4.6 NOISE AND VIBRATION

4.6.1 Introduction

This section describes the existing noise setting of the project site, identifies associated regulatory requirements, evaluates potential impacts, and identifies mitigation measures related to implementation of the proposed McKinley Village Project (proposed project). Specifically, this section analyzes potential noise and vibration impacts due to and upon development of residential uses associated with the adjacent Capital City Freeway and Union Pacific Railroad (UPRR) tracks.

Comments received in response to the Notice of Preparation (see Appendix A) include comments with respect to impacts from a project-related increase in traffic noise and impacts upon the project from noise caused by existing trains passing by the site. Comments requested that the project's interior and exterior noise levels be addressed and that the project meet the City's noise standards and Municipal Code for residential uses. A comment letter from UPRR requested that the City should consider including a mitigation measure that requires disclosure to future homeowners of noise and vibration associated with the adjacent UPRR tracks. UPRR also requested that the project include sound barriers, landscape buffers, and soundproofing materials. Comments were also received regarding vibration from the adjacent UPRR tracks. All of these concerns are addressed in the section.

A few comments requested that the increase in noise associated with the project be evaluated to determine its potential effect on wildlife living along the American River Parkway and in Sutter's Landing Regional Park. Most of the wildlife living in these areas of the City have adapted to an urban environment that includes noise from traffic, airplanes, and trains. Common wildlife living along the American River and Sutter's Landing Regional Park have adapted to urban noise, and noise associated with project operation would not be any different than the existing ambient environment. Therefore, this issue is not further evaluated in this section.

Information in this section is based upon data provided in the Noise Report prepared by Bollard Acoustical Consulting (see Appendix I), the City of Sacramento 2030 General Plan and the City's Municipal Code, as well as information provided by the project applicant and UPRR and other various sources pertaining to operation and construction of the project.

4.6.2 Environmental Setting

Fundamentals and Terminology

Acoustics is the science of sound. Sound may be thought of as mechanical energy of a vibrating object transmitted by pressure waves through a medium to human (or animal) ears. If the pressure variations occur frequently enough (at least 20 times per second), then they can be heard and are called sound. The number of pressure variations per second is called the frequency of sound, and is expressed as cycles per second or hertz (Hz).

Noise is a subjective reaction to different types of sounds. Noise is typically defined as (airborne) sound that is loud, unpleasant, unexpected, or undesired, and may therefore be classified as a more specific group of sounds. Perceptions of sound and noise are highly subjective from person to person.

Measuring sound directly in terms of pressure would require a very large and awkward range of numbers. To avoid this, the decibel scale was devised. The decibel scale uses the hearing threshold (20 micropascals) as a point of reference, defined as 0 dB. Other sound pressures are then compared to this reference pressure, and the logarithm is taken to keep the numbers in a practical range. The decibel scale allows a million-fold increase in pressure to be expressed as 120 dB, and changes in levels (dB) correspond closely to human perception of relative loudness.

The perceived loudness of sounds is dependent upon many factors, including sound pressure level and frequency content. However, within the usual range of environmental noise levels, perception of loudness is relatively predictable, and can be approximated by A-weighted sound levels. There is a strong correlation between A-weighted sound levels (expressed as dBA) and the way the human ear perceives sound. For this reason, the A-weighted sound level has become the standard tool of environmental noise assessment. All noise levels reported in this section are in terms of A-weighted levels, expressed as dBA, unless otherwise noted.

The decibel scale is logarithmic, not linear. In other words, two sound levels 10 dB apart differ in acoustic energy by a factor of 10. When the standard logarithmic decibel is A-weighted, an increase of 10 dBA is generally perceived as a doubling in loudness. For example, a 70 dBA sound is half as loud as an 80 dBA sound and twice as loud as a 60 dBA sound.

Community noise is commonly described in terms of the ambient noise level, which is defined as the all-encompassing noise level associated with a given environment. A common statistical tool is the average, or equivalent, sound level (L_{eq}), which corresponds to a steady-state A-weighted sound level containing the same total energy as a time varying signal over a given time period (usually 1 hour). The L_{eq} is the foundation of the composite noise descriptor, L_{dn}, and shows very good correlation with community response to noise.

The day/night average level (L_{dn}) is based upon the average noise level over a 24-hour day, with a +10 decibel weighting applied to noise occurring during nighttime (10:00 p.m.–7:00 a.m.) hours. The nighttime penalty is based upon the assumption that people react to nighttime noise exposures as though they were twice as loud as daytime exposures. Because L_{dn} represents a 24-hour average, it tends to disguise short-term variations in the noise environment.

Table 4.6-1 lists several examples of the noise levels associated with common situations.

Table 4.6-1
Typical A-Weighted Sound Levels of Common Noise Sources

Decibels	Description
120	Jet aircraft at 100 feet/Threshold of Pain
110	Riveting machine at operator's position
100	Shotgun at 200 feet
90	Bulldozer at 50 feet
80	Diesel locomotive at 300 feet
70	Commercial jet aircraft interior during flight
60	Normal conversation speech at 5–10 feet
50	Open office background level
40	Background level within a residence
30	Soft whisper at 2 feet
20	Interior of recording studio

Source: See Appendix I.

Effects of Noise on People

The effects of noise on people can be placed in three categories:

- Subjective effects of annoyance, nuisance, and dissatisfaction;
- Interference with activities such as speech, sleep, and learning; and
- Physiological effects such as hearing loss or sudden startling.

Environmental noise typically produces effects in the first two categories. Workers in industrial plants can experience noise in the last category. There is no satisfactory way to measure the subjective effects of noise or the corresponding reactions of annoyance and dissatisfaction. A wide variation in individual thresholds of annoyance exists, and different tolerances to noise tend to develop based on an individual's past experiences with noise.

Thus, an important way of predicting a human reaction to a new noise environment is the way it compares to the existing environment to which one has adapted: the so-called ambient noise level. In general, the more a new noise exceeds the previously existing ambient noise level, the less acceptable the new noise will be judged by those hearing it.

With regard to increases in A-weighted noise level, the following relationships occur:

- Except in carefully controlled laboratory experiments, a change of 1 dBA cannot be perceived;
- Outside of the laboratory, a 3 dBA change is considered a just-perceivable difference;
- A change in level of at least 5 dBA is required before any noticeable change in human response would be expected; and
- A 10 dBA change is subjectively heard as approximately a doubling in loudness, and can cause an adverse response.

Stationary point sources of noise, including mechanical equipment at commercial or industrial sites or a group of construction equipment, attenuate (lessen) at a rate of approximately 6 dB per doubling of distance from the source; at greater distances from the source, environmental conditions (i.e., atmospheric conditions) can increase the attenuation, as can either vegetative or manufactured noise barriers at any distance between source and receiver. Moving point sources, typically represented by traffic along a roadway or train operations along a rail corridor, attenuate at a rate of approximately 4.5 dB per doubling of distance from the source, with the same considerations as point sources regarding atmospheric and barrier effects. Line sources, typically represented by extremely busy highways (i.e., I-80 as viewed from the Berkeley Hills), attenuate at a rate of approximately 3 dB per doubling of distance from the source.

Single-Event Noise and Sleep Disturbance

A single event is an individual distinct loud activity, such as a train passage, or any other brief and discrete noise-generating activity. Because most noise policies applicable to transportation noise sources are typically specified in terms of 24-hour-averaged descriptors, such as L_{dn} or community noise equivalent level (CNEL), the potential for annoyance or sleep disturbance associated with individual loud events can be masked by the averaging process.

Extensive studies have been conducted regarding the effects of single-event noise on sleep disturbance, with the Sound Exposure Level (SEL) metric being a common metric used for such assessments. SEL represents the entire sound energy of a given single-event normalized into a 1-second period regardless of event duration. As a result, the single-number SEL metric contains information pertaining to both event duration and intensity. There is currently no national consensus regarding the appropriateness of SEL criteria as a supplement or replacement for cumulative noise level metrics such as L_{dn} and CNEL. Nonetheless, because SEL describes a receiver's total noise exposure from a single impulsive event, SEL is often used to characterize noise from individual brief loud events.

Due to the wide variation in test subjects' reactions to noises of various levels (some test subjects were awakened by indoor SEL values of 50 dB, whereas others slept through indoor SEL values exceeding 80 dB), no definitive consensus has been reached with respect to a universal criterion to apply to environmental noise assessments. Sleep disturbance is recognized as intrinsically undesirable and, thus, is considered an adverse noise impact in and of itself. Sleep disturbance studies have developed predictive models of awakenings caused by transportation noise sources. Predicted awakening percentages as a function of indoor SELs are shown in Table 4.6-2.

Table 4.6-2
Sleep Disturbance as a Function of Single-Event Noise Exposure

Indoor SEL (dBA)	Average Percent Awakened
45	0.8%
50	1.0%
55	1.2%
60	1.5%
65	1.8%
70	2.2%
75	2.8%
80	3.4%
85	4.2%

Note: Average Percent Awakened = 0.58 + (4.30 * 10^{-8}) * SEL
Source: Finegold and Bartholomew 2001.

Vibration

According to the Federal Transit Administration Noise and Vibration Impact Assessment Guidelines (FTA-VA-90-06), ground-borne vibration can be a serious concern for nearby neighbors of a transit system route or maintenance facility, causing buildings to shake and rumbling sounds to be heard. Some common sources of ground-borne vibration are trains, buses on rough roads, and construction activities such as blasting, pile-driving and operating heavy earth-moving equipment.

The effects of ground-borne vibration include “feelable” movement of the building floors, rattling of windows, shaking of items on shelves or hanging on walls, and rumbling sounds. In extreme cases, the vibration can cause damage to buildings. Annoyance from vibration often occurs when the vibration exceeds the threshold of perception by only a small margin. A vibration level that causes annoyance will be well below the damage threshold for normal buildings.

Train wheels rolling on rails create vibration energy that is transmitted through the track support system into the ground, creating vibration waves that propagate through the various soil and rock strata to the foundations of nearby buildings. The vibration of floors and walls may cause perceptible vibration, rattling of items such as windows or dishes on shelves, or a rumble noise. The rumble is the noise radiated from the motion of the room surfaces. In essence, the room surfaces act like a giant loudspeaker causing what is called ground-borne noise.

Vibration can be described in terms of acceleration, velocity, or displacement. A common practice is to monitor vibration measures in terms of peak particle velocities (inches/second). Table 4.6-3 shows expected responses to different levels of ground-borne vibration.

Table 4.6-3
General Human and Structural Responses to Vibration Levels

Response	Peak Vibration Threshold (in./sec. ppv)
Structural damage to commercial structures	6
Structural damage to residential structures	2
Architectural damage to structures (cracking, etc.)	1
General threshold of human annoyance	0.1
Approximate threshold of human perception	0.01

Note: in./sec. ppv = inches/second peak particle velocity
Source: Caltrans 1976.

Existing Land Uses in the Project Vicinity

The project site is currently unimproved. Nearby land uses include the City's former 28th Street Landfill, residential, office, light industrial, and commercial uses, the Capital City Freeway, and the UPRR tracks. The UPRR tracks are located on an elevated berm which separates the project site from the existing land uses to the south and east. Adjacent uses to the south include office and light industrial uses along the north side of C Street and residential uses along B Street and the south side of C Street. Adjacent uses to the east include residential uses in River Park. The property currently has access via a two-lane overpass (A Street Bridge) over Capital City Freeway from the west that connects to the downtown grid system at 28th Street and A Street.

Existing Noise and Vibration Environment in the Project Vicinity

The existing ambient noise environment in the immediate project vicinity is defined primarily by traffic on Capital City Freeway and UPRR train operations. Relative to traffic and rail noise, the project site noise environment is not appreciably affected by aircraft over flights, although departures from Sacramento International Airport are intermittently audible. Trains are the only appreciable source of vibration identified in the project vicinity.

Existing Traffic Noise Environment

In order to characterize on-site noise levels resulting from existing traffic volumes on Capital City Freeway, sound level meters were positioned along this roadway facility and continuous noise monitoring was conducted over a 4-day period spanning August 23–26, 2013. Figure 4.6-1 depicts the location of the noise measurements along Capital City Freeway.

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SOURCE: Bollard Acoustical Consultants 2013

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FIGURE 4.6-1

McKinley Village Project Location and Noise/Vibration Monitoring Sites

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Larson Davis Laboratories (LDL) Model 820 precision integrating sound level meters were used for the ambient noise level measurement surveys. The meters were calibrated before and after use with an LDL Model CAL200 acoustical calibrator to ensure the accuracy of the measurements. The equipment used meets all specifications of the American National Standards Institute for Type 1 sound level meters (ANSI S1.4).

The noise level meters were programmed to record the maximum and average hourly noise levels during the survey, among other descriptors, for each 1-hour period of the 4-day monitoring program. The average value, denoted L_{eq}, represents the energy average of all of the noise received by the sound level meter microphone during each 1-hour period. The hourly noise level data (L_{eq}) was used to calculate the average day/night noise level (L_{dn}). The noise level measurement results summary in terms of computed L_{dn} is provided in Table 4.6-4.

Table 4.6-4
Ambient Noise Monitoring Results – August 23–26, 2013

Site	Date	Day of Week	Primary Noise Source	L_{dn}, dBA
1	8-23-13 8-24-13 8-25-13 8-26-13	Friday Saturday Sunday Monday	Capital City Freeway	74 73 73 73 Average: 73
2	8-23-13 8-24-13 8-25-13 8-26-13	Friday Saturday Sunday Monday	Capital City Freeway	76 75 75 76 Average: 76
3	8-23-13 8-24-13 8-25-13 8-26-13	Friday Saturday Sunday Monday	Capital City Freeway & UPRR	81 80 79 80 Average: 80
4	8-23-13 8-24-13 8-25-13 8-26-13	Friday Saturday Sunday Monday	UPRR	64 61 62 67 Average: 64
5	8-23-13 8-24-13 8-25-13 8-26-13	Friday Saturday Sunday Monday	UPRR	67 67 68 69 Average: 68

Table 4.6-4
Ambient Noise Monitoring Results – August 23–26, 2013

Site	Date	Day of Week	Primary Noise Source	L_{dn}, dBA
6	8-23-13 8-24-13 8-25-13 8-26-13	Friday Saturday Sunday Monday	UPRR & Capital City Freeway	75 71 75 74 Average: 74

Source: Bollard Acoustical Consultants 2013.

The existing traffic noise environment on the project site is defined exclusively by traffic on Capital City Freeway. Traffic on surface streets to the south does not contribute to the noise levels on the project site due to the dominance of traffic noise from the freeway, low traffic volumes on surface streets, and the existing railroad embankment separating the project site from the local roadway network to the south. Figure 4.6-2 illustrates existing traffic noise contours for the site.

Existing Off-Site Roadway Noise

As discussed above, none of the local roads have the potential to affect on-site noise levels because the noise levels produced by Capital City Freeway are far greater at the site than any local road contribution. However, in order to assess project-related traffic noise effects off-site, existing roadway network noise levels must be identified.

In order to characterize local roadway network noise levels, the Federal Highway Administration Highway Traffic Noise Prediction Model (FHWA RD-77-108) was used to predict off-site traffic noise levels along roadways which would provide access to the project site.

The FHWA model is based upon the Calveno reference noise factors for automobiles, medium trucks and heavy trucks, with consideration given to vehicle volume, speed, roadway configuration, distance to the receiver, and the acoustical characteristics of the site. The FHWA model was developed to predict hourly L_{eq} values for free-flowing traffic conditions. To predict noise levels in terms of L_{dn}, the daytime and nighttime distribution of traffic must be included in the computations.

Existing arterial traffic volumes were obtained from a traffic analysis prepared for this project by Fehr and Peers Transportation Consultants. Truck usage on the local area roadways was estimated from published Caltrans 2011 truck classification counts, Bollard Acoustical Consultants Inc. site observations, and file data for similar arterial roadways.

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SOURCE: ESRI 2013

FIGURE 4.6-2

Existing Traffic Noise Contour Map

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Table 4.6-5 shows the predicted baseline traffic noise levels in terms of the Day/Night Average Level descriptor (L_{dn}) at a standardized reference distance of 50 feet from the centerlines of the existing project-area arterial roadways, and 75 feet from the centerline of Capital City Freeway. Table 4.6-5 also provides the distances to existing traffic noise contours.

The extent to which existing land uses in the project vicinity are affected by existing traffic noise depends on their respective proximity to the roadways and their individual sensitivity to noise. The Bollard noise study (Appendix I) provides the FHWA Model inputs and results for existing (baseline) conditions.

Table 4.6-5
Baseline Traffic Noise Levels and Distances to Contours

Roadway	Segment Description	L_{dn}[1]	Distance to L_{dn} Contours (feet)[2]		
			70 dB	*65 dB*	*60 dB*
28th Street	C Street to E Street	61	12	26	57
28th Street	E Street to H Street	59	9	19	41
C Street	Alhambra Blvd to 33rd Street	61	13	29	62
C Street	33rd Street to 39th Street	62	15	31	68
C Street	39th Street to 40th Street	62	14	31	66
C Street	40th Street to Lanatt Street	61	14	29	63
Elvas Avenue	Lanatt Street to McKinley Blvd	61	13	28	61
Elvas Avenue	McKinley Blvd to C Street	63	16	35	76
39th Street	C Street to McKinley Blvd	52	3	7	14
40th Street	C Street to McKinley Blvd	43	1	2	4
Meister Way	C Street to McKinley Blvd	49	2	5	10
McKinley Blvd	35th Street to D Street	62	14	29	63
McKinley Blvd	D Street to Meister Way	58	8	17	37
McKinley Blvd	Meister Way to Elvas Avenue	57	7	14	30
C Street	West of 28th Street	60	12	25	53
Tivoli Way	C Street to McKinley Blvd	46	1	3	6
San Antonio Way	C Street to McKinley Blvd	48	2	4	8
San Miguel Way	C Street to 36th Way	45	1	2	5
36th Way	McKinley Blvd to Meister Way	52	3	7	15

Source: See Appendix I.
Note:
1 The computed L_{dn} for Capital City Freeway is at a reference distance of 75 feet from the roadway centerline whereas the L_{dn} values reported for the arterial roadways are computed at a reference distance of 50 feet from the roadway centerlines.
2 Distances to traffic noise contours are measured in feet from the centerlines of the roadways.

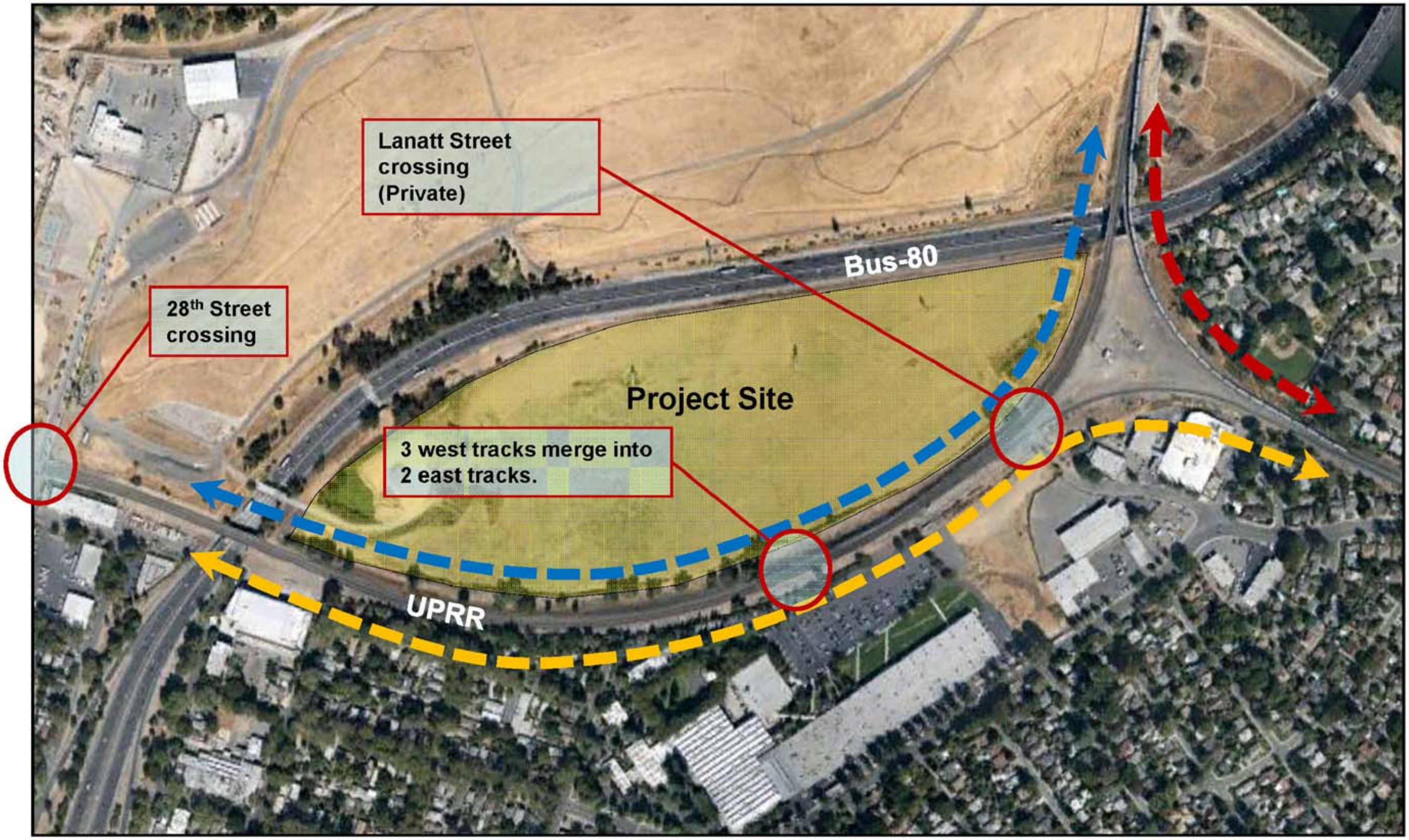
Existing Railroad Noise Environment

The project site is bordered by the existing UPRR tracks to the south and east, as indicated on Figure 4.6-1. Just southeast of the project site, UPRR operations from the north, south, and west are connected by a series of switches which effectively form a triangular junction. This junction results in three possible routes upon which railroad operations pass in close proximity to the project site. These routes are shown on Figure 4.6-3.

The day/night average noise level (L_{dn}) at the project site resulting from adjacent UPRR operations primarily depends on the following variables:

- Number of daily passenger (Amtrak) and freight operations;
- Percentage of passenger and freight operations which occur at night (10 p.m. – 7 a.m.);
- Warning horn usage;
- Train speed; and
- Number of locomotives and cars per train.

The effects of each of these factors were accounted for in the ambient noise survey results presented in Table 4.6-4. Please refer to Appendix I for a detailed discussion of monitoring activity and data analysis used to establish the current noise environment associated with rail operations. UPRR was contacted to obtain information on freight and passenger train travel proximate to the project area. According to UPRR, homeland security concerns prevent UPRR from releasing any specific information pertaining to train schedules or frequency of train travel (pers comm. Jim Smith). UPRR verbally indicated that freight trains run on a 24 hour basis and up to 40 total trains per day pass by the project site (pers comm. Jim Smith). UPRR is unable, however, to provide specific information pertaining to the schedule of those train passages or how many of those 40 daily operations occurred on each of the three routes identified on Figure 4.6-3. In addition, a Federal Railroad Administration (FRA) website provides information on the estimated daily average of trains that pass through the 28th Street at-grade crossing. (Pursuant to pers comm. from Felix Ko, State Office of Railroad Safety, the data provided on the FRA website are considered “rough estimates”. Pursuant to pers comm. from Heather Jones at UPRR, UPRR provides the information for the FRA website). Information from the FRA website accessed in August 2013 indicated an estimated daily average of 22 total trains pass through the 28th Street at-grade crossing based on information provided as of January 1, 2011. Information from the FRA website accessed in October 2013 provides updated information from July 10, 2013, which indicates an estimated daily average of 41 total trains pass through the 28th Street crossing. Also according to the FRA website, the average speed of the trains crossing at 28th Street is between 10 and 35 miles per hour (FRA 2013).



: North-South Route (Roseville – Stockton)

: North-West Route (Roseville – Downtown Sacramento)

: South-West Route (Stockton – Downtown Sacramento)

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SOURCE: Bollard Acoustical Consultants 2013

FIGURE 4.6-3

Railroad Routes, At-Grade Crossing, and Track Merge Location

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Because specific information regarding train schedules and frequency are not provided by UPRR or available on the FRA website, actual train counts in the project area were collected by Bollard Acoustical Consultants using noise meters, direct observations, and review of public passenger train schedules. Bollard Acoustical Consultants spent six days (4 full days and 2 partial days) on railroad single-event noise monitoring. The single-event monitoring was conducted concurrently with the ambient noise level monitoring program described in Table 4.6-5. The noise meters located at sites 4-6 were programmed to log individual single-event data to capture the noise generated by individual train pass bys. Considerable analysis of the railroad single-event data was required to quantify the approximate number of existing daily freight train operations which pass the project site. The results of that analysis are presented in Table 4.6-6.

Table 4.6-6
Number of Existing Railroad Operations (apparent) – August 22–27, 2013

Noise Monitoring Site[1]	Average Day[2]			Peak Day		
	Amtrak	*Freight*	*Total*	*Amtrak*	*Freight*	*Total*
4 and 5[3]	8	15	23[3]	8	22	30
6[3]	4	23	27[3]	4	31	35

Source: See Appendix I.
Notes:
1 Monitoring sites are shown on Figure 4.6-1.
2 The noise monitoring program spanned 127 hours (4 full days and 2 partial days). The partial days were extrapolated to a 24-hour period and the average of the 6 days of monitoring is reported here.
3 The reason the counts from sites 4 and 5 differ from the counts at site 6 is that trains which pass by Sites 4 & 5 may not pass by Site 6, and vice versa, as shown on Figure 4.6-3.

Table 4.6-6 data indicate that approximately 23–27 trains passed by the project site on average over a 24-hour period, with 30–35 trains on the busiest day of railroad activity during the monitoring period. The number of daily rail activity adjacent to the project site compare favorably with similar monitoring conducted over a 4-day period in June of 2007, where 30 daily train operations were registered. Information from the FRA website from August 2013 indicates that there were an average of 24 trains that passed through the 28th Street at-grade crossing. It should be noted that acoustical analyses make use of annual average traffic volumes for the prediction of noise impacts and the development of noise mitigation measures. For this reason, conservative estimates of typical-daily train operations are used to define existing rail operation noise levels at the project site, rather than the higher number of train operations observed during the peak day of monitoring. Although analysis of the 2007 and 2013 single-event data indicate that daily rail activity adjacent to the project site varies, the data supports the conservative assumption of 30 existing rail operations passing the project site over a typical 24-hour period (8 Amtrak (or passenger) and 22 freight trains).

A total of 329 train single event points recorded at the three monitoring sites during the approximately 6-day monitoring period were analyzed to quantify existing railroad noise exposure at the project site. From this data, the mean SEL and maximum noise levels were calculated. Using the observational data, applicable noise measurement results, and numbers of daily passenger and freight operations described above, the day/night average noise level (L_{dn}) for isolated railroad activity was then calculated using the following equation:

$$L_{dn} = SEL + 10 \log Neq - 49.4 \text{ dB, where:}$$

SEL is the mean measured SEL of the freight or passenger train events, Neq is the sum of the daytime (7 a.m. to 10 p.m.) train events plus 10 times the number of nighttime (10 p.m. to 7 a.m.) train events, and 49.4 is a constant representing 10 times the logarithm of the number of seconds in a day.

Table 4.6-7 contains the summary of the railroad noise measurement results and computed L_{dn} values at a representative distance of 90 feet from the nearest rail lines (south of the project site). The 90-foot distance was used because it represents the closest proposed residences within the project site to the railroad tracks. Railroad noise levels at more distant locations can be determined using industry standard algorithms for sound propagation over distance.

Table 4.6-7
Existing Railroad Noise Levels @ 90 feet from UPRR Tracks

Train Type	Sound Exposure Level (SEL, dBA)	Maximum (Lmax, dBA)	Day/Night Average Level (L_{dn}, dBA)
Passenger	94	83	58
Freight	100	90	70
Combined	n/a	n/a	70

Source: See Appendix I.

Table 4.6-7 data indicate that existing railroad noise exposure at the project site is approximately 70 dB L_{dn} at a distance of 90 feet from the centerline of the nearest set of railroad tracks. Table 4.6-6 also indicates that existing passenger (Amtrak) operations do not affect the computed L_{dn} values at the project site. Because freight train noise levels are more than 10 dB above passenger train noise levels, the logarithmic nature of the decibel scale is such that the two are not additive when rounded to the nearest decibel. Figure 4.6-4 illustrates existing rail operations noise contours for the site.

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SOURCE: ESRI 2013

FIGURE 4.6.4

Existing Railroad Noise Contour Map

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Existing Railroad Vibration Environment

The only identified source of potentially significant vibration levels at the project site is railroad pass bys. To quantify railroad vibration levels, Bollard Acoustical Consultants Inc. conducted vibration measurements of representative passenger and freight train pass bys on August 27, and September 23–24, 2013. The measurements were conducted at distances of 45, 65, and 90 feet from the nearest railroad track at the location shown on Figure 4.6-1. These distances were used because 90 feet represents the nearest distance from the proposed residences to the existing railroad tracks; 45 feet represents the minimum distance to the nearest tracks which would occur following construction of the new Capitol Corridor track in the future; and 65 feet represents an intermediate data point between the two. This data was supplemented with vibration data collected at the project site by Bollard Acoustical Consultants staff on November 13, 2008.

The vibration measurements consisted of peak particle velocity (ppv) sampling using a Larson Davis Laboratories Model HVM100 Vibration Analyzer with a PCB Electronics Model 353B51 ICP Vibration Transducer. The test system is a Type I instrument designed for use in assessing vibration as perceived by human beings, and meets the full requirements of ISO 8041:1990(E). The results of the vibration measurements are shown in Table 4.6-8.

Table 4.6-8
Vibration Measurement Results – Various Distances from UPRR Tracks

Date	Duration (minutes)	Distance (feet)[1]	Type	Peak Vibration (in./sec.)[2]
9/23/13	5:37	45	Freight	0.08
9/23/13	3:49	45	Freight	0.05
9/24/13	0:29	45	Passenger	0.05
9/24/13	1:41	65	Freight	0.05
9/24/13	0:37	65	Passenger	0.04
8/27/13	3:17	90	Freight	0.04
8/27/13	1:57	90	Freight	0.05
8/27/13	0:38	90	Passenger	0.05
8/27/13	0:32	90	Freight	0.01
11/13/08	1:02	100	Freight	0.01
11/13/08	3:58	100	Freight	0.03

Source: See Appendix I.
Notes:
1 The data collected for freight trains at the 45-foot distance is for information purposes only, as no freight activity is anticipated to occur at the 45-foot distance. The 45-foot distance was monitored in the event that an additional passenger train track is added in the future to accommodate the Capitol Corridor expansion.
2 See Table 4.6-3 for general human and structural responses to vibration levels.

4.6.3 Regulatory Setting

Federal Regulations

There are no federal regulations relevant to noise that would apply to this project.

State Regulations

California Code of Regulations has guidelines for evaluating the compatibility of various land uses as a function of community noise exposure. The State of California also establishes noise limits for vehicles licensed to operate on public roads, with those limits contained in the Motor Vehicle Code. These standards are implemented through controls on vehicle manufacturers and by legal sanction of vehicle operators by state and local law enforcement officials.

The state has also established noise insulation standards for new multi-family residential units, hotels, and motels that would be subject to relatively high levels of transportation-related noise. These requirements are collectively known as the California Noise Insulation Standards (Title 24, California Code of Regulations). The noise insulation standards set forth an interior standard of L_{dn} 45 dBA in any habitable room. They require an acoustical analysis demonstrating how dwelling units have been designed to meet this interior standard where such units are proposed in areas subject to noise levels greater than L_{dn} 60 dBA. Title 24 standards are typically enforced by local jurisdictions through the building permit application process.

Local Regulations

City of Sacramento 2030 General Plan

The following relevant goals and policies are contained in the City of Sacramento 2030 General Plan Environmental Constraints Element. The General Plan identifies the normally acceptable exterior noise environment for residential land uses is 60 to 70 dB Ldn and establishes 45 dB L_{dn} as an acceptable interior noise environment for residential uses. In instances where attainment of the normally acceptable exterior noise level is not possible with best available noise reduction measures, the General Plan allows an exterior noise level exceeding the acceptable L_{dn}, up to the conditionally acceptable range, provided that noise level reduction measures have been implemented and that interior noise level standards are achieved.

Goal EC 3.1 Noise Reduction. Minimize noise impacts on human activity to ensure the health and safety of the community.

> **Policy EC 3.1.1 Exterior Noise Standards.** The City shall require noise mitigation for all development where the projected exterior noise levels exceed those shown in Table EC 1 (see Table 4.6-9), to the extent feasible.

Policy EC 3.1.2 Exterior Incremental Noise Standards. The City shall require noise mitigation for all development that increases existing noise levels by more than the allowable increment shown in Table EC 2 (see Table 4.6-10), to the extent feasible.

Table 4.6-9
Exterior Noise Compatibility Standards for Various Land Uses

Land Use Type	Highest Level of Noise Exposure that is Regarded as "Normally Acceptable"[1] (L_{dn}[2] or CNEL[3])[4]
Residential: Low Density Single-Family, Duplex, Mobile Homes	60 dBA[5,6]
Residential: Multifamily	65 dBA
Urban Residential Infill[7] and Mixed-Use Projects[8]	70 dBA
Transient Lodging: Motels, Hotels	65 dBA
Schools, Libraries, Churches, Hospitals, Nursing Homes	70 dBA
Auditoriums, Concert Halls, Amphitheaters	Mitigation based on site-specific study
Sports Arena, Outdoor Spectator Sports	Mitigation based on site-specific study
Playgrounds, Neighborhood Parks	70 dBA
Golf Courses, Riding Stables, Water Recreation, Cemeteries	75 dBA
Office Buildings: Business, Commercial, and Professional	70 dBA
Industrial, Manufacturing, Utilities, Agriculture	75 dBA

Source: OPR 2003
Notes:

1 As defined in the Guidelines, "Normally Acceptable" means that the "specified land use is satisfactory, based upon the assumption that any building involved is of normal conventional construction, without any special noise insulation requirements."

2 L_{dn} or Day/Night Average Level is an average 24-hour noise measurement that factors in day and night noise levels.

3 CNEL or Community Noise Equivalent Level measurements are a weighted average of sound levels gathered throughout a 24-hour period.

4 These standards shall not apply to balconies or small attached patios in multistory/multifamily structures.

5 dBA or A-weighted decibel, a measure of noise intensity.

6 The exterior noise standard for the residential area west of McClellan Airport known as McClellan Heights/Parker Homes is 65 dBA.

7 With land use designations of Central Business District, Urban Neighborhood (Low, Medium, or High) Urban Center (Low or High), Urban Corridor (Low or High).

8 All mixed-use projects located anywhere in the City of Sacramento.

Table 4.6-10
Allowable Incremental Noise Increases

Residences and buildings where people normally sleep[1]		Institutional land uses with primarily daytime and evening uses[2]	
Existing L_{dn}	*Allowable Noise Increment*	*Existing L_{dn}*	*Allowable Noise Increment*
45	8	45	12
50	5	50	9
55	3	55	6
60	2	60	5
65	1	65	4
70	1	70	4
75	0	75	1
80	0	80	0

Source: City of Sacramento 2009.
Notes:
1 This category includes homes, hospitals, and hotels where a nighttime sensitivity to noise is assumed to be of utmost importance.
2 This category includes schools, libraries, theaters, and churches where it is important to avoid interference with such activities as speech, meditation, and concentration on reading material.

Policy EC 3.1.3 Interior Noise Standards. The City shall require new development to include noise mitigation to assure acceptable interior noise levels appropriate to the land use type: 45 dBA L_{dn} for residential, transient lodgings, hospitals, nursing homes, and other uses where people normally sleep; and 45 dBA L_{eq} (peak hour) for office buildings and similar uses.

Policy EC 3.1.4 Interior Noise Review for Multiple, Loud Short-Term Events. In cases where new development is proposed in areas subject to frequent, high-noise events, (such as aircraft overflights, or train and truck pass-bys), the City shall evaluate noise impacts on any sensitive receptors from such events when considering whether to approve the development proposal, taking into account potential for sleep disturbance, undue annoyance, and interruption in conversation, to ensure that the proposed development is compatible within the context of its surroundings.

Policy EC 3.1.5 Interior Vibration Standards. The City shall require construction projects anticipated to generate a significant amount of vibration to ensure acceptable interior vibration levels at nearby residential and commercial uses based on the current City or Federal Transit Administration (FTA) criteria.

Policy EC 3.1.7 Vibration. The City shall require an assessment of the damage potential of vibration-induced construction activities, highways, and rail lines in close proximity to historic buildings and archaeological sites and require all feasible mitigation measures be implemented to ensure no damage would occur.

Policy EC 3.1.10 Construction Noise. The City shall require development projects subject to discretionary approval to assess potential construction noise impacts on nearby sensitive uses and to minimize impacts on these uses, to the extent feasible.

Policy EC 3.1.11 Alternatives to Sound Walls. The City shall encourage the use of design strategies and other noise reduction methods along transportation corridors in lieu of sound walls to mitigate noise impacts and enhance aesthetics.

Policy EC 3.1.12 Residential Streets. The City shall discourage widening streets or converting streets to one-way in residential areas where the resulting increased traffic volumes would raise ambient noise levels.

City of Sacramento Noise Ordinance

The City of Sacramento Noise Ordinance (Section 8.68 of the Sacramento City Code) states that it is unlawful for any person at any location within the City to create any noise that causes ambient noise levels at an affected receptor to exceed the noise standards shown in Table 4.6-11. Table 4.6-11 standards are specifically applicable to sources of noise which can be controlled at the local level. The City's standards do not apply to traffic, aircraft, or railroad noise exposure as control of noise from those sources is subject to state or federal oversight, and not subject to local control.

Table 4.6-11
Noise Ordinance Standards Applicable at Exterior Spaces of Residential Uses

Cumulative Duration of Intrusive Sound	Noise Metric	Daytime, dB	Nighttime, dB
Cumulative period of 30 minutes per hour	L_{50}	55	50
Cumulative period of 15 minutes per hour	L_{25}	60	55
Cumulative period of 5 minutes per hour	L_{08}	65	60
Cumulative period of 1 minute per hour	L_{02}	70	65
Level not to be exceeded for any time during hour	L_{max}	75	70

Source: City of Sacramento n.d.
Notes:
Daytime is defined as 7 a.m. to 10 p.m. and Nighttime is defined as 10 p.m. to 7 a.m.
Each of the noise limits specified above shall be reduced by 5 dBA for impulsive or simple tone noise or for noises consisting of speech or music. If the existing ambient noise levels exceed that permitted in the first four noise-limit categories, the allowable limit shall be increased in 5 dB increments to encompass the ambient.

Section 8.68.080.D, Exemptions, exempts from the Noise Ordinance standards those noise sources due to the erection (including excavation), demolition, alteration, or repair of any building or structure between the hours of 7 a.m. and 6 p.m., on Monday through Saturday, and between 9 a.m. and 6 p.m. on Sunday; provided, however, that the operation of an internal combustion engine shall not be exempt pursuant to this subsection if such engine is not equipped with suitable exhaust and intake silencers which are in good working order. The director of building inspections may permit work to be done during the hours not exempt by this subsection in the case of urgent necessity and in the interest of public health and welfare for a period not to exceed 3 days.

Application for this exemption may be made in conjunction with the application for the work permit or during progress of the work. It should be noted that the following activities are specifically exempted from the provisions of the City of Sacramento Noise Ordinance:

E. Noise sources associated with maintenance of street trees and residential area property provided said activities take place between the hours of seven a.m. and six p.m.

H. Tree and park maintenance activities conducted by the city department of parks and community services; provided, however, that use of portable gasoline-powered blowers within 200 feet of residential property shall comply with the requirements of Section 8.68.150 of this chapter.

4.6.4 Impacts and Mitigation Measures

Methods of Analysis

Existing literature, noise and vibration measurements, and application of accepted noise and vibration prediction and propagation algorithms were used to predict impacts due to and upon development of the proposed project. More specific detail is provided below.

Impacts of the environment on a project or plan (as opposed to impacts of a project or plan on the environment) are beyond the scope of required California Environmental Quality Act (CEQA) review. "[T]he purpose of an EIR is to identify the significant effects of a project on the environment, not the significant effects of the environment on the project." (*Ballona Wetlands Land Trust v. City of Los Angeles,* (2011) 201 Cal.App.4th 455, 473 (*Ballona*).) The impacts discussed in this section related to noise from the adjacent Capital City Freeway and the UPRR tracks are effects on users of the project and structures in the project of preexisting environmental hazards, as explicitly found by the court in the *Ballona* decision, and therefore "do not relate to environmental impacts under CEQA and cannot support an argument that the effects of the environment on the project must be analyzed in an EIR" (*Ballona, supra,* 201 Cal.App.4th at p. 475). Nonetheless, an analysis of these impacts is provided for informational purposes.

Project-Related and Cumulative Traffic Noise Level Increases

CEQA requires that the noise impacts *caused by* the project be considered; for a residential development, the principal source of project-generated noise is the addition of vehicle trips to area roadways. As a result, noise impacts resulting from increases in off-site traffic noise levels along roadways which would provide access to the project site must be evaluated.

Off-site traffic noise impacts are identified where existing or future traffic noise levels with the proposed project would significantly exceed existing or future traffic noise levels without the project. To describe project-related changes in existing and future traffic noise levels, the Federal Highway Administration Highway Traffic Noise Prediction Model (FHWA RD77108) was used. Existing and future conditions both with and without the project were obtained from the California Department of Transportation (Caltrans) and Fehr and Peers, Transportation Consultants. To determine the relative differences between the proposed project and no project traffic noise conditions, the predicted traffic noise levels at a standardized distance of 75 feet from Capital City Freeway and 50 feet from the arterial roadway centerlines were computed. The predicted traffic noise levels and the project-related changes in noise levels for existing conditions and cumulative conditions are presented in Table 4.6-12. A complete listing of the FHWA model inputs, predicted noise levels, and distances to traffic noise contours is presented in the noise report (Appendix I).

Table 4.6-12
Predicted Baseline and Cumulative Traffic Noise Levels

Roadway	**Segment**	**L_{dn}, dB[1] (Change, dB)**	
		Baseline + Project	*Cumulative + Project*
Cap City Fwy	Entire Span of Project Site	81(0)	82 (0)
28th Street	C Street to E Street	61 (+1)	63 (+1)
28th Street	E Street to H Street	59 (+1)	59 (+1)
C Street	Alhambra Blvd to 33rd Street	61 (0)	64 (0)
C Street	33rd Street to 39th Street	62 (+1)	64 (0)
C Street	39th Street to 40th Street	62 (+1)	64 (+1)
C Street	40th Street to Lanatt Street	61 (0)	63 (0)
Elvas Avenue	Lanatt Street to McKinley Blvd	61 (0)	63 (0)
Elvas Avenue	McKinley Blvd to C Street	63 (+1)	63 (0)
39th Street	C Street to McKinley Blvd	52 (0)	52 (+1)
40th Street	C Street to McKinley Blvd	43 (+1)	45 (+2)
Meister Way	C Street to McKinley Blvd	49 (0)	51 (+1)

Table 4.6-12
Predicted Baseline and Cumulative Traffic Noise Levels

Roadway	Segment	L_{dn}, dB[1] (Change, dB)	
		Baseline + Project	*Cumulative + Project*
McKinley Blvd	35th Street to D Street	62 (0)	63 (0)
McKinley Blvd	D Street to Meister Way	58 (+1)	60 (0)
McKinley Blvd	Meister Way to Elvas Avenue	57 (0)	58 (0)
C Street	West of 28th Street	60 (0)	64 (0)
Tivoli Way	C Street to McKinley Blvd	46 (0)	47 (0)
San Antonio Way	C Street to McKinley Blvd	48 (0)	49 (+1)
San Miguel Way	C Street to 36th Way	45 (0)	47 (+1)
36th Way	McKinley Blvd to Meister Way	52 (0)	53 (0)

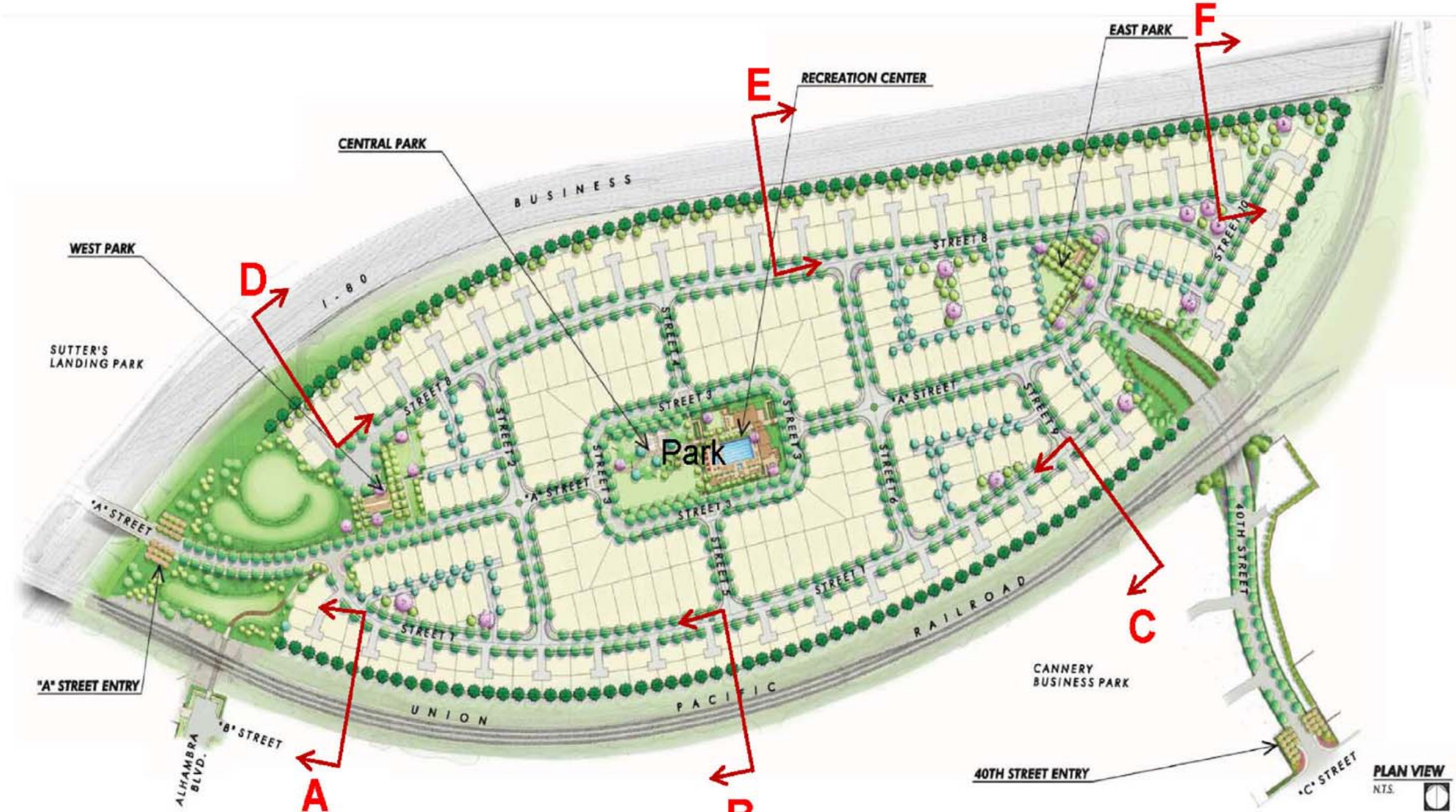
Source: See Appendix I.
Notes:
1. L_{dn} Values are computed distances of 75 feet from the Capital City Freeway centerline and 50 feet from the arterial roadway centerlines.

Traffic Noise Impact Assessment

The noise level at the project site resulting from major transportation sources must be evaluated for traffic volume and roadway configuration which could occur in the foreseeable future, across the life span of the project. Cumulative traffic volumes from the build-out year of the General Plan (2030) are frequently used to characterize future traffic noise exposure levels.

The future traffic noise environment at the project site will continue to be defined by traffic on Capital City Freeway. Forecasts of future traffic (cumulative) volumes were obtained from Fehr and Peers Transportation Consultants for the arterial roadways analyzed in the traffic study.. Based on a future 2035 traffic volume of approximately 183,000 daily vehicles for Capital City Freeway, future traffic noise levels at the project site are predicted to be approximately 82 dB L_{dn} at a reference distance of 75 feet from the freeway centerline.

The reference distance of 75 feet with respect to the Capital City Freeway was selected because it represents the future traffic noise level at the boundary of the project site (Caltrans right-of-way fence). Please refer to Figure 4.6-5 for the proposed site plan, including the location of cross-sections illustrating project improvements such as finished grading, berms, and sound barriers. This noise level at 75 feet is subsequently extrapolated to predict highway traffic noise levels at the nearest proposed building façades, private yard areas, and parks using industry-standard acoustical algorithms. The specific noise levels at those locations, which vary in distance from the freeway, are discussed later in this analysis.



NOT TO SCALE

SOURCE: Bollard Acoustical Consultants 2013

FIGURE 4.6-5

McKinley Village Project Site and Cross-Section Key

7828

MCKINLEY VILLAGE PROJECT EIR

Path: Z:\Projects\7828\01\MAPDOC\MAPS\DEIR\Fig4_6_5_Xsection_key.mxd

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In addition to increases in traffic volume on Capital City Freeway over time, Caltrans is considering adding an additional eastbound travel lane to this roadway from approximately the UPRR overcrossing to the west of the site to the bridge over the American River. The new lane is currently anticipated to be created by restriping the three existing 12-foot lanes to four 11-foot lanes and by increasing the travel way approximately 8 feet further south. Because the location of the median between eastbound and westbound travel lanes is not anticipated to change as a result of this additional lane, no change in westbound traffic noise would result as indicated below.

The distance from the nearest proposed residences in the project site to the effective noise center of the existing eastbound travel lanes is approximately 83 feet. The 8-foot shift in distance to the nearest travel lane, with this additional lane, would result in a 4-foot shift in the distance to the effective noise center of the eastbound lanes. Relative to the existing 83-foot distance, the shift to the 79-foot distance to the noise center of the eastbound travel lanes would result in a traffic noise level increase of 0.3 dB L_{dn}. Because an increase of less than 1 dB L_{dn} is considered imperceptible, the addition of this proposed eastbound lane is not predicted to noticeably affect existing or future traffic noise exposure at the project site.

Railroad Noise Impact Assessment

The assessment of rail operations noise levels and their effect upon the proposed project must consider increased frequency of trains or the addition of tracks adjacent to the project site, which may occur over the life of the project. Bollard Acoustical Consultants Inc. consulted with UPRR operations representatives regarding planned rail operations, and according to information provided by UPRR, there are up to approximately 40 trains on the tracks which pass adjacent to the project site on a busy day, including both passenger and freight trains. UPRR is unable, however, to provide specific information pertaining to the schedule of those train passages or how many of those 40 daily operations occurred on each of the three routes identified on Figure 4.6-3. Due to homeland security concerns UPRR is unable to release any information pertaining to train schedules or frequency (pers comm. Jim Smith). Existing rail operations (discussed above) account for 22 existing freight and 8 existing passenger train operations adjacent to the project site on a typical day, for a total of 30 existing combined railroad operations. For future conditions, an additional 10 freight and 18 passenger trains were assumed, for a future combined total of 58 daily trains adjacent to the project site. See Appendix I for more detail.

The speeds of several train pass bys were monitored at the project site using a Bushnell Velocity radar gun on August 27, 2013. Those measurements indicated that train speeds are fairly slow, typically ranging from 20–25 mph. These slow train speeds were expected given the curvature of the tracks adjacent to the project site and the proximity of the project site to the downtown Sacramento Amtrak station. During several days of observations, at no time were elevated train speeds observed above 25 mph. Information from the FRA website from August 2013 indicates that the average speed of the trains crossing at 28th Street is between 5 and 35 miles per hour (FRA 2013).

The aforementioned use of 10 additional daily freight operations to reflect future conditions would result in an increase in day/night average levels (L_{dn}) of 2 dB over existing conditions. The resulting future railroad noise environment at the project site would be approximately 72 dB L_{dn} at the reference distance of 90 feet from the nearest railroad track. The 2 dB L_{dn} increase would not be considered perceptible, in comparison to the existing 70 dB L_{dn} noise level at 90 feet from the tracks. Because the noise contours employ a 5 dB difference, the future condition rail operations noise contours would shift by an imperceptible distance away from the tracks, as compared to the existing noise contours (see Figure 4.6-4*).*

If the potential Capitol Corridor expansion project is completed, passenger rail operations adjacent to the project site would increase by approximately 18 trains per day (from 8 to 26). In addition, the construction of a new rail line to accommodate the Capitol Corridor expansion would result in those new passenger rail operations passing within a minimum distance of approximately 45 feet from the nearest proposed residences within the project site. It should be noted that the 4 existing daily Amtrak operations between Stockton and Sacramento on the south-west route (see Figure 4.6-3) would continue to occur on the tracks located approximately 115 feet from the nearest proposed residences, not the new tracks constructed for the Capitol Corridor expansion along the southern boundary of the site.

Currently, the 8 daily passenger train operations generate a day/night average level of 58 dB L_{dn} at the reference distance of 90 feet from the railroad tracks, as indicated in Table 4.6-6. Increasing the number of passenger trains to 26 per day, assuming all daytime operations for the Capitol Corridor trains, would result in a 3 dB L_{dn} increase in passenger train noise levels, to 61 dB L_{dn} at a distance of 90 feet from the nearest existing track. When combined with the future 72 dB L_{dn} noise level from freight operations, noise generated by these additional passenger train operations would continue to be inconsequential, as combined noise levels would still be 72 dB L_{dn}. As mentioned previously, because the decibel scale is logarithmic, when two decibel levels that differ by 10 dB or more are added together, their sum is equal to the value of the greater decibel level.

After construction of the new tracks up to 45 feet closer to the project site to accommodate the Capitol Corridor expansion, the passenger train noise level at the nearest proposed residences would increase by 6 dB relative to existing noise levels to 64 dB L_{dn}. When combined with the 72 dB L_{dn} level for future freight train noise, the total future railroad noise exposure at the nearest residences within the project site would be approximately 73 dB L_{dn}. This combined future train operations (passenger and freight) noise level increase of 3 dB L_{dn} would be just perceptible to an average listener (see Figure 4.6-4).

ATS Consulting will be providing noise and vibration technical assistance to the Capitol Corridor Joint Powers Authority for the Capitol Corridor expansion project. Bollard Acoustical Consultants contacted Hugh Saurenam, President of ATS Consulting, to inquire if there were any foreseeable innovations in rail technology which would be implemented for the expansion project which might cause future rail noise and/or vibration levels to be lower than existing levels. Mr. Saurenam stated that he was unaware of any such technology at this time, but that it is possible that innovations in rail noise and vibration reduction technology may be developed before the project is implemented.

Warning Horn

There is a public at-grade vehicle crossing at 28th Street, and a private at-grade crossing at Lanatt Street. In August 2013, Bollard Acoustical Consultants staff observed some trains sounding their horns on approach to the 28th Street crossing, and the noise measurement data indicate that some warning horn usage also occurred near the private at-grade Lanatt Street crossing. Because the 28th Street crossing is 1,500 feet from the nearest proposed residences in the project site (corresponding to noise measurement site 4), the horns were not sufficiently loud enough to have affected the single-event noise measurement results even though the horns were occasionally audible. As a result, the 28th Street crossing warning horn usage did not appreciably affect railroad noise exposure at the project site. The warning horn usage near the private at-grade Lanatt Street crossing did affect the measured single-event noise results at site 6.

It should be noted that, effective September 6, 2013, the City implemented a Quiet Zone at the 28th Street and Lanatt Street crossings. That Quiet Zone significantly reduces the frequency of warning horn usage at those crossings even though horn usage can still be used for safety as deemed necessary by the engineer. This decrease in warning horn usage will result in a decrease in single-event and 24-hour railroad noise exposure at the project site.

Construction Noise Impact Assessment

During the construction phases of the project, noise from construction activities would add to the noise environment in the immediate project vicinity. Activities involved in construction would generate maximum noise levels, as indicated in Table 4.6-13, ranging from 70 to 90 dB at a distance of 50 feet. Construction activities are proposed to occur during normal daytime working hours, consistent with the City's Noise Ordinance.

Table 4.6-13
Typical Construction Equipment Noise

Equipment Description	Maximum Noise Level at 50 feet, dBA
Auger drill rig	85
Backhoe	80
Bar bender	80
Boring jack power unit	80
Chain saw	85
Compactor (ground)	80
Compressor (air)	80
Concrete batch plant	83
Concrete mixer truck	85
Concrete pump truck	82
Concrete saw	90
Crane (mobile or stationary)	85
Dozer	85
Dump truck	84
Excavator	85
Flatbed truck	84
Front-end loader	80
Generator (25 kilovolt-amperes [kVA] or less)	70
Generator (more than 25 kVA)	82
Grader	85
Hydra break ram	90
Jackhammer	85
Mounted impact hammer (hoe ram)	90
Paver	85
Pickup truck	55
Pneumatic tools	85
Pumps	77
Rock drill	85
Scraper	85
Soil mix drill rig	80
Tractor	84
Vacuum street sweeper	80
Vibratory concrete mixer	80
Welder/Torch	73

Source: FHWA 2006.

Noise would also be generated during the construction phase by increased truck traffic on area roadways. An important project-generated noise source would be truck traffic associated with transport of heavy materials and equipment to and from construction sites, particularly through existing residential neighborhoods. This noise increase would be of short duration, and would likely occur primarily during daytime hours.

Construction Vibration Impact Assessment

Construction activities produce varying degrees of ground vibration, depending on the equipment and methods employed. While ground vibrations from typical construction activities rarely reach levels high enough to cause damage to structures, special consideration must be made when sensitive or historic land uses are near the construction site. The construction activities that typically generate the highest levels of vibration are blasting and impact pile driving. Neither blasting nor impact pile driving are proposed or anticipated for project construction.

On-site construction equipment that would cause the most noise and vibration would be associated with site grading and the potential use of a vibratory pile driver for construction of sound barriers. According to the FTA, vibration levels associated with the use of bulldozers (from the smallest to the largest available models, representing differing weight measured in the tons) range from approximately 0.003–0.089 inch/second ppv and 58–87 vibration decibels (VdB referenced to 1 micro-inch per second [μin/sec] and based on the root mean square [RMS] velocity amplitude) at 25 feet, as shown in Table 4.6-14.

Table 4.6-14
Typical Construction Equipment Vibration Levels

Equipment	At 25 feet (inch/second)[1]	Approximate L_v at 25 feet[2]
Large Bulldozer	0.089	87
Trucks	0.076	86
Vibratory Pile Driver	0.170	93
Small Bulldozer	0.003	58

Sources: See Appendix I.
Notes:
1 PPV = peak particle velocity
2 L_v is the velocity level in decibels (VdB) referenced to 1 micro-inch/second and based on the root mean square (RMS) velocity amplitude.

Project Design Elements

UPRR Tracks – Noise Barrier

The project design includes connecting the residences located adjacent to the UPRR tracks through the creation of an outdoor room with a 16-foot tall wall adjacent to the UPRR right-of-way. These outdoor rooms, shown on Figure 4.6-5, would effectively create a solid noise barrier 16 feet in height which would shield the private yard areas of the residences proposed adjacent to the railroad tracks. Although the parking area of the residences is not sensitive to noise, the project design bridges the gap between the garages with a 10-foot-tall barrier to provide additional shielding of railroad noise within those areas.

As an alternative to the construction of an outdoor room connecting the residences adjacent to the railroad tracks, a solid barrier of equal height to the proposed outdoor rooms (16 feet) may be constructed. Because these options would both provide a noise barrier 16-feet in height relative to the private yard area, they are considered acoustically equivalent.

The center of the proposed private yards of the residences located adjacent to the railroad tracks would be approximately 110 feet (+/-) from those tracks. At this distance, existing railroad noise exposure is predicted to be 69 dB L_{dn}, not including shielding by the proposed residences or barriers themselves.

A noise barrier analyses was completed for these private yard areas using an accepted noise barrier insertion loss prediction methodology. The apex of the residences would be approximately 25 feet tall while the outdoor room or optional noise barrier would 16 feet tall. When combined, the results of the barrier analysis indicate that the residences would provide approximately 15 dB of railroad noise attenuation, resulting in an existing railroad noise exposure in the private yard areas of the nearest residences of approximately 54 dB L_{dn}. These levels would be considered acceptable relative to City of Sacramento 60 dB L_{dn} exterior noise standard applied to new residential uses. Because the proposed design of the residences located adjacent to the railroad tracks would result in acceptable exterior noise environments (60 dB L_{dn} or less) within private yard areas, even these closest yard areas would be in compliance with the noise element exterior noise exposure guideline with respect to rail operations.

Capital City Freeway – Noise Barrier

The combination of an earthen berm and noise barrier adjacent to the Capital City Freeway right-of-way would reduce traffic noise exposure at the project site. A noise barrier analysis was conducted for these proposed barriers using the FHWA noise barrier insertion loss prediction methodology. The results of that analysis indicate that a sound wall ranging from 9 to 12 feet tall on top of the proposed 4-foot earthen berms (relative to future building pad elevations) would be required to reduce future traffic noise levels to 60 dB L_{dn} or less at the outdoor activity areas proposed nearest to the freeway.

Maximum noise levels associated with traffic on Capital City Freeway are predicted to be approximately equal to the L_{dn} values corresponding to the ultimate barrier heights constructed for the project. After barrier construction, typical maximum noise levels in the backyard areas associated with freeway traffic would be approximately 60 dB L_{max}. Maximum noise levels in this range would not be expected to interfere with typical outdoor recreation activities or outdoor communication if the distance between the persons conversing is relatively small.

Thresholds of Significance

Consistent with Appendix G of the CEQA Guidelines, the City's thresholds, and professional judgment, a significant impact would occur if the proposed project would do any of the following:

- result in a substantial permanent increase in ambient exterior noise levels in the project vicinity that exceed standards in the City's General Plan;
- result in residential interior noise levels of 45 dBA L_{dn} or greater caused by noise level increases due to project operation;
- result in construction noise levels that exceed the standards in the City of Sacramento Noise Ordinance;
- permit existing and/or planned residential and commercial areas to be exposed to vibration-peak-particle velocities greater than 0.5 inch per second due to project construction;
- permit adjacent residential and commercial areas to be exposed to vibration peak particle velocities greater than 0.5 inch per second due to highway traffic and rail operations; or
- permit historic buildings and archaeological sites to be exposed to vibration-peak-particle velocities greater than 0.2 inch per second due to project construction, highway traffic, and rail operations.

With regard to the final significance threshold (Historic Buildings and Archaeological sites), there are no historic buildings on the project site nor are there any known archaeological sites that could potentially be impacted by vibration due to project construction activities. Therefore, the analysis does not evaluate potential vibration impacts to historic buildings or archaeological sites.

Project-Specific Impacts and Mitigation Measures

4.6-1: Short-term project construction could exceed the City's Noise Ordinance. Based on the analysis below, the impact is *less than significant*.

Construction activities would occur over an approximately 4-year period in three phases, starting in spring 2014 and continuing through late fall 2017 (assuming the project is approved). Activities involved in project construction would generate maximum noise levels, as indicated in Table 4.6-13, ranging from 70 to 90 dB at a distance of 50 feet. Construction noise levels would likely be very low to imperceptible at the nearest existing residences to the project site due to the earthen railroad embankment separating the project site from existing residential neighborhoods to the south and east. In addition, project construction would be temporary in nature and is proposed to occur during normal daytime working hours, consistent with Section 8.68.080.D of the City's Noise Ordinance.

Noise would also be generated during the construction phase by increased truck traffic on area roadways, including heavy-trucks associated with transport of materials and equipment to and from construction sites, particularly where routed through existing residential neighborhoods. This noise increase would be of short duration, and would likely occur primarily during daytime hours. As discussed in Chapter 2, Project Description, per City requirements, the project applicant is required to prepare a traffic management plan for construction vehicles and equipment that would be reviewed and approved by the City's Department of Public Works prior to beginning any construction activities. Daily construction round trips would range from approximately 38 to 66 vehicle trips, including construction employees and deliveries. The majority of this traffic would use 28th Street and the A Street Bridge access until the 40th Street underpass is complete. Once the underpass is complete, this analysis assumes approximately half of the trips would access the site from 40th Street. Most of this traffic would be construction workers arriving between 7:00 a.m. and 8:00 a.m., and leaving the site between 4:00 p.m. and 5:00 p.m. Roads used by construction workers accessing the site from A Street would use 28th Street to A Street. The construction traffic accessing the site from 40th Street could access the site from Elvas Avenue and Highway 50 or from C Street and the Capital City Freeway. The specific roads used for construction of the project would be included in the traffic management plan to be reviewed and approved by the City.

The City of Sacramento exempts construction noise from the Noise Ordinance provisions if construction activity is limited to daytime hours. These exemptions are typical of City and County noise ordinances and reflect the recognition that construction-related noise is temporary in character, is generally acceptable when limited to daylight hours, and is part of what residents of urban areas expect as part of a typical urban noise environment (along with sirens, etc.) Therefore, the impact associated with project construction is considered **less than significant.**

Mitigation Measures

None required.

4.6-2: Project construction could expose existing or planned residential areas to vibration greater than 0.5 inches per second. Based on the analysis below, the impact is *less than significant*.

Construction activities produce varying degrees of ground vibration, depending on the equipment and methods employed. On-site construction equipment that would cause the most noise and vibration would be associated with site grading and the potential use of a vibratory pile driver for construction of the sound barriers. Table 4.6-14 provides anticipated ground acceleration (ground-borne vibration) for various types of construction equipment.

According to the reference distance vibration levels in Table 4.6-14, vibration levels would not exceed the City of Sacramento's threshold (0.5 inch per second) within 25 feet of any construction equipment or activity. Existing off-site structures are located on the opposite side of the UPRR embankment and are not closer than 200 feet from potential project construction activity. Likewise, the use of heavy bulldozers or vibratory pile drivers within 25 feet of a completed project residence is not anticipated, and can easily be planned for and avoided. Therefore, vibration levels would not exceed applicable City thresholds for residential structures for general construction activity or pile driving, and the impact would be **less than significant**.

Mitigation Measures

None required.

4.6-3: The proposed project could permanently increase ambient exterior noise levels in the project vicinity (off site) that exceed city standards. Based on the analysis below, the impact is *less than significant*.

Traffic Noise

Table 4.6-12 indicates that the proposed project would result in increases in traffic noise levels on project-area roadways ranging from 0–2 dB L_{dn}. Table 4.6-10 provides the City's allowable incremental noise level increases for new projects affecting existing sensitive receptors. As shown in Table 4.6-10, the allowable increase is a function of the existing, or baseline, noise environment present prior to the project. With the exception of Capital City Freeway, the existing baseline noise level at a representative distance of 50 feet from the arterial roadway centerlines is below 65 dB L_{dn}. As a result, the allowable noise increase due to the proposed project would be 2 dB or more on all roadways other than Capital City Freeway. The increase in existing traffic noise levels reported in Table 4.6-12 for all roadways other than Capital City Freeway do not exceed the 2 dB threshold. Consequently, the increase in project-related traffic noise on local roadways would be **less than significant.**

For the Capital City Freeway, which has an existing noise level of 80 dB L_{dn}, no increase (0 dB) is allowed, according to Table 4.6-10*.* Table 4.6-12 indicates that project traffic would increase noise levels on Capital City Freeway by 0 dB. Therefore, because the addition of project traffic would not result in an increase in noise above allowable levels, this impact is considered **less than significant**.

Recreation Noise

The project includes three parks (see Figure 4.6-5*)*. The east and west parks would be used primarily for passive recreation and fairly quiet activities such as bocce ball, picnics, etc. The central park would include a pool and larger lawn areas where active recreation would occur.

The nearest existing residences in the adjacent neighborhood south of the UPRR tracks, approximately 600 feet from the park sites, are shielded by the UPRR embankment. At that distance from the park sites, noise generated by activities at any of the three parks is predicted to be inaudible over background noise levels, and well within the City's Noise Ordinance standards shown in Table 4.6-11*.* Therefore, off-site noise impacts due to on-site recreational activities are **less than significant**.

The proposed residences within the project site closest to the main (central) park, would be located across a street, as shown in Figure 4.6-5. In this configuration, the private rear yard areas of those nearest residences would be shielded from view of park activities by the residential structures themselves. Because of this shielding, noise generated within the central park area is predicted to not exceed the City's Noise Ordinance standards, shown in Table 4.6-11. Furthermore, park noise is exempt from the City's Noise Ordinance standards. As a result, this impact is considered **less than significant**.

Mitigation Measures

None required.

4.6.4: Noise from the adjacent UPRR tracks could result in interior noise levels at the project that exceed the City's 45 dBA L_{dn} standard. Based on the analysis below and with implementation of mitigation, the impact is *less than significant*.

Residences Closest to the UPRR tracks

According to the City of Sacramento noise standards, railroad noise impacts are identified within interior areas (homes) if noise levels would exceed 45 dB L_{dn} within any area of the proposed residences. In addition, the City of Sacramento requires evaluation of single-event noise levels in locations affected by train pass bys. Application of an interior single-event noise standard of 65 dB SEL would provide an additional degree of protection against sleep interference beyond that achieved through satisfaction of the City's 45 dB L_{dn} interior standard alone.

As indicated in Table 4.6-7, the predicted railroad noise levels at the exterior building façades proposed nearest to the UPRR tracks are approximately 70 dB L_{dn}, 90 dB L_{max}, and 100 dB SEL. These exposure levels are based upon the project design adjacent to the UPRR alignment. Cross-sections illustrating the design features included to address rail noise are presented in Figures 4.6-6 through 4.6-9. To achieve satisfaction with the City's 45 dB L_{dn} interior noise level standard, a building façade railroad noise reduction of 25 dB L_{dn} would be required. Based on the objective of reducing interior noise levels during train pass bys to 65 dB SEL or less, a building façade noise reduction of approximately 35 dB would be required.

The degree of exterior to interior noise level reduction provided by the various building façades is a function of their construction. Important factors which affect the building façade noise reduction include exterior wall thickness (i.e., 2 x 4-inch versus 2 x 6-inch studs), construction materials (i.e., stucco versus wood siding), percent window area, window sound transmission class rating (STC), exterior wall penetrations, roof materials (e.g., asphalt shingles versus concrete tiles), and exterior door weather-stripping.

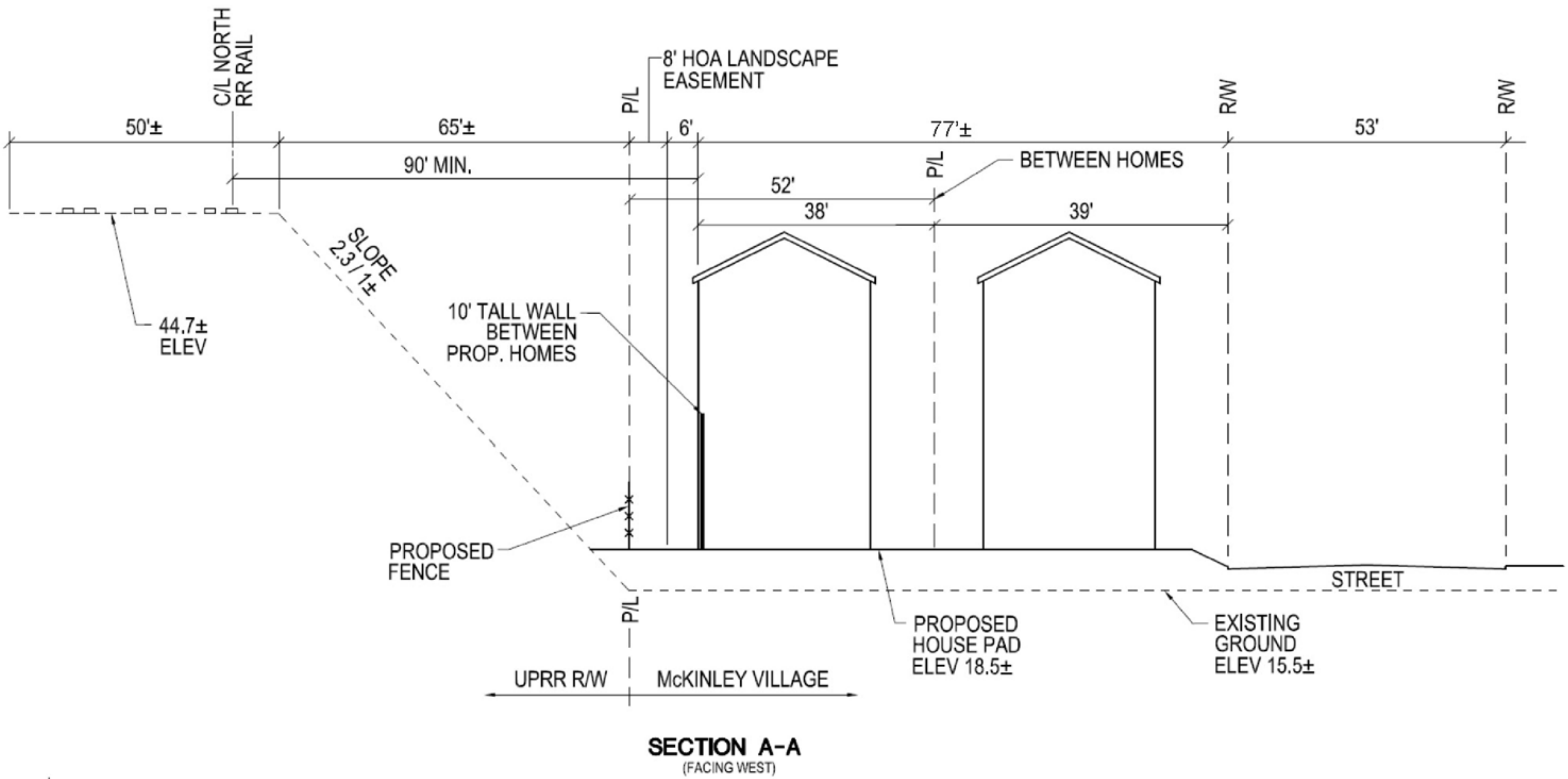
Standard residential construction in conformance with common industry practices and local building code requirements normally consists of 2 x 4-inch wood stud exterior walls, exterior stucco siding, dual pane windows (two 1/8-inch panes separated by 1/4-inch airspace – STC 27), perimeter weather-stripping, and concrete tile roofs. Attenuation data for residential construction similar to the proposed project indicates this construction type provides at least 25 dB of exterior to interior building façade for railroad noise reduction. For a conservative assessment of project noise impacts, this analysis assumes 25 dB exterior to interior railroad noise reduction for all proposed residences within the project area with windows in the closed position. Thus, based on standard construction techniques, the proposed residences would achieve a 25 dB reduction, thereby complying with the City's 45 dB L_{dn} interior criterion.

However, standard residential construction techniques would not achieve interior SEL values of 65 dB SEL or less in sleeping rooms during train pass bys; a building façade noise reduction of approximately 35 dB would be required to achieve SEL values of 65 dB or less. Consequently, conventional construction materials and methods for the residences would be inadequate to achieve the City's 65 db SEL interior criterion; therefore this is a **potentially significant impact.**

Second Tier Residences

According to project site plans, the building façades of the second tier of residences (not the second row, but the residences located on the north side of the road nearest the UPRR tracks), would be located approximately 225 to 230 feet from the UPRR tracks. At this distance, railroad noise would be attenuated to approximately 64 dB by distance alone, without even considering the partial shielding provided by intervening residential structures and/or barriers to the south. Shielding provided by the residences closer to the tracks is anticipated to further reduce railroad noise exposure by at least 10 dB, resulting in exterior noise exposure of less than 60 dB L_{dn} for the second row of residences. Because exterior noise levels would not exceed 60 dB L_{dn} beyond the second tier residences, no additional construction upgrades would be required for these residential units to meet the City's 45 dB L_{dn} interior noise standard.

In terms of single-event noise and the potential for sleep disturbance, SEL values at the exterior façades of these residences are predicted to be approximately 84 dB SEL (taking into account intervening structures and distance) during train pass bys. Given a target interior SEL value of 65 dB, approximately 19 dB of railroad noise reduction would be required of these building façades. Because standard construction practices would be adequate to achieve this degree of noise reduction, construction upgrades would not be required to achieve the interior noise objectives of 45 dB L_{dn} and 65 dB SEL. Nonetheless, it is recommended that disclosure statements should still be provided to all prospective residences in this area, as well as recorded against the land, notifying all potential homebuyers of the presence of the UPRR tracks and the accompanying elevated noise environment associated with existing and projected increased future rail activity. Interior noise levels within second-row residences and within the remainder of the project site are predicted to be within acceptable City noise levels; therefore, the impact is **less than significant**.



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SOURCE: Bollard Acoustical Consultants 2013

FIGURE 4.6-6

Railroad Section A

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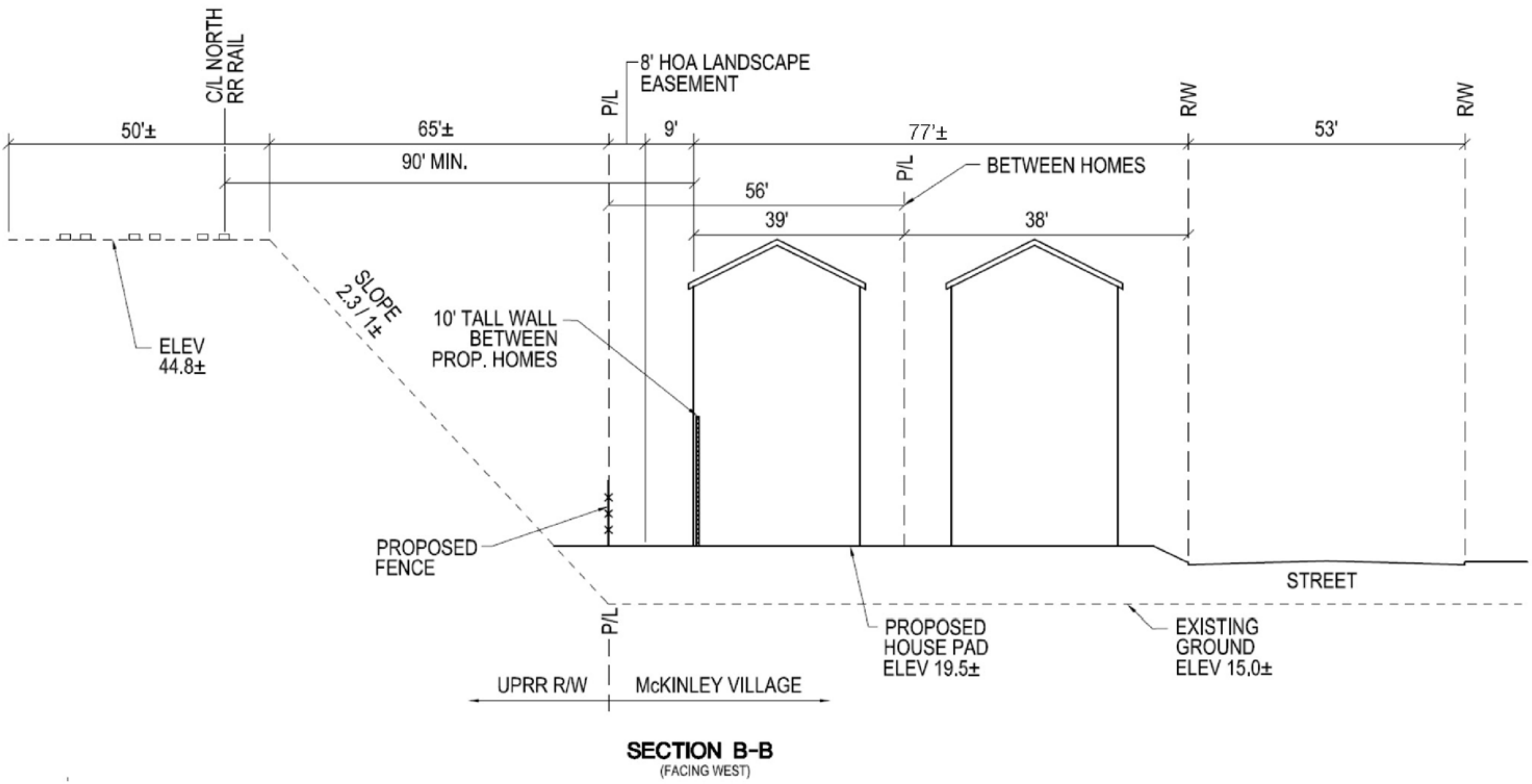

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FIGURE 4.6-7

Railroad Section B

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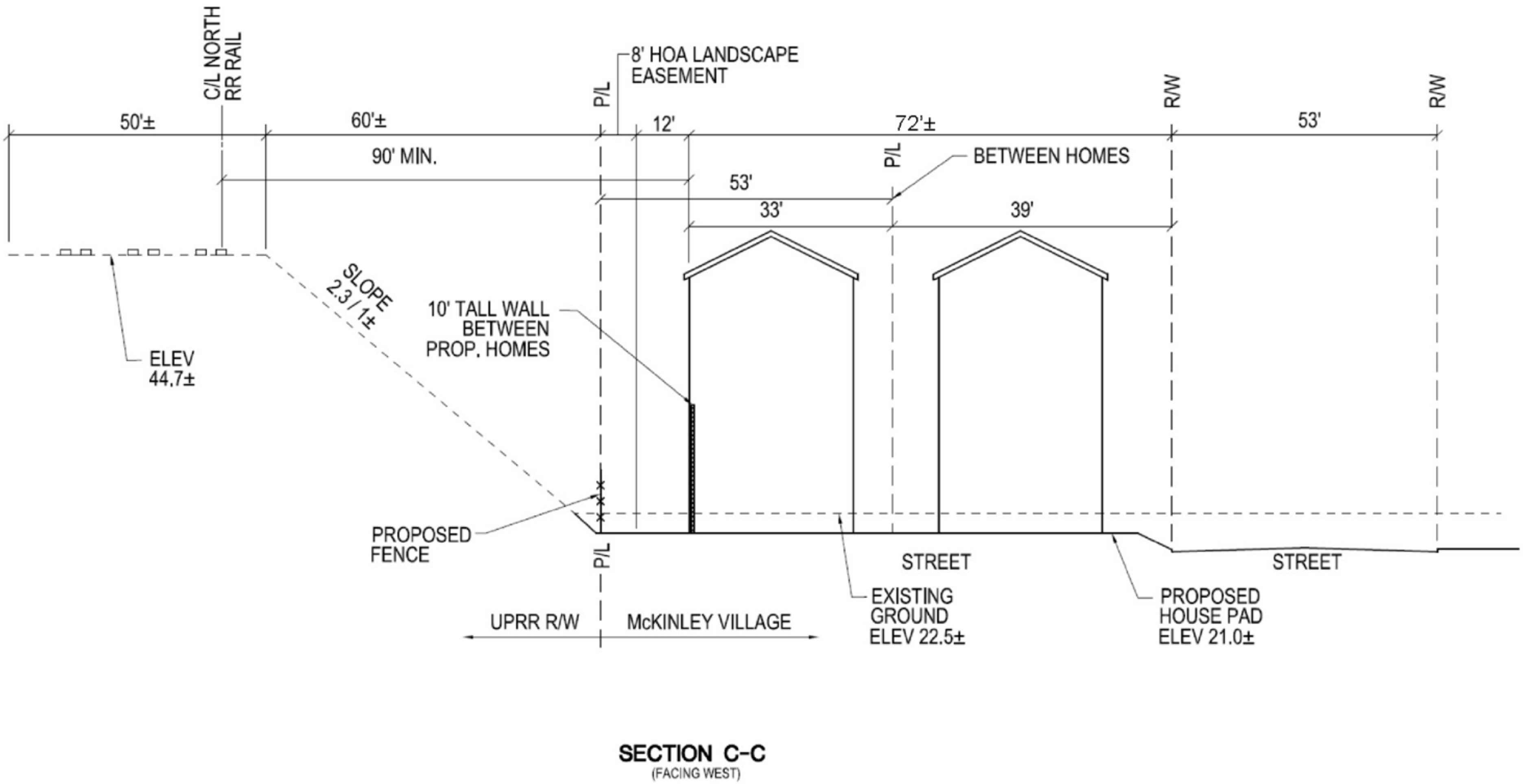

SOURCE: Bollard Acoustical Consultants 2013

FIGURE 4.6-8

Railroad Section C

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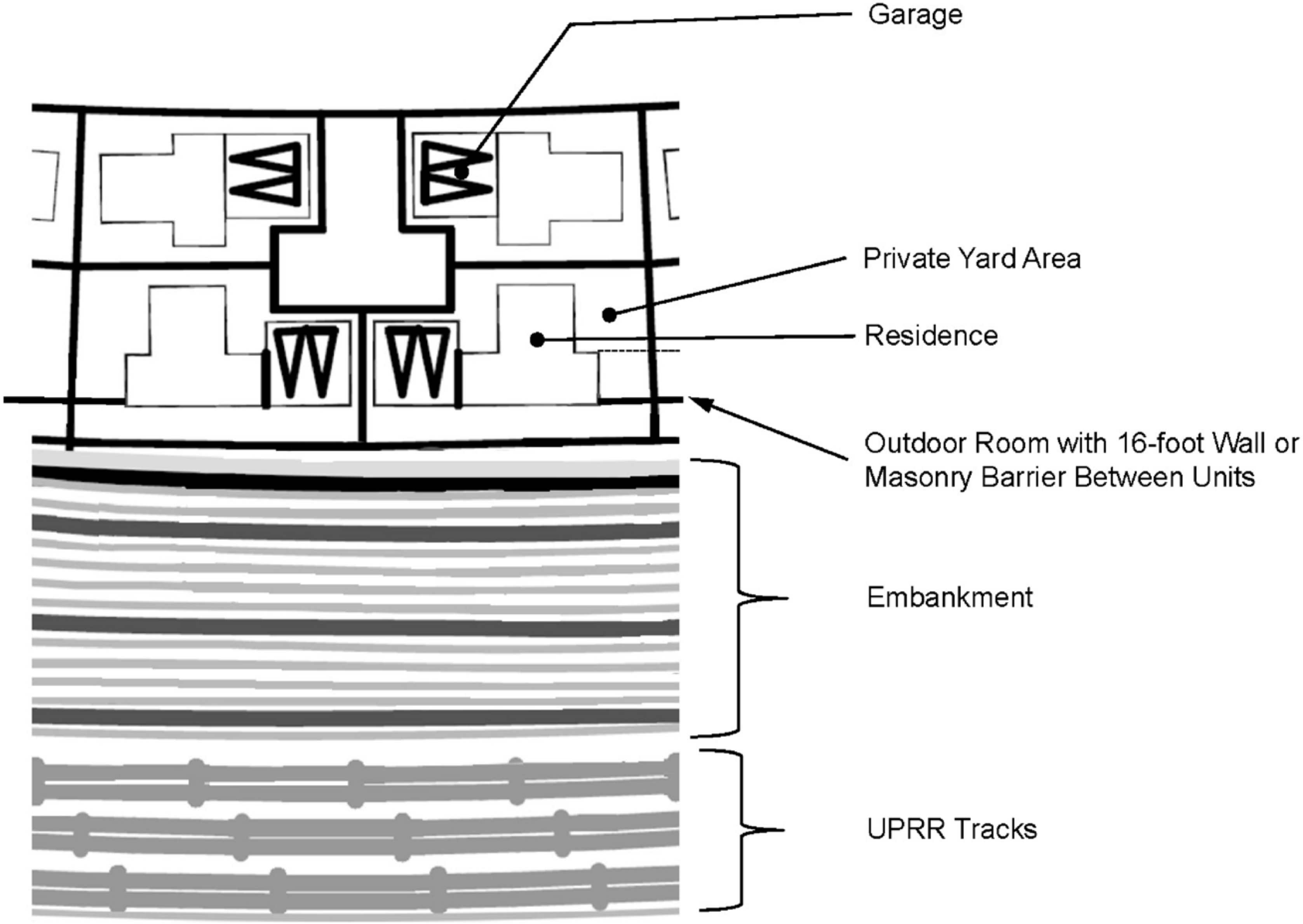

SOURCE: Bollard Acoustical Consultants 2013

FIGURE 4.6-9

Conceptual Residential Design Adjacent to Railroad Tracks

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Mitigation Measures

The following mitigation measures are required for the residences constructed on the first row of lots adjacent to the UPRR tracks to achieve interior SEL values of 65 dB SEL or less in bedrooms during train pass bys. Because interior noise levels are predicted to be 45 dB L_{dn} within these residences with standard construction, these measures would not be required to achieve compliance with the City's 45 dB L_{dn} interior noise standard. These measures would, however, further reduce interior noise levels to below 40 dB L_{dn} within these residences, thereby providing an additional factor of safety relative to the City's 45 dB L_{dn} interior noise standard. Compliance with this mitigation would reduce the impact to **less than significant.**

4.6-4 (a) All windows visible to trains shall have a minimum Sound Transmission Class (STC) Rating of 35. All other windows (bedroom or otherwise) from which the trains would NOT be visible shall have a STC rating of at least 30.

4.6-4 (b) Exterior doors facing the railroad tracks shall be solid core with a minimum rated STC value of 35.

4.6-4 (c) Exterior wall construction for the walls facing the railroad tracks shall consist of 2-x 6-inch studs with insulation completely filling the stud cavity, stucco exterior, and two layers of 5/8-inch thick gypsum board on the interior surfaces.

4.6-4 (d) Mechanical ventilation shall be provided to allow occupants to close doors and windows as desired to achieve acoustical isolation as desired.

4.6-4 (e) Roof materials shall be concrete tile or heavy-duty shingles such as the CertainTeed Presidential Series (or acoustic equivalent).

4.6-4 (f) Disclosure statements shall be provided to all prospective residences, as well as recorded against the land, notifying of the presence of the UPRR tracks and the accompanying elevated noise environment associated with existing and projected increased future rail activity.

4.6.5: Noise from the adjacent Capital City Freeway could result in interior noise levels at the project that exceed the City's 45 dBA L_{dn} standard. Based on the analysis below and with implementation of mitigation, the impact is *less than significant*.

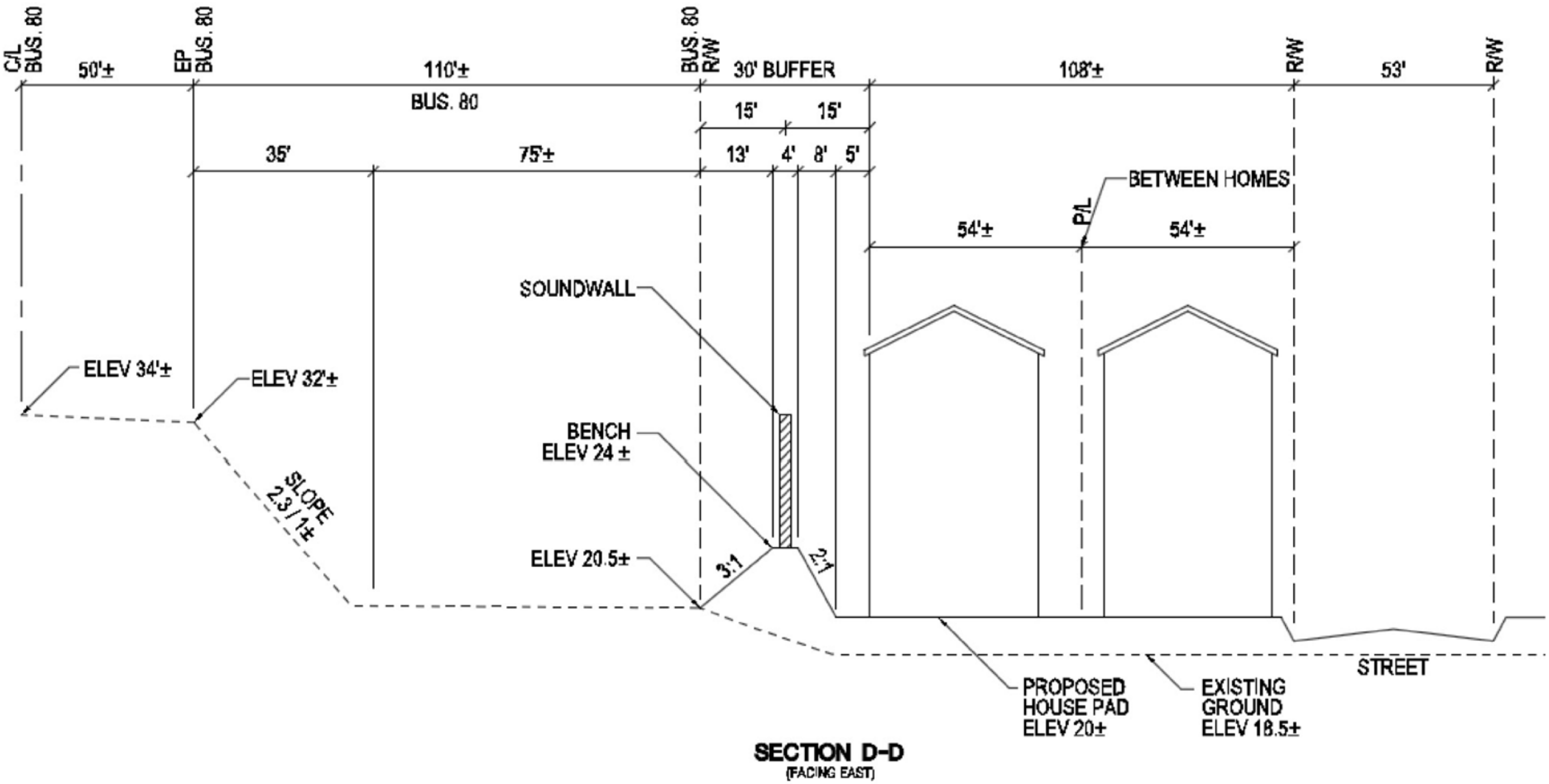
According to City of Sacramento noise standards, significant traffic noise impacts would occur within interior spaces of residences within the project site if traffic noise levels would exceed 45 dB L_{dn} within any area of the proposed residences.

The predicted traffic noise levels at exterior building façades proposed nearest to the Capital City Freeway would range from 74–77 dB L_{dn} at the upper floor façades not shielded by the proposed berm/wall combination, and 65-68 at first-floor façades which would be shielded by the proposed berm/wall combination. These exposure levels are based upon the project design adjacent to the Capital City Freeway. Cross-sections illustrating the design features included to address freeway noise are presented in Figures 4.6-10 through 4.6-12. To comply with the City's interior noise level standard at upper floor façades, a building façade traffic noise reduction of 32 dB L_{dn} would be required. At first-floor façades, a building façade traffic noise reduction of 23 dB L_{dn} would be required.

As noted above under Impact 4.6-4, the degree of exterior to interior noise level reduction provided by the various building façades is a function of their construction and types of building materials. Standard residential construction in conformance with common industry practices and local building code requirements normally consists of 2- x 4-inch wood stud exterior walls, exterior stucco siding, dual pane windows (two 1/8-inch panes separated by 1/4-inch airspace – STC 27), perimeter weather-stripping, and concrete tile roofs. Data available for residential construction similar to the proposed project adjacent to Interstate 80 in Dixon, California, indicates this construction type provides at least 25 dB of exterior to interior building façade traffic noise reduction. For a conservative assessment of project noise impacts, this analysis assumes a 25 dB exterior to interior traffic noise reduction for all proposed residences within the project area with windows in the closed position.

Based on a required 23 dB of building façade traffic noise attenuation for first-floor façades, standard residential construction practices would be acceptable provided those façades are shielded by the proposed berm/wall combination. Thus, interior noise levels for the first floor of the residences closest to Capital City Freeway would be anticipated to comply with the 45 dB L_{dn} interior criterion, resulting in a **less-than-significant impact**.

At the second tier of residences, located south of Capital City Freeway, exterior traffic noise exposure is predicted to be less than 70 dB L_{dn} due to the additional distance from the roadway and shielding of the residences by the intervening residences to the north (adjacent to the freeway) and the proposed berm/wall combination. As a result, interior traffic noise levels within the interior lots are predicted to be 45 dB L_{dn} or less with standard construction practices. However, should traffic from Capital City Freeway be visible from second story windows of interior lots (a condition considered unlikely), it is recommended that the STC ratings for such windows be upgraded to STC 30 from the typical STC 27 rating. This impact is considered **less than significant**.



SOURCE: Bollard Acoustical Consultants 2013

FIGURE 4.6-10

Traffic Section D

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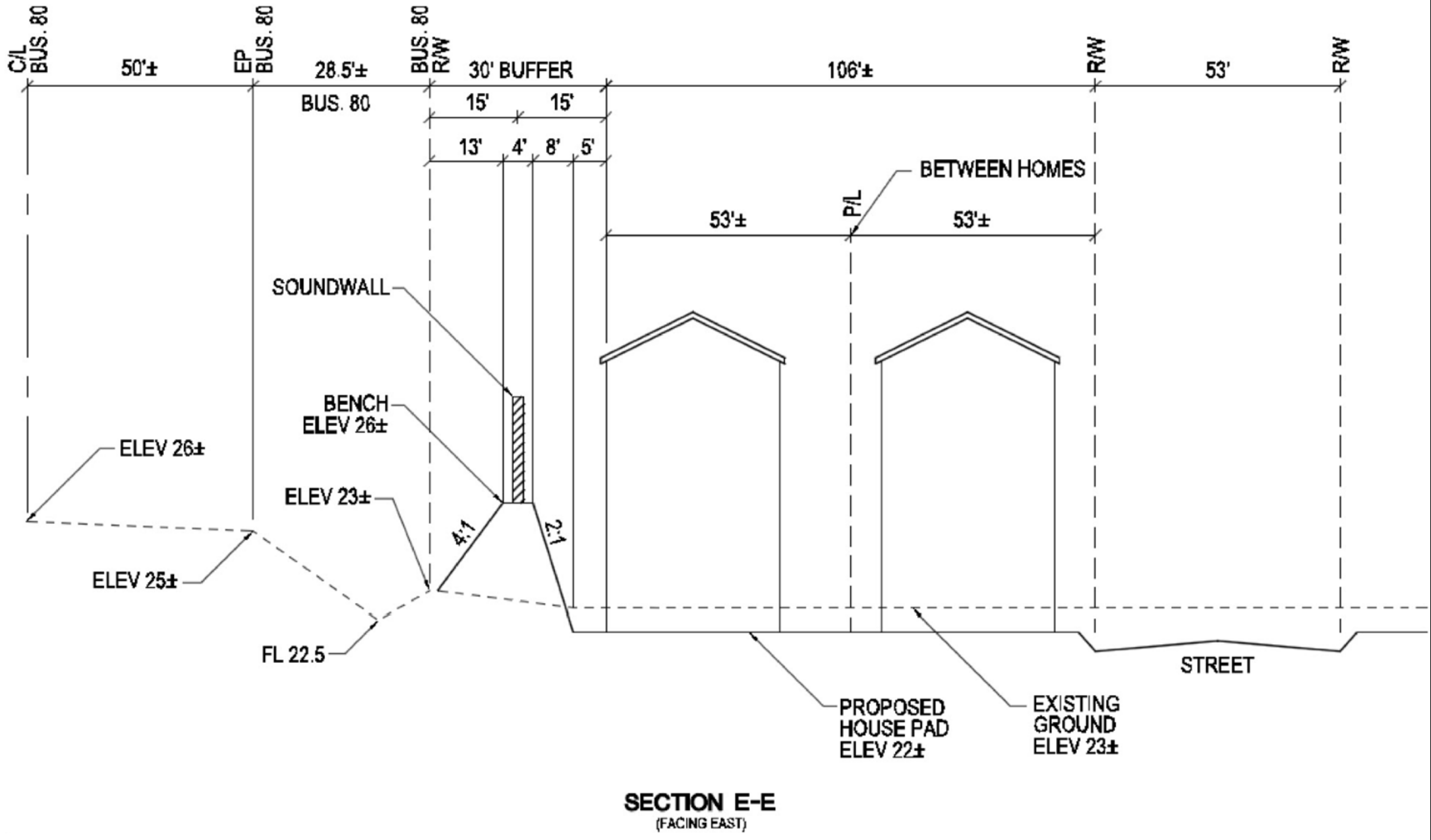

SOURCE: Bollard Acoustical Consultants 2013

FIGURE 4.6-11

Traffic Section E

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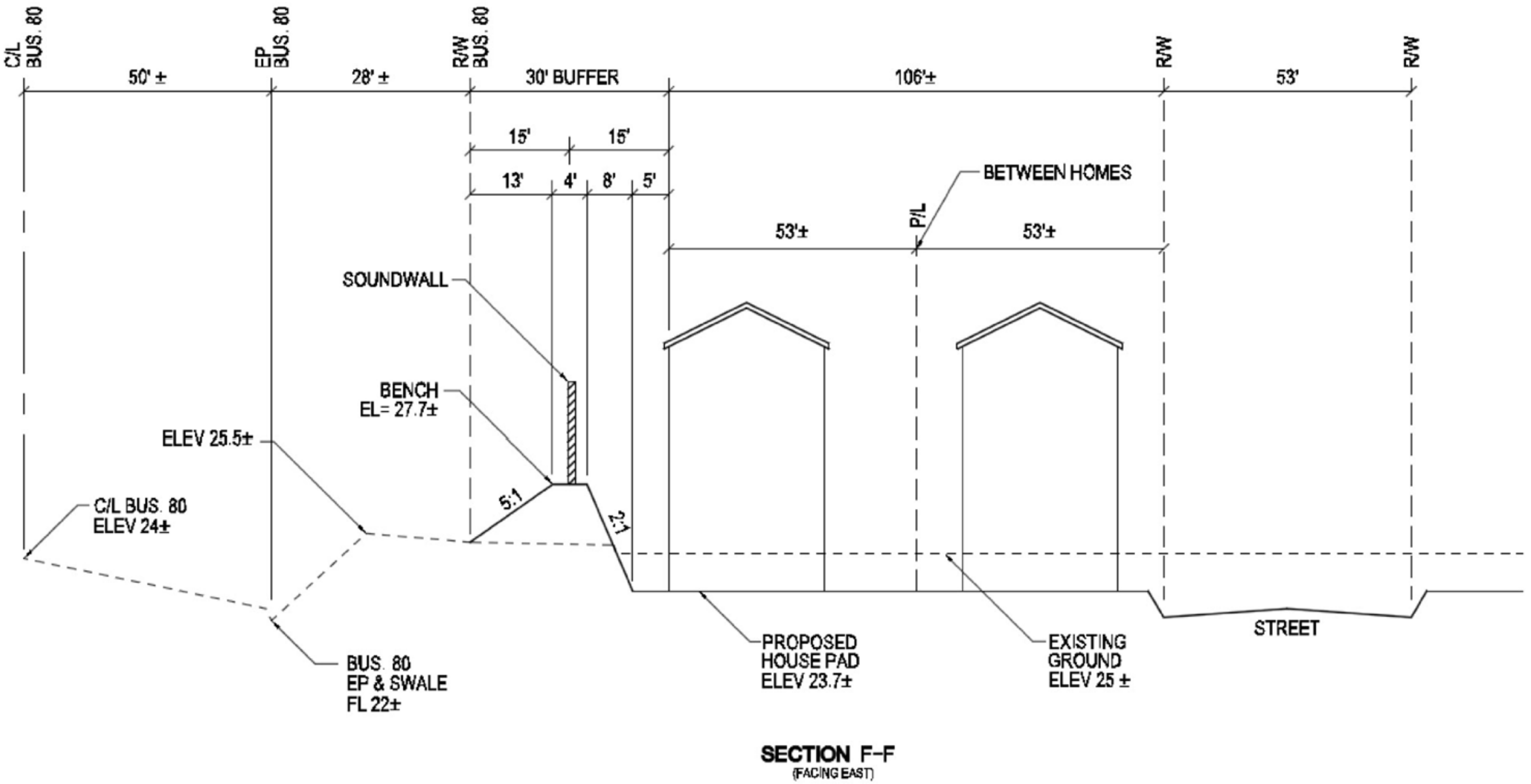

SOURCE: Bollard Acoustical Consultants 2013

FIGURE 4.6-12

Traffic Section F

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At elevated second-floor façades of those residences located adjacent to Capital City Freeway, which would not be shielded by the proposed berm/wall combination, standard construction would be insufficient to provide the degree of noise attenuation necessary to achieve compliance with the City's 45 dB Ldn interior noise level standard. Therefore, because the interior noise levels in second floor interior spaces of the residences closest to Capital City Freeway would not meet City standards, this is considered a **potentially significant impact.**

Mitigation Measures

To provide sufficient exterior to interior traffic noise reduction to ensure compliance with the City's 45 dB L_{dn} interior noise level standard, the following mitigation measures are required for residences located adjacent to Capital City Freeway (Lots 1-80). These measures provide specific building materials and techniques that would reduce interior noise levels to comply with the City's 45 L_{dn} interior noise standard. Compliance with this mitigation would reduce the impact to **less than significant.**

4.6-5 (a) All windows visible to Capital City Freeway (not just bedroom windows) shall have a minimum Sound Transmission Class (STC) Rating of 35. All other windows shall have a minimum STC Rating of 30.

4.6-5 (b) Exterior wall construction shall consist of insulation in the stud cavity, stucco exterior, and 5/8-inch thick gypsum board on the interior surfaces.

4.6-5 (c) All exterior doors and windows shall be fully weather-stripped.

4.6-5 (d) Mechanical ventilation shall be provided to allow occupants to close doors and windows as desired to achieve acoustical isolation as desired.

4.6-5 (e) Disclosure statements shall be provided to all prospective residences, as well as recorded with the deed, notifying of the presence of the highway and the accompanying elevated noise environment associated with existing and projected increased traffic on Capital City Freeway.

4.6-6: The proposed project could expose on-site residential areas to vibration greater than 0.5 inch per second due to adjacent highway traffic and rail operations. Based on the analysis below, the impact is *less than significant*.

Vibration measurements conducted on the project site during train pass bys indicate that peak particle velocity vibration levels (see Table 4.6-8) were below the thresholds at which annoyance or architectural damage would be expected, even at locations as close as 45 feet from the tracks. The low measured vibration levels are believed to be due to the very slow train speeds adjacent to the project site. Because the project site plan indicates that the nearest residences would also be approximately 90 feet to the UPRR tracks, annoyance or architectural damage to residences and structures is not anticipated.

It should be noted, however, that although the measured vibration levels were well within compliance with the City's vibration thresholds, they were still within the "perceptible" range, meaning that persons living in the residences nearest to the UPRR tracks may be able to detect vibration during train passages. Because annoyance is highly subjective, it is not possible to predict with certainty the extent by which persons living in the residences nearest the tracks would be annoyed by perceptible railroad vibration. Although construction of the residences located adjacent to the railroad tracks would utilize slab construction with upgraded wall and window assemblies, which would tend to reduce vibration levels to less-than-significant levels, it is recommended that disclosure statements be provided to prospective residents informing them that vibration may be periodically perceptible during train pass bys. This impact is considered **less than significant**.

Mitigation Measures

Railway and roadway vibration levels at future proposed residences were found to be less than significant. However, the following measure is *recommended,* pursuant to the request by UPRR.

4.6-6 Disclosure statements shall be provided to prospective homebuyers for homes located adjacent to the UPRR right-of-way, informing them of the presence of the UPRR tracks and that vibration may be periodically perceptible during train pass bys.

Cumulative Impacts

The existing ambient noise environment in the immediate project area is defined primarily by traffic on Capital City Freeway and trains on the UPRR tracks. Future development within the City of Sacramento, including the proposed project, would affect the future (cumulative) ambient noise environment. While it is difficult to project exactly how the ambient noise conditions within the area would change, it is known that traffic noise levels would increase due to the additional traffic generated by the proposed project and other development in the city and the region. In the cumulative scenario, ongoing development in the City of Sacramento and buildout of the City's 2030 General Plan would be expected to increase the ambient noise environment in the area as a result of increased traffic volumes and increased residential population and commercial activities. The cumulative context for noise is buildout of the City's 2030 General Plan.

The primary factor for the cumulative noise impact analysis is the consideration of future traffic volumes. Non-transportation noise sources (e.g., project operation) and construction noise impacts are typically project-specific and highly localized. Construction activities associated with anticipated development within the area would contribute to cumulative noise levels, but in a highly localized and transient manner. As other development occurs in the area, noise from different types of uses (e.g., traffic, aircraft, fixed noise sources) would continue to combine, albeit on a localized basis, to cause increases in overall background noise conditions within the area. As a result, such sources do not significantly contribute to cumulative noise impacts at distant locations and are not evaluated on a cumulative level.

4.6-7: Increase in cumulative noise generated by future passenger and freight train operations could expose project residents closest to the UPRR tracks to increased noise and exceed City standards. Based on the analysis below, the impact is *less than significant*.

The project would not be contributing to an increase in train activity; however, an analysis of the potential noise impacts to proposed residences associated with an increase in future train activity is included below.

As noted previously under the Methods of Analysis, future train operations were assumed to include 10 additional daily freight trains and, if the Capitol Corridor expansion project is completed, 18 additional Capitol Corridor (passenger) trains per day. In addition, the Capitol Corridor expansion would add a new track on the rail lines adjacent to the southern boundary of the site. This new track would be up to 45 feet closer to the project site. The increase in the number of train operations and decrease in distance to the Capitol Corridor trains would cause an overall increase in railroad noise exposure at the project site of approximately 3 dB. The increase in railroad noise exposure from the increased passenger and freight trips of 3 dB in the proposed private yards of the residences located closest to the railroad tracks would still be expected to be 60 dB Ldn or less. Thus, future noise levels in the proposed exterior areas would continue to be in compliance with the City's noise element exterior noise exposure guideline with respect to rail operations, and the cumulative impact is **less than significant.**

Mitigation Measures

None required.

4.6-8: Increase in cumulative traffic noise at the exterior of residences proposed adjacent to Capital City Freeway could expose project residents to increased noise and exceed City standards. Based on the analysis below the impact is *less than significant*.

As discussed above, to determine future traffic volumes, data from the FHWA Traffic Noise Prediction Model along with information provided by the transportation consultants were used to predict the cumulative increase in traffic noise levels in the project vicinity. The only source of traffic noise which appreciably affects the project site is Capital City Freeway, which borders the entire northern boundary of the project site. Because the City of Sacramento General Plan Noise Policies apply to future noise forecasts, the assessment of noise impacts on the project is conducted using an estimated future daily traffic volume for Capital City Freeway.

As discussed above under the Methods of Analysis, Caltrans is considering constructing a fourth lane eastbound on Capital City Freeway from the UPRR overcrossing to the bridge over the American River, adjacent to the project site. This would result in the effective noise center of the eastbound travel lanes being 4 feet closer to the proposed residences. This would result in a traffic noise level increase of 0.3 dB L_{dn}. Because an increase of less than 1 dB L_{dn} is considered imperceptible, the proposed eastbound lane addition is not predicted to noticeably affect existing or future traffic noise exposure at the project site. Therefore, the project, plus the reasonably foreseeable cumulative development, would result in a less-than-significant cumulative impact. The project's contribution to an increase in traffic noise on Capital City Freeway would be 0 dB.

Because future traffic noise levels in exterior areas adjacent to Capital City Freeway would meet the City's noise standards applicable to new residential developments, the cumulative impact is **less than significant.**

Mitigation Measures

None required.

4.6-9: Cumulative exposure of project residents to traffic and train noise could expose project residents to increased noise that exceeds City standards. Based on the analysis below, the impact is *less than significant*.

As indicated in Figure 4.6-5, no residential uses are proposed in the extreme southwest portion of the project site. As a result, there would be no cumulative impact at the residences in this area due to combined traffic and railroad noise exposure. At the northeast corner of the project site, however, residential lots are proposed at the apex of the intersection of Capital City Freeway and the UPRR overcrossing. At these locations, residences would be exposed to both traffic and railroad noise exposure.

To quantify noise generated by combined traffic and railroad noise exposure at the project site, a residence proposed in the northeast corner of the project site was selected for analysis. According to Figure 4.6-5, that residence would be located approximately 200 feet from the centerline of Capital City Freeway and 120 feet from the nearest UPRR track. At those distances, unmitigated traffic and railroad noise exposure is predicted to be a combined 77 dB L_{dn}. After construction of the noise barrier along the freeway, and the construction of residences adjacent to the southern and eastern boundary of the site, which would screen train noise exposure, the traffic and railroad noise exposure is predicted to be 58 dB L_{dn} and 55 dB L_{dn}, respectively. When combined under a future cumulative scenario, the total traffic and railroad noise exposure at this residence would be 60 dB L_{dn}, which would meet the City's 60 dB L_{dn} exterior noise standard applicable to new residential development. Because this residence represents the worst-case combined traffic and railroad noise exposure of any in the development, combined noise levels at all other proposed residences would be lower, and also within compliance with the City's 60 dB L_{dn} exterior noise standard. Therefore, the cumulative impact would be **less than significant.**

4.6.5 Sources Cited

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