characteristics of the District that qualify it for inclusion in the National Register because they would occur in areas along busy roads in an urban area and, once completed, would not prevent the continued occupation and intended use of the contributing elements of this Historic District as part of a school campus. None of the proposed improvements occurring outside the District would cross the resource's boundary. Therefore, under the both the single-bore and dual-bore design variations of the Freeway Tunnel Alternative, the proposed alterations at the District described above would result in No Adverse Effect. In summary, the effect finding of the Freeway Tunnel Alternative improvements on this Historic District would be No Adverse Effect. .*

For any transit project, a noise increase from 61 dB to 72 dB (an 11 dB increase) represents a severe impact, far exceeding the allowable noise exposure increase (See Appendix N, Table 3.14.2 and Table 3.14.3) and requiring mitigation. Using the concert hall criteria, this impact is even more severe.

**TABLE 3.14.3:  
 Noise Impact Criteria – Effect on Cumulative Noise Exposure**

<b>L<sub>dn</sub> or L<sub>eq</sub> (in dBA rounded to nearest whole decibel)</b>			
<b>Existing Noise Exposure</b>	<b>Allowable Project Noise Exposure</b>	<b>Allowable Combined Total Noise Exposure</b>	<b>Allowable Noise Exposure Increase</b>
45	51	52	7
50	53	55	5
55	55	58	3
60	57	62	2
65	60	66	1
70	64	71	1
75	65	75	0

Source: *Noise Study Report* (2014).

dBA = A-weighted decibels

L<sub>eq</sub> = equivalent continuous sound level

L<sub>dn</sub> = day-night average sound level

In the Noise Study Report, Volume 1, Table B.6, receptor FR-121 (corresponding to Ambassador Auditorium) is assigned to having a Noise Abatement Criteria 'D', per NEPA 23 CFR71 for interior locations. This corresponds to a Leq(h) of 52 and a L10(h) of 55. However, there is no evidence that an interior analysis was performed. In Section S.1 of the Noise Study Report Volume 1, it states, "13 schools were evaluated for potential long-term interior noise impacts associated with project operations". There is no mention of Ambassador Auditorium, or if noise abatement criteria 'D' can be successfully implemented without damage to both the concert hall's historic building or sound quality.

There is also no evidence that a ground-borne vibrational impact analysis was performed for Ambassador Auditorium. It appears that the only ground-borne analysis performed was for Grifols Pharmaceutical at the south tunnel portal (Volume 1, on page 3.14-10). The document states "at a distance of 450 feet, a conservative estimate of the ground-borne vibration during tunnel boring is approximately 0.0018 in/sec root mean square (RMS). This is equivalent to a vibration level of 65 VdB." No reference was given for this tunnel boring ground vibration level and it was not stated if the TBM was assumed to be exposed or underground at some depth. Also, it was not stated how the vibration would change if two TBMs operated at the same time.

Consequently, the analysis cannot be validated. Even so, the 65 VdB estimate is the same as the threshold criteria for concert halls as shown in Appendix N, Table 3.14.5. While Ambassador Auditorium may be more than 450 feet from the planned TBM bored-tunnel start point, it is very close to the tunnel construction site where the TBMs will be assembled and tested, presumably to their maximum capability. Consequently, the ground-borne vibrations during testing may have a large impact on the concert hall.

**6. The DEIR/DEIS fails to address either short or long-term noise impacts associated with the reasonable possibility of having to fix a failed Tunnel Boring Machine (TBM).**

The real possibility of a TBM breakdown and typical TBM recovery scenarios are covered in the Construction section of this document. This EIR/EIS failed to assess the noise impacts to communities along the tunnel route if a TBM recovery operation were required. As evidenced by the Seattle Alaskan Viaduct tunnel breakdown, such recovery scenarios could require very large construction sites and operations lasting years. Also, noise impacts related to moving equipment and workers to/from the construction site could impact all communities along transportation routes between the portals and the construction site.

**7. The DEIR/DEIS does not analyze noise from the TBM during the construction of the LRT or freeway Tunnel Alternative, or from other special equipment required to build a 60' diameter tunnel.**

When analyzing construction noise the DEIR/DEIS refers to typical construction equipment noise levels in **Table 3.14.20** on page N-45 of the Appendix N, but this list does not include Tunnel Boring Machines (TBMs), or other special equipment required to build a 60' diameter tunnel. For the 60' diameter tunnels, equipment is likely to include a slurry filtering/recycling plant, trains to move muck, a dewatering plant, a tunnel lining segment plant, and very large crawling cranes.

What are the noise levels for TBMs in their different operating modes? How do noise levels change as function of depth from the surface? What would the noise levels of TBMs be when operated near the tunnel portals? The document should provide a reference noise level for TBMs, as well as analyze the noise levels of the TBMs.

What other special construction facilities and equipment will be used to build the 60' diameter tunnels? What are their noise and vibration levels and for different operating modes? What will be the cumulative noise and vibration effects of this equipment? When will this equipment be allowed to operate? When is it planned to operate?

**8. DEIR/DEIS does not adequately analyze or assess the impacts resulting from TBM vibrations for either the LRT or the Freeway Alternative.**

The document fails to adequately discuss vibrations that could be generated by TBMs during the construction of the LRT and Freeway Alternatives. For example, in Volume 1, page 3.14-10, only one ground-borne vibration analysis is discussed. This is for the freeway alternative and the analysis estimates the vibration impact for Grifols Pharmaceutical at the south tunnel portal. Key analysis assumptions are not provided and there is insufficient information to verify this analysis. For other broadly stated scenarios, claims of 'no impact' are made without evidence.

For example, on page 3.14-9 of the DEIR/DEIS, it is stated "there may be a very short-term vibration impact (up to 3 days) due to TBM operation when the tunnel is being constructed directly below a sensitive receiver. This level of vibration would not be capable of producing damage to structures". The DEIR/DEIS does not estimate the level of vibration at sensitive receivers either above or adjacent to tunnel boring activities; therefore, it is impossible to determine whether TBM vibrations would be capable of exceeding vibration impact levels or result in damage to structures in the vicinity of tunnel-boring.

In order to adequately analyze the vibrational impacts of the TBMs, the document should estimate the level of vibration that would occur at receivers in the vicinity of tunnel boring. The vibrational estimates should then be compared to the Impact Criteria Tables (Tables 3.14.4 through 3.14-6) contained in Appendix N to determine if vibration from TBMs would result in significant impacts. The project includes four TBMs, so the calculations should include the cumulative vibration level if two or more TBMs are working in the same area. A sufficient number of reference scenarios should be presented that represent the range of conditions. Major error sources should be identified.

Furthermore, references should be given for TBM vibration levels under different conditions; for example, operating above ground, operating partially buried, operating fully buried and for different depths, soil conditions and operating modes.

**9. The DEIR/DEIS does not analyze the vibrational impacts of potential blasting used for excavating the LRT and Freeway Tunnel alternatives.**

On page 3.14-9 of the DEIR/DEIS, it is stated that "No blasting is anticipated; however, if higher

strength bedrock is expected in the cut-and-cover sections or in the excavation of the cross passages, controlled blasting methods may be evaluated. This would be determined when more detailed geotechnical information is evaluated for these areas.” The preliminary evaluation of geotechnical information should have been performed prior to the submittal of the Draft EIR/EIS. Without this information, environmental impacts cannot be assessed. Blasting impacts and mitigation measures should be included in the Final EIR/EIS because the document leaves open the possibility that blasting may be required as part of the project. This blasting would not be trivial, as it would be for hard rock material that can't be penetrated by the TBM. The use and mitigation measures for explosives should be evaluated now.

**10. Continuous tunnel-boring operations would conflict with local noise regulations and result in a significant noise impact.**

In Volume 1, page 2-58 of the DEIR/DIES it is stated: “Tunnel boring operations and muck handling could potentially occur 24 hours per day, 7 days per week.” Continuous construction activities would not comply with local noise regulations of the cities of Pasadena and Los Angeles where tunnel boring would occur. The noise regulations for the cities are listed on page 26 of the SR 710 Noise Study Report, Volume 1.

Section 9.36.070 of the City of Pasadena Municipal Code limits construction-related noise within a residential district or within a radius of 500 feet to between the hours of 7:00 a.m. and 7:00 p.m. Monday through Friday and between the hours of 8:00 a.m. and 5:00 p.m. on Saturdays. Construction-related activities are prohibited on Sundays and holidays. Section 12.08.440 of the Los Angeles County Code limits construction-related noise that creates a noise disturbance across a residential or commercial real- property line between weekday hours of 7:00 p.m. and 7:00 a.m. or at any time on Sundays or holidays.

Construction noise occurring outside of the allowable hours contained in the Municipal Codes for the cities of Pasadena and Los Angeles County would exceed local noise standards and would result in a significant impact. The significance determination must be corrected, and the DEIR/DEIS will need to be recirculated for further public review.

**11. The noise model for the tunnel alternative north portal may be invalid; there is evidence that at least some model parameters incorrectly assumed that the tunnel(s) exit is approximately 1500 feet south of the proposed location.**

The proposed tunnel north exit is planned to be just north of Del Mar Blvd; however, at least one part of the noise model appears to have assumed that it is located much further south near the Sequoyah School. The first piece of evidence for this is in the Draft EIR/EIS Noise Abatement Decision Report Vol. II, Figures 2-3 and 2-4, which shows the end of the tunnel at the bored segment / cut-and-cover segment boundary rather than where the cut-and-cover tunnel exits. See Figure A. The second piece of evidence is given in the Draft EIR/EIS Noise Abatement Decision Report Vol. I, Sec. 7.1.3, Freeway Tunnel Alternative, pg. 91, where it is stated

*“Additionally, in reference to Table 15 of the National Cooperative Highway Research Program (NCHRP) Report 791: Supplemental Guidance of the Application of FHWA’s*

*Traffic Noise Model (TNM) (Transportation Research Board 2014), an additional 1 dBA was added to the future build levels of Receptors FR-44, FR-62, FR-63 and FR-129 to FR-131 due to their proximity to the tunnel openings.”*

Receptors F-62, F-63 and FR-129 to FR-131 are located near the Sequoia School, approximately 1500 feet south of the actual tunnel exit. This is also shown in Figure A.

Figure A: Draft EIR/EIS Noise Abatement Decision Report Vol. II, Figure 2-4



**12. The noise model did not use conservative estimates for modeling tunnel effects near the tunnel openings; consequently environmental impacts are underestimated, including for the Maranatha School and Ambassador Auditorium.**

In the State Route 710 Noise Study Report Volume I, Sec. 7.1.3, Freeway Tunnel Alternative, pg. 91, it is stated that.

*“Additionally, in reference to Table 15 of the National Cooperative Highway Research Program (NCHRP) Report 791: Supplemental Guidance of the Application of FHWA’s Traffic Noise Model (TNM) (Transportation Research Board 2014), an additional 1 dBA was added to the future build levels of Receptors FR-44, FR-62, FR-63 and FR-129 to FR-131 due to their proximity to the tunnel openings.”*

However, in the stated reference document, Appendix L Tunnel Openings, Sec. Sec. L.5, Tunnel Affects, page L-12, it states

*“when the contribution from the road outside the tunnel is combined with tunnel-radiated noise, the overall effect ranges from 0 to 5 dBA. In general, the tunnel effect may be as much as 5 dBA in close proximity to long tunnels and less than 1 dBA at distances of 100 meters, or more, from the centerline of the roadway.”*

Several sensitive receptors are less than 100 meters from the tunnel exits, including the Maranatha School and Ambassador Auditorium.

**13. The noise environmental impact for Receptor FR-71 is incorrect.**

Receptor FR-71 has been improperly classified as vacant land. This site is currently occupied by apartment buildings. Consequently, the noise environmental impact is incorrect for this land parcel.