APPENDIX I

Noise Report

Environmental Noise Assessment

McKinley Village Project

Sacramento, California

BAC Job #2013-076

Prepared For:

Encore McKinley Village, LLC

3001 I Street, Suite 200
Sacramento, CA 95816

Prepared By:

Bollard Acoustical Consultants, Inc.

Paul Bollard, President

October 22, 2013

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Introduction

The McKinley Village project (project) site is located on an approximately 48.75-acre site in the City of Sacramento bounded by Business 80 (Capital City Freeway) to its north and west, and the elevated Union Pacific Railroad (UPRR) tracks to its south and east. Further north and west of the Property is the Sutter's Landing Regional Park and the American River. Further south and east are the existing McKinley Park and East Sacramento neighborhoods. The project Site Vicinity is shown by Figure 1. The project proposes single family residences, as indicated in the site plan shown on Figure 2.

The project applicant has retained Bollard Acoustical Consultants, Inc. (BAC) to conduct an analysis of potential noise impacts due to and upon the proposed McKinley Village project. This report contains the results of that analysis, including noise level data collected by BAC, analysis methodology, applicable noise standards, and other supporting information.

Fundamentals and Terminology

Noise

In addition to the following discussion, definitions of acoustical terminology uses in this assessment are included in Appendix A. Noise is often described as unwanted sound. Sound is defined as any pressure variation in air that the human ear can detect. If the pressure variations occur frequently enough (at least 20 times per second), they can be heard and hence are called sound. The number of pressure variations per second is called the frequency of sound, and is expressed as cycles per second, called Hertz (Hz).

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 the 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. Another useful aspect of the decibel scale is that 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 weighing the frequency response of a sound level meter by means of the standardized A-weighting network. Because the A-weighting scale conditions the flat (unfiltered) sound signal received by the noise meter to match the natural filtering conducted by the human ear, there is a strong correlation between A-weighted sound levels (expressed as dBA) and community response to noise. 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. Table 1 provides examples of sound pressure levels for various noise sources or activities.

Figure 1
McKinley Village Project Location and Noise / Vibration Monitoring Sites

: Noise Monitoring Site

: Railroad Vibration Monitoring Site

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Figure 2
McKinley Village Project Site Plan & Cross-Section Key

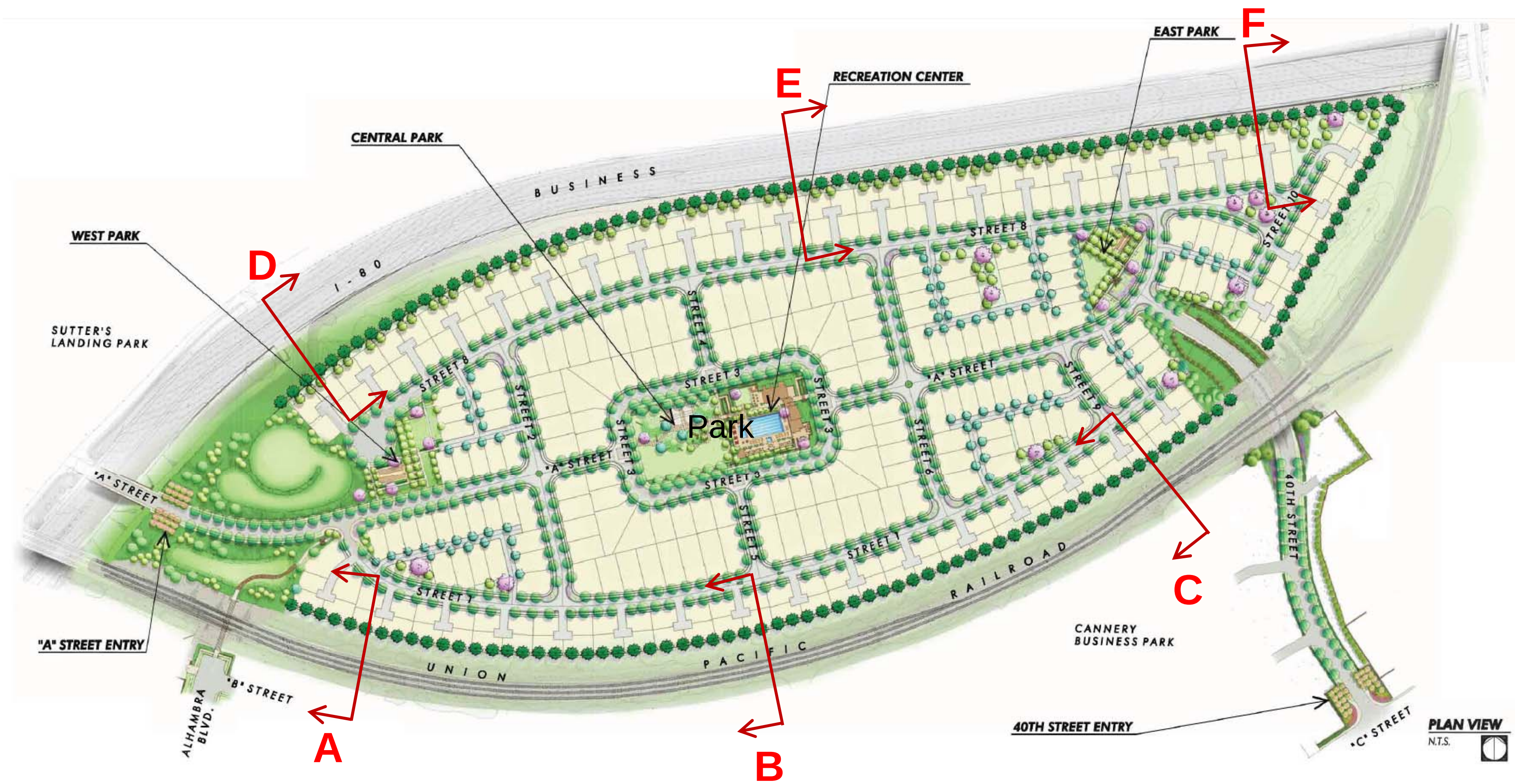

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Table 1
Typical A-Weighted Sound Levels of Common Noise Sources

Decibels	Description
120	Jet aircraft at 100 feet / Threshold of Pain
110	Riveting machine at operators 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: Egan 2007

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 noise environment. A common statistical tool to measure the ambient noise level is the average, or equivalent, sound level (Leq), 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 one hour). The Leq is the foundation of the composite noise descriptor, Ldn, 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 weighing applied to noise occurring during nighttime (10:00 p.m. to 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. L_{dn} based noise standards are commonly used to assess noise impacts associated with traffic, railroad and aircraft noise sources.

Negative effects of noise exposure include physical damage to the human auditory system, interference with daily activities, sleep disturbance, and disease. Exposure to excessive noise may result in physical damage to the auditory system, which may lead to gradual or traumatic hearing loss. Gradual hearing loss is caused by sustained exposure to moderately high noise levels over a period of time; traumatic hearing loss is caused by sudden exposure to extremely high noise levels over a short period. Gradual and traumatic hearing loss both may be permanent. In addition, noise may interfere with or interrupt sleep, relaxation, recreation, and communication. Although most interference may be classified as annoying, the inability to hear a warning signal (for example) may be considered dangerous. Noise may also be a contributor to diseases associated with stress, such as hypertension, anxiety, and heart disease. The degree to which noise contributes to such diseases depends on the frequency, bandwidth, and level of the noise and the exposure time (Caltrans 2009:2-65, 2-66).

Audibility

It should be noted that audibility is not a test of significance according to CEQA. If this were the case, any project which added any audible amount of noise to the environment would be considered unacceptable according to CEQA. Because every physical process creates noise, the use of audibility alone as significance criteria would be unworkable. CEQA requires a substantial increase in noise levels before noise impacts are identified, not simply an audible change. The discussion of what constitutes a substantial change in noise environments, both existing and cumulative, is provided in the Regulatory Setting section of this report.

Single-Event Noise & 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 Ldn or 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 one-second period regardless of event duration. As a result, the single-number SEL metric contains information pertaining to both event duration and intensity. Another descriptor utilized to assess single-event noise is the maximum, or Lmax, noise level associated with the event. A problem with utilizing Lmax to assess singe events is that the duration of the event is not considered.

There is currently no national consensus regarding the appropriateness of SEL criteria as a supplement or replacement for cumulative noise level metrics such as Ldn 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.

It is estimated that only 10 to 20 percent of the reported cases of sleep disturbance are for reasons relating to transportation noise. Most studies focus on investigating possible secondary effects of sleep disturbance, including reduced perceived sleep quality, increased fatigue, depressed mood or wellbeing, and decreased performance (Carter 1996, INRETS 1993, Passchier-Vermeer 1993, Pearson et al. 1995). 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 2.

Table 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%

Notes: Average Percent Awakened = 0.58 + (4.30 * 10^{-8}) * SEL
Source: Finegold and Bartholomew, 2001. "A Predictive Model of Noise Induced Awakenings from Transportation Sources" In *Noise Control Engineering Journal*, 2001: pp. 331-338.

Perception of Changes in Noise Levels

Table 3 is an approximation of human sensitivity to changes in sound levels. According to Egan (Architectural Acoustics, 2007), sound intensity is not perceived directly in the ear; rather pressure waves impacting the eardrum are transferred to the brain where acoustical sensations are interpreted as loudness. This makes hearing perception highly individualized. Sensitivity to noise also depends on frequency content, time of occurrence, duration of sound, and psychological factors such as emotion and expectations. Nevertheless, Table 3 is a reasonable guide to illustrate changes in sound levels for many situations.

Table 3
Human Reaction to Changes in Noise Exposure

Change in Sound Level (dBA)	Reaction
1	Imperceptible (except for tones)
3	Just barely perceptible
6	Clearly noticeable
10	About twice (or half) as loud
20	About four times (or one-fourth) as loud

Source: Egan, 2007

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. In contrast to airborne noise, ground-borne vibration is not a common environmental problem. It is unusual for vibration from sources such as buses and trucks to be perceptible, even in locations close to major roads. 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. Building damage is not a factor for normal transportation projects, with the occasional exception of blasting and pile-driving during construction. 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 propagates from the foundation throughout the remainder of the building structure. The maximum vibration amplitudes of the floors and walls of a building often will be at the resonance frequencies of various components of the building.

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.

Ground-borne vibration is almost never annoying to people who are outdoors. Although the motion of the ground may be perceived, without the effects associated with the shaking of a building, the motion does not provoke the same adverse human reaction. In addition, the rumble noise that usually accompanies the building vibration is perceptible only inside buildings.

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 shows expected responses to different levels of ground-borne vibration.

Table 4
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

Source: Survey of Earth-borne Vibrations due to Highway Construction and Highway Traffic, Caltrans

Environmental Setting

Existing Land Uses in the Project Vicinity

The project site is currently unimproved. Nearby land uses include a landfill, residential and commercial uses, Business Route 80, and the Union Pacific Railroad (UPRR) tracks. The UPRR tracks are located on a berm which separates the project site from the existing land uses to the south. Those uses 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. The property currently has access via a 2-lane overpass across Business 80 from the west that connects to the downtown grid system at 28^{th} and A Streets.

Noise and Vibration Sources Affecting the Project Area

The existing ambient noise environment in the immediate project vicinity is defined primarily by traffic on Business Route 80/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. The Union Pacific Railroad is the only appreciable source of vibration identified in the project vicinity.

Ambient Noise Level Survey

To quantify existing ambient noise levels at the project site, continuous noise monitoring was conducted at six (6) locations on the project site for the 4-day period spanning August 23-26, 2013. The noise monitoring sites are shown on Figure 1. The sites were selected to represent locations primarily affected by noise from Business Route 80 traffic, sites primarily affected by UPRR rail noise, and sites affected by a combination of rail and traffic noise.

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 maximum value, denoted L_{max}, represents the highest noise level measured during each 1-hour period. 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 Ldn is provided in Table 5. Graphs of the hourly average and maximum noise levels at each location for each day are provided in Appendix B.

Table 5
Ambient Noise Monitoring Results
McKinley Village EIR – August 23-26, 2013

Site	Date	Day of Week	Primary Noise Source	Ldn, dBA
1	8-23-13	Friday	Business 80	74
	8-24-13	Saturday		73
	8-25-13	Sunday		73
	8-26-13	Monday		73
				Average: 73
2	8-23-13	Friday	Business 80	76
	8-24-13	Saturday		75
	8-25-13	Sunday		75
	8-26-13	Monday		76
				Average: 76
3	8-23-13	Friday	Business 80 & UPRR	81
	8-24-13	Saturday		80
	8-25-13	Sunday		79
	8-26-13	Monday		80
				Average: 80
4	8-23-13	Friday	UPRR	64
	8-24-13	Saturday		61
	8-25-13	Sunday		62
	8-26-13	Monday		67
				Average: 64
5	8-23-13	Friday	UPRR	67
	8-24-13	Saturday		67
	8-25-13	Sunday		68
	8-26-13	Monday		69
				Average: 68
6	8-23-13	Friday	UPRR & Business 80	75
	8-24-13	Saturday		71
	8-25-13	Sunday		75
	8-26-13	Monday		74
				Average: 74

Source: Bollard Acoustical Consultants, Inc. 2013

The ambient noise survey results indicate that the measured noise levels at the project site are elevated well above City of Sacramento noise level standards, as would be expected of areas immediately adjacent to Business Route 80 and the UPRR tracks. Table 5 also indicates that there was no appreciable difference in measured Business Route 80 traffic noise levels between the weekday and weekend periods. Individual analysis of traffic and railroad noise is provided in the following sections of this report.

Existing Traffic Noise Environment

The existing traffic noise environment on the project site is defined exclusively by traffic on Business Route 80. Traffic on surface streets to the south is essentially inaudible at the project site due to the high noise generation of Business 80, the low traffic volumes and speeds on the surface streets, and the existing 20+foot tall railroad embankment separating the project site from the local roadway network to the south. As a result, the analysis of traffic noise impacts upon the proposed residential uses within the project site focuses entirely on the existing and future noise generation of Business Route 80.

In addition to the assessment of potential noise impacts affecting the project site, CEQA also requires that the noise impacts *caused by* the project be considered. As a result, noise impacts resulting from increases in off-site traffic noise levels along the roadways which would provide access to the project site are also evaluated.

In addition to the Business Route 80 traffic noise monitoring conducted at Sites 1-3, 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 traffic volumes for Business Route 80 were obtained from published California Department of Transportation 2012 traffic counts. Existing arterial traffic volumes were obtained from a traffic analysis prepared for this project by Fehr & 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.

Table 6 shows the predicted baseline traffic noise levels in terms of the Day/Night Average Level descriptor (L_{dn}) at a standardized distance of 50 feet from the centerlines of the existing project-area arterial roadways, and 75 feet from the Business Route 80 centerline. Table 6 also shows the distances to existing traffic noise contours. The 50-foot distance was selected as a reference distance for the arterial roadways because it generally corresponds to the distance from the centerline of the arterial roadways to existing residences located along those roadways. The 75 foot distance was utilized for Business Route 80 because that represents the distance from the highway centerline to the microphones located at the right-of-way fence at measurement Sites 2 & 3 (See Figure 1 for measurement locations). Because the distances from the arterial roadway centerlines to existing residential building facades and outdoor activity areas vary, the extent by 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. Appendix C provides the FHWA Model inputs and results for existing (baseline) conditions.

The Table 6 data for existing Business Route 80 indicate an existing Ldn of 81 dB was calculated at a distance of 75 feet from the highway centerline. Because the predicted level of 81 dB Ldn shows reasonable agreement (within 1 dB), with the average level of 80 dB Ldn measured at Site 3, no calibration of the FHWA Model is considered to be warranted for this location.

Table 6
Baseline Traffic Noise Levels and Distances to Contours
McKinley Village EIR - Sacramento, California

			Distance to Ldn Contours (feet)[1]		
Roadway	**Segment Description**	**L_{dn}[2]**	**70 dB**	**65 dB**	**60 dB**
Bus. Rte. 80	Entire Span of Project Site	81	423	911	1962
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: FHWARD77108 with inputs from Fehr & Peers and Bollard Acoustical Consultants.
1 - Distances to traffic noise contours are measured in feet from the centerlines of the roadways.
2 – The computed Ldn for Business Route 80 is at a reference distance of 75 feet from the roadway centerline whereas the Ldn values reported for the arterial roadways are computed at a reference distance of 50 feet from the roadway centerlines.

Future (Cumulative) Traffic Noise Environment

The future traffic noise environment at the project site will continue to be defined by traffic on Business Route 80. Forecasts of future traffic (cumulative) volumes were obtained from Fehr & Peers Transportation Consultants for the arterial roadways analyzed in the traffic study. The 2008 Draft EIR prepared for the previous McKinley Village reported a future traffic forecast of approximately 210,000 daily vehicles for Business Route 80. Based on this future traffic volume for Business Route 80, future traffic noise levels at the project site are predicted to be approximately 82 dB Ldn at the reference distance of 75 feet from centerline.

The reference distance of 75 feet was selected for Business Route 80 because it represents the future traffic noise level at the boundary of the project site (the right of way fence). This level at 75 feet is subsequently extrapolated to predict highway traffic noise levels at the nearest proposed building facades, private yard areas, and parks using industry-standard acoustical algorithms (i.e. 4.5 dB decrease in traffic noise per each doubling of distance from the Business Route 80 centerline). The specific noise levels at those locations, which vary in distance from Business Route 80, are discussed later in this analysis.

In addition to increases in traffic volume on Business Route 80 over time, Caltrans is considering adding an additional eastbound travel lane to this roadway. 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.

The distance from the nearest proposed residences in the McKinley Village development to the effective noise center of the existing eastbound travel lanes is approximately 83 feet. The 8-foot shift in the distance to the near travel lane resulting from the additional lane would result in a 4-foot shift in the distance to the effective noise center of the eastbound travel 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 Ldn. Because an increase of less than 1 dB Ldn is considered imperceptible (Table 3), the proposed eastbound lane addition is not predicted to noticeably affect existing or future traffic noise exposure at the project site.

Existing Railroad Noise Environment

The project site is bordered by the existing Union Pacific Railroad (UPRR) tracks to the south and east, as indicated on Figure 1. Just east 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 3.

The day/night average noise level (Ldn) 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 pm – 7 am).
- Warning horn usage.
- Train speed.
- Number of locomotives and cars per train.

The effects of each of these factors were accounted for in the ambient noise survey results described previously in this report. Additional analysis of railroad single-event noise levels and average daily noise exposure at the project site follows.

Number of Existing Daily Passenger Operations

According to the Amtrak schedule, there are currently two (2) Amtrak Capitol Corridor and two (2) Amtrak California Zephyr trains which pass the site each day on the north-west route. In addition, there are four (4) daily Amtrak San Joaquin trains which pass the project site on the south-west route. BAC site observations, schedule review, and noise measurements confirmed that there are currently eight (8) daily passenger train passbys adjacent to the project site. Six (6) of the eight (8) passenger train passbys occur during daytime hours.

Number of Existing Daily Freight Train Operations

According to information provided by the Union Pacific Railroad (UPRR), there are approximately 40 trains on the tracks which pass adjacent to the project site on a busy day, including both passenger and freight trains. The Union Pacific Railroad 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 3.

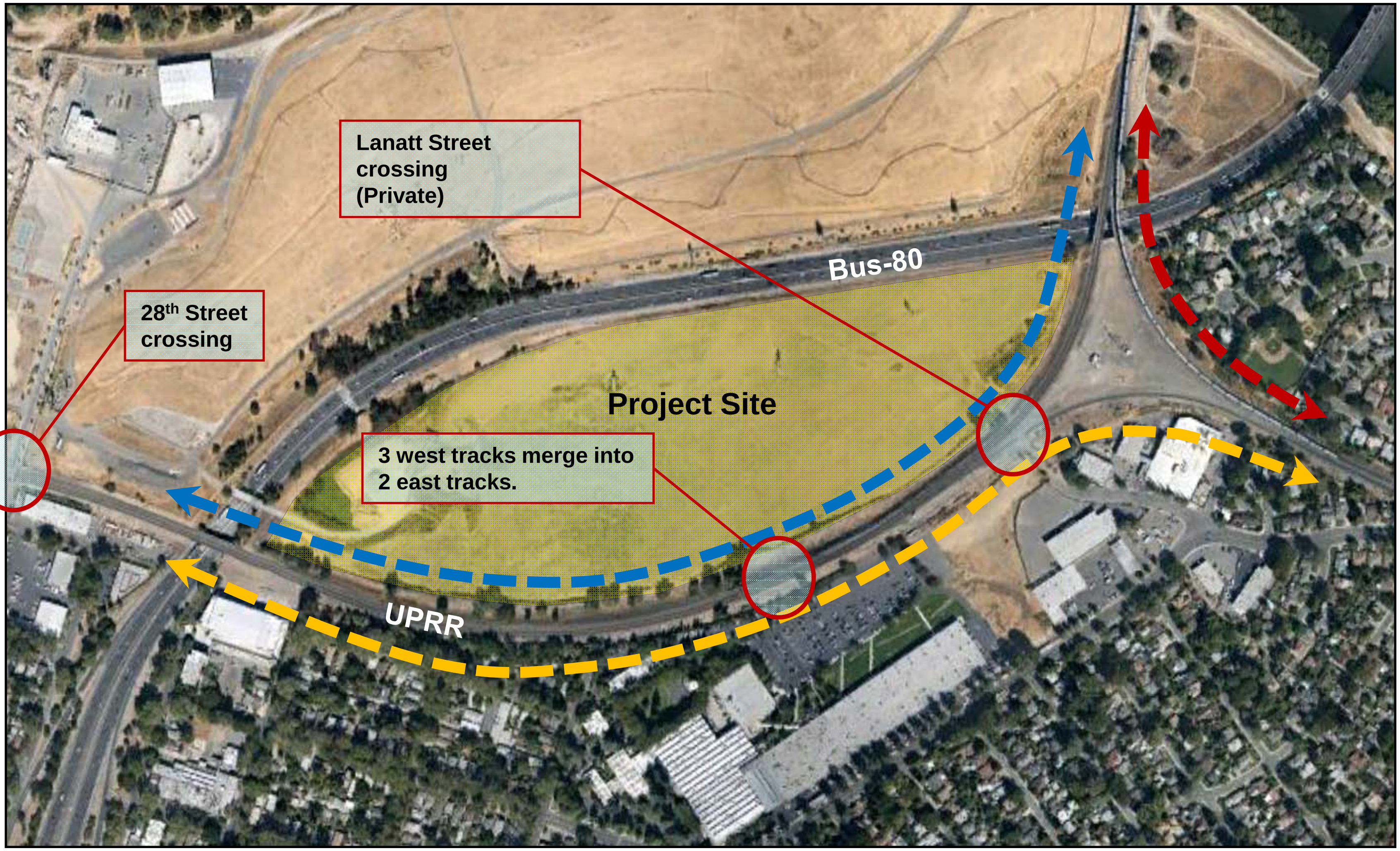
To more specifically quantify the existing number of trains which pass the project site during a typical day of railroad operations, BAC utilized 20-hours of staff observations and six days (4 full days and 2 partial days) of railroad single-event noise monitoring. The single-event monitoring was conducted concurrently with the ambient noise level monitoring program described in Table 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 passbys. This was accomplished by programming each meter with thresholds for single event maximum noise levels and duration. Specifically, the meters were programmed to store records of individual events which exceeded a level of 75 dB Lmax for a duration of at least 5 seconds. These thresholds were selected to try to capture single-events caused by passing trains, while excluding events caused by other sources of noise such as random aircraft overflights and noise generated by the occasional particularly loud vehicles on Business Route 80. Despite the careful selection of thresholds, some events which did not appear to have been caused by trains were logged, while some trains were too quiet to have triggered the single-event thresholds at each measurement site.

Because each of the three sound level meters located near the railroad tracks (Site 4-6) were time synchronized, it was possible to correlate the single-events between the three sites to determine the direction of the trains based on the order of the event time stamps. This aided in the identification of railroad operations versus non-railroad operations. As noted previously, not all train events registered on all three meters located adjacent to the railroad tracks. This was due to the different routes identified on Figure 3 (only trains on the north-west route passed all 3 monitoring sites), varying degrees of warning horn usage in the vicinity of each monitoring site, and partial shielding of railroad noise depending on which set of tracks the train was on during passby.

The most heavily used route identified during BAC staff field observations was the north-west route between Roseville and Downtown Sacramento. The north-south route between Roseville and Stockton was observed to be the second most heavily used track, but with considerably fewer operations than the Roseville-Sacramento route. The south-west route between Stockton and Sacramento was observed to be very infrequently used, with only one (1) freight operation observed by BAC staff over the course of approximately 20 hours of onsite observations.

To summarize, a combination of BAC on-site observations of railroad passages and an extensive analysis of the single-event data collected at all three sound level monitoring sites was used to develop counts of freight railroad activity adjacent to the project site over the course of the noise monitoring program. Given the noise generation of freight locomotives, while it is possible that some trains passed all three railroad noise monitoring sites at sound levels below the single-event thresholds, this is considered unlikely. As a result, the railroad count information developed from the field observations and noise measurement surveys, as reported in Table 7, are considered to be reliable estimates of existing freight activity on the tracks adjacent to the project site.

Figure 3
Railroad Routes, At-Grade Crossings, and Track Merge Location



: North-South Route (Roseville – Stockton)

: North-West Route (Roseville – Downtown Sacramento)

: South-West Route (Stockton – Downtown Sacramento)

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Combined Number of Daily Passenger and Freight Operations

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 7.

Table 7
Apparent Number of Existing Railroad Operations - August 22-27, 2013
McKinley Village Project Site Sacramento, California

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

Notes:
1- Monitoring sites are shown on Figure 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&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 3.

The Table 7 data indicate that approximately 23-27 trains passed the project site on average over a 24-hour period, with 30-35 operations on the busiest day of railroad activity during the monitoring program. These numbers 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 operations were registered. 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 operations are used to define existing traffic noise levels at the project site, rather than the higher number of 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 & 22 freight trains).

Future Railroad Operations

As noted previously, UPRR officials have reported that there could be as many as 40 trains per day on the tracks located adjacent to the project site, including service. This represents approximately 10 additional freight train operations relative to observed existing conditions. To provide a conservative assessment of future railroad noise exposure at the project site, this analysis assumes that 10 additional freight operations would occur in the future.

In addition to the potential for increased freight rail service in the future, an expansion of the Capitol Corridor service has been proposed which could potentially affect the project site noise environment. The expansion would increase existing Capitol Corridor service from two (2) daily operations to twenty (20) daily operations adjacent to the project site. When added to the existing passenger service adjacent to the project site (California Zephyr and San Joaquin lines), a total of 26 daily passenger trains would pass the project site daily. This expansion would require the construction of a new track up to approximately 45 feet closer to the project site.

To summarize, this analysis assumes 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.

Warning Horn Usage

According to the Federal Railroad Administration (FRA), under the Train Horn Rule (49 CFR Part 222), locomotive engineers must begin to sound train horns at least 15 seconds, and no more than 20 seconds, in advance of all public grade crossings. If a train is traveling faster than 60 mph, engineers will not sound the horn until it is within ¼ mile of the crossing, even if the advance warning is less than 15 seconds.

Train horns must be sounded in a standardized pattern of 2 long, 1 short and 1 long blast. The pattern must be repeated or prolonged until the lead locomotive or lead cab car occupies the grade crossing. The rule does not stipulate the durations of long and short blasts. The maximum volume level for the train horn is 110 decibels, and the minimum sound level is 96 decibels.

Unless a Quiet Zone is in effect, train horns are required by federal law to be sounded at all public crossings, 24 hours a day, to warn motorists and pedestrians that a train is approaching. Train crews may also sound their horns when there is a vehicle, person or animal on or near the track and the crew determines it is appropriate to provide warning. Crews may also sound the horn when there are track or construction workers near the tracks, or when gates and lights at the crossing are not functioning properly.

As indicated on Figure 3, there is a public grade crossing at 28th Street, and a private grade crossing at Lanatt Street. BAC 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 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 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 Lanatt Street crossing did affect the measured single-event noise measurement 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 occurrence 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.

Train Speeds

The speeds of several train passbys were monitored at the project site using a Bushnell Velocity radar gun on August 27, 2013. Those measurements indicated that typical 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.

Number of Locomotives and Cars per Train

BAC observations of railroad activity at the project site indicated that passenger operations typically had one (1) locomotive and approximately 8-10 cars, although the eastbound California Zephyr was observed to have two (2) locomotives. Freight train lengths varied but typically consisted of 2-3 locomotives at the beginning of the train and one (1) locomotive at the end.

Day/Night Distribution of Railroad Events

As noted previously, six of the eight existing daily Amtrak operations passing the project site occur during daytime hours. For freight operations, they day/night distribution was approximately 57% daytime and 43% nighttime. A uniform distribution of freight activity over a 24-hour period would yield a day/night split of 63% / 37%, so the observed distribution was very near a uniform distribution.

Existing Railroad Noise Levels

A total of 329 single event data points recorded at the three railroad monitoring sites were analyzed to quantify existing railroad noise exposure at the project site. From this data, the mean Sound Exposure Levels (SEL) and maximum noise levels were calculated. Because warning horn usage at the project site has been virtually eliminated due to the implementation of a Quiet Zone after the noise monitoring period was completed, those railroad events which clearly indicated warning horn usage were excluded from the calculations. Using the observational data, applicable noise measurement results, and numbers of daily passenger and freight operations described above, the day/night average noise level (Ldn) for isolated railroad activity was then calculated using the following equation:

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

SEL is the mean measured SEL of the freight or passenger train events, N_{eq} 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 8 contains the summary of the railroad noise measurement results and computed Ldn values at a representative distance of 90 feet from the nearest rail. The 90 foot distance was used because it represents the closest proposed residences within the McKinley Village project site to the railroad tracks. Railroad noise levels at more distant locations, such as private yard areas and parks, were extrapolated from this 90-foot reference distance using industry standard algorithms for sound propagation over distance.

Table 8
Existing Railroad Noise Levels @ 90 feet from Near Tracks
McKinley Village Project Site Sacramento, California

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

Source: Bollard Acoustical Consultants, Inc. (BAC)

The Table 8 data indicate that existing railroad noise exposure at the project site is approximately 70 dB Ldn at a distance of 90 feet from the centerline of the nearest set of railroad tracks. Table 8 also indicates that existing passenger (Amtrak) operations do not affect the computed Ldn values at the project site. This is because there are only eight (8) current daily passenger trains with two (2) of those events occurring during nighttime hours versus 22 daily freight operations with 9 of those freight operations occurring during nighttime hours. 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.

Future Railroad Noise Levels

The aforementioned use of 10 additional daily freight operations to reflect future conditions would result in an increase in day/night average levels (Ldn) of 2 dB over existing conditions. The resulting future railroad noise environment at the project site would be approximately 72 dB Ldn at the reference distance of 90 feet from the nearest railroad track.

If the 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 McKinley Village project. It should be noted that the four (4) existing daily Amtrak operations between Stockton and Sacramento on the south-west route (see Figure 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.

Currently, the eight (8) daily passenger train operations generate a day/night average level of 58 dB Ldn at the reference distance of 90 feet from the railroad tracks, as indicated in Table 8. 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 Ldn increase in passenger train noise levels, to 61 dB Ldn at a distance of 90 feet from the nearest existing rail. When combined with the future 72 dB Ldn noise level from freight operations, noise generated by these additional passenger operations would continue to be inconsequential, as combined noise levels would still be 72 dB Ldn. As mentioned previously, because the decibel scale is logarithmic, when two decibel levels 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 Ldn. When combined with the 72 dB Ldn 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 Ldn.

ATS Consulting will be providing noise and vibration technical assistance to the Capitol Corridor Joint Powers Authority for the Capitol Corridor expansion project. BAC contacted Mr. 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.

Baseline Railroad Vibration Environment

The only identified source of potentially significant vibration levels at the project site is railroad passbys. To quantify railroad vibration levels, Bollard Acoustical Consultants, Inc. conducted vibration measurements of representative passenger and freight train passbys on August 27, and September 23-24, 2013. The measurements were conducted at distances of 45, 65 and 90 feet from the near railroad track at the location shown on Figure 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 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 BAC staff on November 13, 2008.

The vibration measurements consisted of peak particle velocity 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 9.

Table 9
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: Bollard Acoustical Consultants, Inc.
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 for general human and structural responses to vibration levels.

Criteria for Acceptable Noise Exposure

City of Sacramento 2030 General Plan

The General Plan focuses on the effect that noise from various sources has on the community. The noise element of the City of Sacramento 2030 General Plan is intended to ensure that noise control is incorporated into the planning process and to achieve and maintain appropriate noise levels for existing and proposed land uses. The following goals and policies of the City of Sacramento 2030 General Plan relating to noise would apply to the proposed project:

Goal EC 3.1 Noise Reduction. Minimize noise impacts on land uses and 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 exterior noise standards exceed those shown in Table 10 (Table EC-1 of the General Plan), to the extent feasible.

Table 10
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 – Multi-family	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: Governor's Office of Planning and Research, State of California General Plan Guidelines 2003, October 2003

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 multi-stories multi-family 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.

- **Policy EC 3.1.2 Exterior Incremental Noise Standards.** The City shall require mitigation for all development that increases existing noise levels by more than the allowable increment as shown in Table 11 (Table EC-2 of the General Plan), to the extent feasible.

Table 11
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

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.
Source: City of Sacramento. 2009. Sacramento 2030 General Plan Master Environmental Impact Report. Certified March 3, 2009

- **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 over-flights, 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.

Sacramento City Code

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 12. The Table 12 standards are specifically applicable to sources of noise which can be controlled at the local level. The Table 12 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 12
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

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.
Source: City of Sacramento Noise Ordinance. www.qcode.us/codes/sacramento/view.php?topic=8-8_68-ii&frames=off.

With respect to construction noise, the City of Sacramento Noise Ordinance (Section 8.68.080) exempts noise generated by construction activities from the standards identified above in Table 5.7-9, as follows:

E. Noise sources due to the erection (including excavation), demolition, alteration, or repair of any building or structure between the hours of seven a.m. and six p.m. on Monday, Tuesday, Wednesday, Thursday, Friday, and Saturday, and between nine a.m. and six 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 or urgent necessity and in the interest of public health and welfare for a period not to exceed three days.

Application for this exemption may be made in conjunction with the application for the work permit or during progress of the work.

With respect to noise generated at neighborhood parks, the City of Sacramento Noise Ordinance (Section 8.68.080) specifically exempts noise generated by activities conducted at parks or public playgrounds, provided such parks and playgrounds are owned and operated by a public entity.

Railroad Single-Event Noise Level Criteria

As noted in City of Sacramento General Plan Policy EC 3.1.4, in cases where new development is proposed in areas subject to frequent, high-noise events (such as train 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. The City of Sacramento General Plan does not, however, provide a quantifiable threshold against which single-event noise impacts are to be evaluated.

As noted in Table 2, studies of sleep disturbance have indicated that an interior Sound Exposure Level (SEL) of 65 dBA resulted in an average percentage of awakening of approximately 2% of the population. Because 2% of the population can be expected to regularly awaken due a variety of factors not related to noise, the use of an interior SEL threshold of 65 dBA for the assessment of single-event impacts within residences is both reasonable and scientifically defensible.

Vibration Standards

The City of Sacramento Noise Element Policies EC 3.1.5 and EC 3.1.7 pertain to vibration generated by construction as well as impacts on historic structures. The City of Sacramento has indicated that an appropriate vibration threshold to be applied to highway traffic and railroad operations is 0.5 inches/second peak particle velocity for proposed new residential uses and 0.2 inches/second for historic structures and archaeological sites.

Discussion of Noise Standards Applicable to Outdoor Activity Areas

In evaluating noise impacts for this project, the proper selection of exterior noise level standards for the proposed outdoor spaces of this development is critical. As noted previously, the project is located in an elevated noise environment due to the combined contributions from the Capital City Freeway and the Union Pacific Railroad. As a result, the project has been designed to make use of proposed residential structures and noise barriers to shield areas such as parks and private yard areas. In addition to individual private yards of proposed residential lots, the project also includes three parks which will be available to all residents of the development for passive or active outdoor recreation. The locations of the proposed parks are identified on Figure 2. The target exterior noise environment in the proposed parks is 70 dB Ldn (Table 10). The target exterior noise environment in the private yard areas of each residence is 60 dB Ldn (Table 10).

Impacts and Mitigation Measures

Standards of Significance

For this project, noise and vibration impacts would be considered significant if the project would:

- result in a substantial permanent increase in ambient exterior noise levels in the project vicinity that exceed standards in the City's General Plan (60 dBA standard for low density single family residential);
- result in residential interior noise levels of 45 dBA Ldn 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 inches per second due to project construction;
- permit adjacent residential and commercial areas to be exposed to vibration peak particle velocities greater than 0.5 inches 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 inches per second due to project construction, highway traffic, and rail operations.

Methodology

A combination of use of 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 McKinley Village project. The following specific impacts are evaluated in this assessment:

- Impacts of existing and cumulative traffic and railroad noise exposure at noise-sensitive exterior areas (residential backyards and park spaces) of the proposed McKinley Village development.
- Impacts of existing and cumulative traffic and railroad noise exposure at noise-sensitive interior areas of the proposed residential uses in the McKinley Village development.
- Impacts associated with existing and future railroad vibration at interior spaces of the proposed residential uses located within the McKinley Village development.
- Impacts associated with project-related increased surface traffic noise levels at existing and cumulative off-site noise-sensitive land uses resulting from the project.

Impacts Associated with Existing and Expanded Railroad Operations

Impact 1: Existing Railroad Noise Levels at Proposed Individual Outdoor Activity Areas (private yards) of First Row of Residences

As indicated in Table 8, the existing railroad noise environment at the project site is approximately 70 dB Ldn at a reference distance of 90 feet from the nearest tracks. Figures 4-6 illustrate the three cross-sections identified on Figure 2. Those figures indicate that the nearest proposed residences would be approximately 90 feet from the nearest railroad track. The private yard areas of these lots would be located in front of the residential structure, as indicated in Figure 7.

The developer is proposing to connect the residences along the railroad tracks through the creation of an outdoor room with a 16-foot tall wall along the railroad side. These outdoor rooms, which are shown on Figure 7, 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 car park area of the residences is not sensitive to noise, the developer is proposing to bridge the gap between 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 Ldn, not including shielding by the proposed residences or barriers themselves.

BAC conducted noise barrier analyses for these private yard areas using an accepted noise barrier insertion loss prediction methodology. The analysis was complicated in that 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 Ldn. These levels would be considered acceptable relative to City of Sacramento 60 dB Ldn exterior noise standard applied to new residential uses. Appendix E shows the detailed noise barrier results for Section B.

Because the residential structures are predicted to provide approximately 15 dB of noise reduction in the nearest private yard areas, maximum noise levels during railroad passages would be reduced to approximately 74 dB Lmax in the yard areas, which would not interfere with typical outdoor recreation activities and which may not even briefly interfere with outdoor communication if the distance between the persons conversing is small. Given the substantial shielding of these outdoor activity areas by the residences, resulting railroad noise levels are expected to be acceptable for outdoor activities and communication.

Because the proposed design of the residences located adjacent to the railroad tracks would result in acceptable exterior noise environments (60 dB Ldn or less) within private yard areas, this impact is considered ***less than significant***.

Figure 4
Railroad Section A
Source: Wood Rogers – May 2013

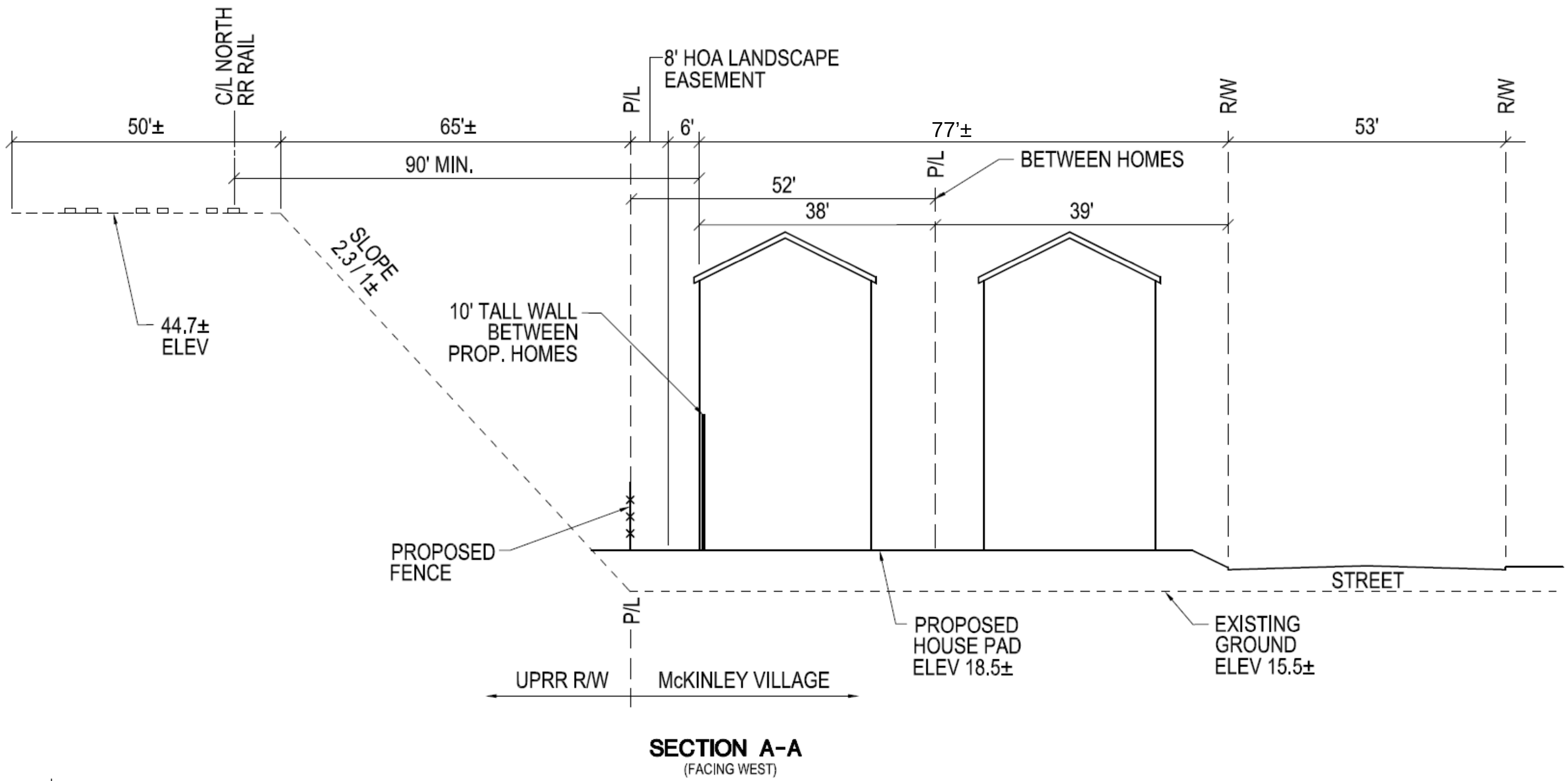

Figure 5
Railroad Section B
Source: Wood Rogers – May 2013

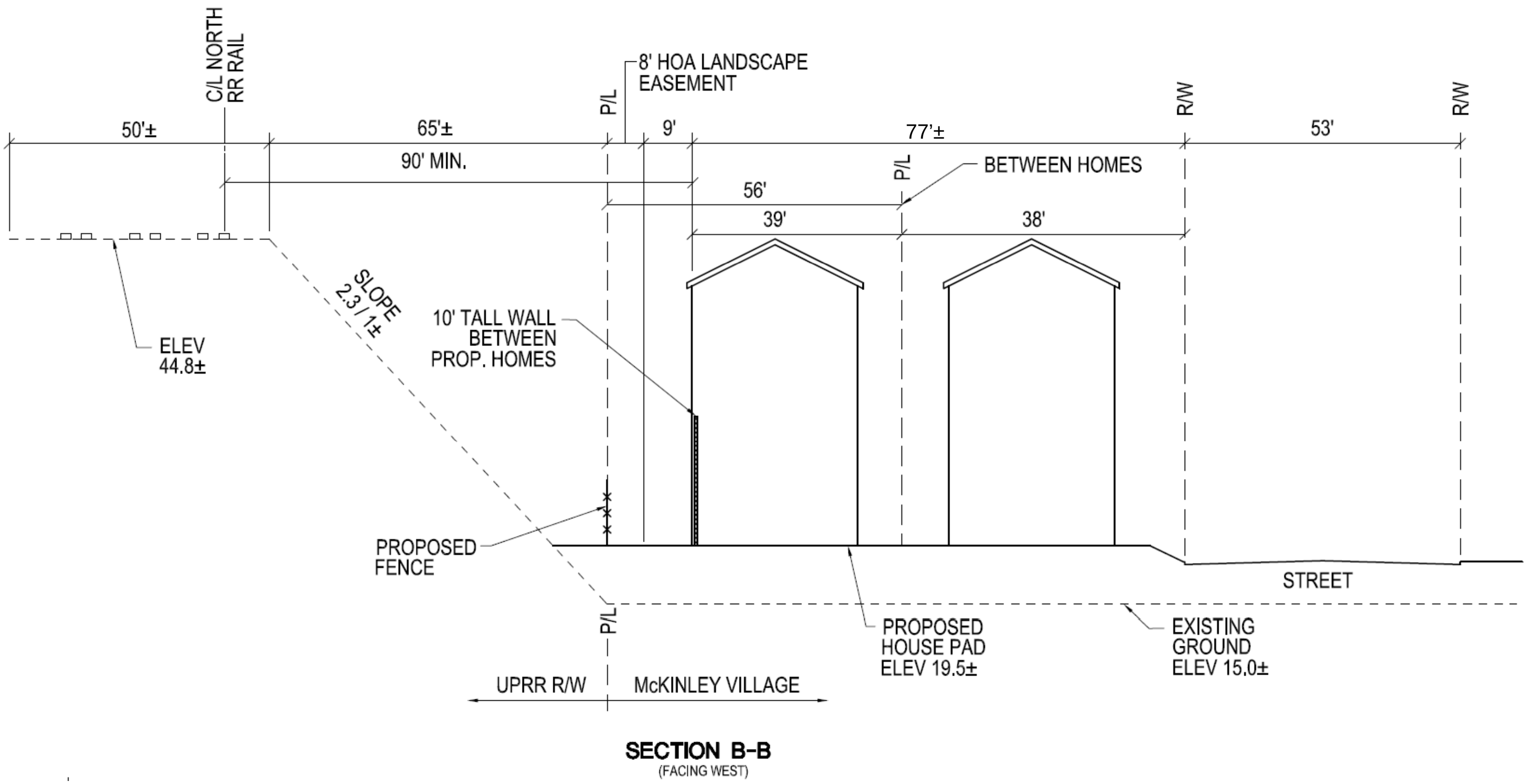

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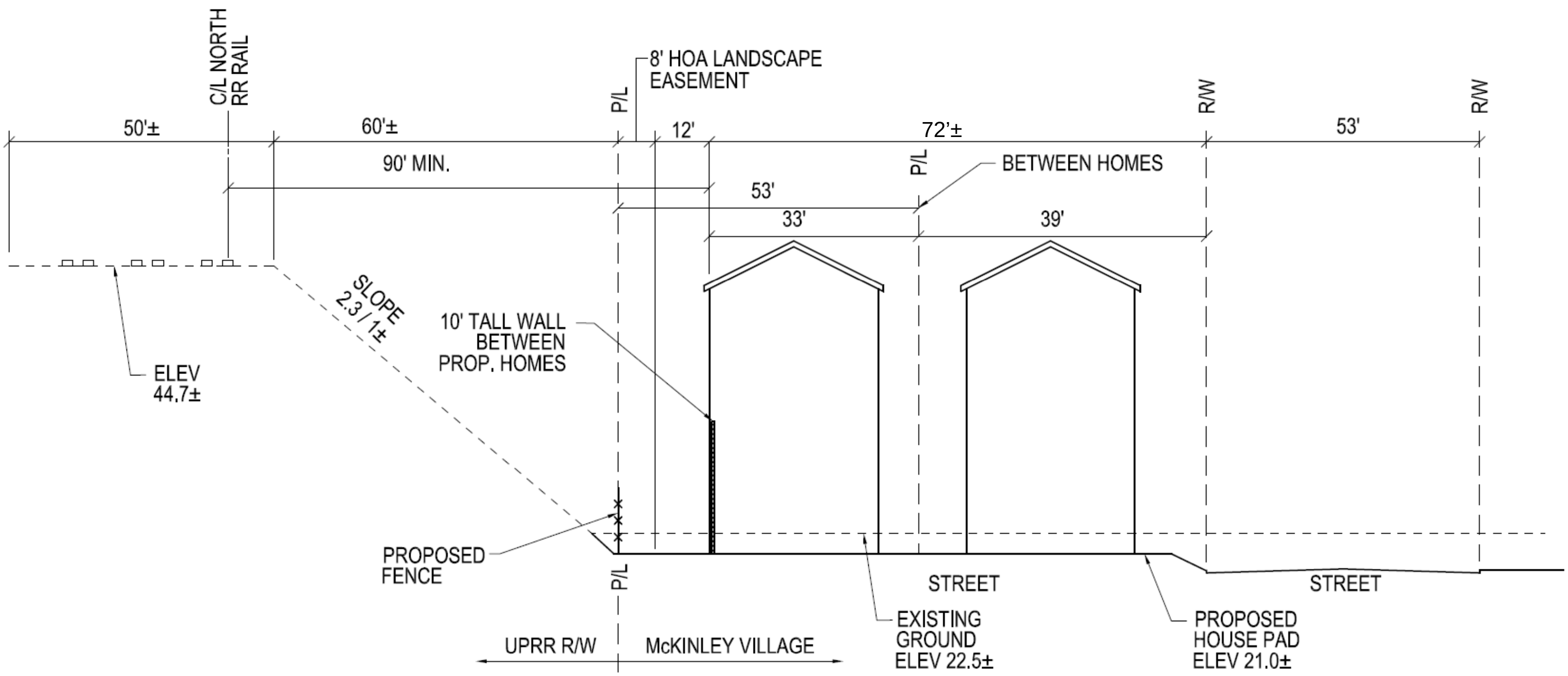
Figure 6
Railroad Section C
Source: Wood Rogers – May 2013



SECTION C-C
(FACING WEST)

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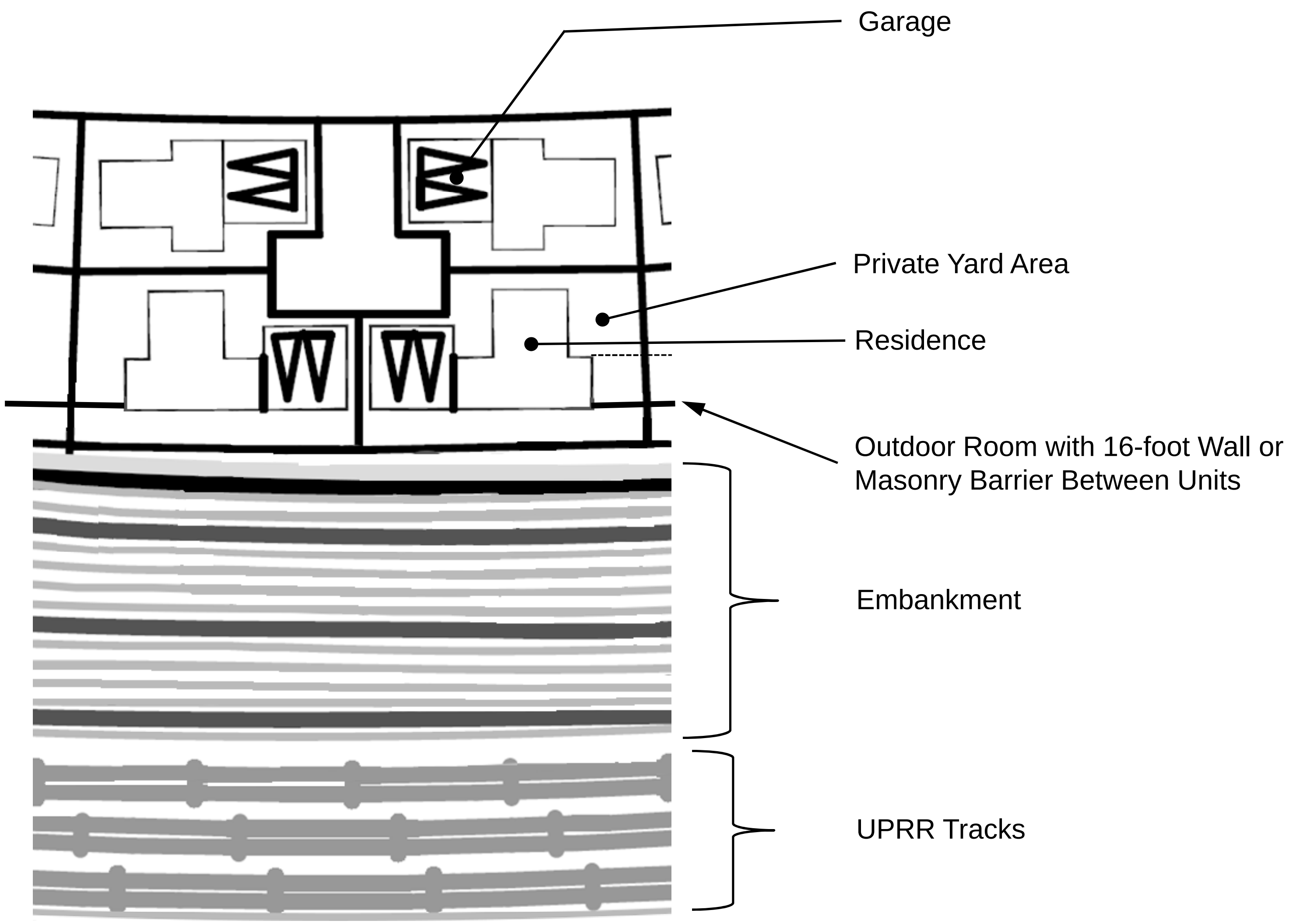
Figure 7
Conceptual Residential Design Adjacent to Railroad Tracks



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Impact 2: Existing Railroad Noise Levels at Outdoor Activity Areas of Second Tier Residences

According to project site plans, the building facades of the second tier of residences (not the second row, but the residences on the north side of the road nearest the railroad tracks), would be located approximately 225-230 feet from the railroad tracks. At that 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. That shielding is anticipated to further reduce railroad noise exposure by at least 10 dB, resulting in exterior noise exposure of less than 60 dB Ldn for the second row of residences. This exposure would be considered acceptable by the City of Sacramento for residential developments without the need for additional exterior noise mitigation measures such as noise barriers. As a result, this impact is considered ***less than significant***.

Impact 3: Existing Railroad Noise Levels at Proposed Park Sites

As indicated on Figure 2, the project proposes three (3) park sites. The proposed park sites would be located at least 350 feet from the nearest railroad tracks. At that distance, railroad noise would be attenuated to approximately 61 dB Ldn by distance alone, without even considering the partial shielding provided by intervening residential structures to the south. That shielding is anticipated to further reduce railroad noise exposure by at least 10 dB at the park sites, resulting in exterior railroad noise exposure below 55 dB Ldn. This exposure would be considered acceptable relative to the City of Sacramento 70 dB Ldn exterior noise standard applied to parks (Table 10). As a result, no additional exterior noise mitigation measures would be warranted for the park sites.

Due to shielding by intervening residences, maximum noise levels within the park areas during railroad passages would be approximately 70 dB Lmax, which would not interfere with typical outdoor recreation activities and which may not even briefly interfere with outdoor communication if the distance between the persons conversing is small. Given the substantial shielding of these park areas by the intervening residences, resulting railroad noise levels are expected to be acceptable for outdoor activities and communication. As a result, this impact is considered ***less than significant***.

Impact 4: Existing Railroad Noise Levels within Proposed Residences

According to the City of Sacramento noise standards, railroad noise impacts are identified at interior spaces of this development if railroad noise levels will exceed 45 dB Ldn within any area of the proposed residences. In addition, the City of Sacramento requires evaluation of single-event noise levels in locations affected by railroad passbys. 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 Ldn interior standard alone.

As indicated in Table 8, the predicted railroad noise levels at the exterior building facades proposed nearest to the UPRR tracks are approximately 70 dB Ldn, 90 dB Lmax, and 100 dB SEL. To achieve satisfaction with the City's 45 dB Ldn interior noise level standard, a building façade railroad noise reduction of 25 dB Ldn would be required. Based on the objective of reducing interior noise levels during railroad passages 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 facades is a function of their construction. Important factors which affect the building façade noise reduction include exterior wall thickness (i.e. 2x4-inch versus 2x6-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 2x4-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. BAC test data for residential construction similar to the proposed project indicates this construction type provides at least 25 dB of exterior to interior building façade 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.

When windows are in the open position, much of the noise reducing benefits of the façade are lost as sound will enter the sensitive rooms through the path of least resistance (the open window). With windows in the open configuration, the degree of noise reduction provided by the building façade depends on the window size, wall size, room volume, proximity to open window, and sound absorption present within the room. Although this number is highly variable, building façade noise reduction with windows open is often considered to be at least 10 dB. Although it is recognized that interior noise levels are considerably higher with windows open, the City of Sacramento, as with most jurisdictions, applies the interior noise level standards assuming windows in the closed position.

The following specific measures are recommended for the residences constructed on the first row of lots adjacent to the railroad tracks to achieve interior SEL values of 65 dB SEL or less in sleeping rooms during rail passages. Because interior noise levels are predicted to be 45 dB Ldn within these residences with standard construction, these measures would not be required to achieve compliance with the City's 45 dB Ldn interior noise standard. They would, however, further reduce interior noise levels to below 40 dB Ldn within these residences, thereby providing an additional factor of safety relative to the City's 45 dB Ldn interior noise standard:

a) All windows from which trains will be visible shall have a minimum Sound Transmission Class 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.

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

c) Exterior wall construction for the facades 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.

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

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

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

Following implementation of these measures, this impact is considered ***Less than Significant***.

Impact 5: Existing Railroad Noise Levels within Second Tier Residences

According to project site plans, the building facades of the second tier of residences (not the second row, but the residences on the north side of the road nearest the railroad tracks), would be located approximately 225-230 feet from the railroad tracks. At that 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. That shielding is anticipated to further reduce railroad noise exposure by at least 10 dB, resulting in exterior noise exposure of less than 60 dB Ldn for the second row of residences. Because exterior noise levels would not exceed 60 dB Ldn outside the second tier residences, no additional construction upgrades would be required of the residences to achieve satisfaction with the City's 45 dB Ldn interior noise standard.

In terms of single-event noise and the potential for sleep disturbance, SEL values at the exterior facades of these residences are predicted to be approximately 84 dB SEL during train passages. Given a target interior SEL value of 65 dB, approximately 19 dB of railroad noise reduction would be required of these building facades. 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 Ldn and 65 dB SEL. Nonetheless, disclosure statements should still be provided to all prospective residences of this development, as well as recorded with the deed, notifying of the presence of the UPRR tracks and the accompanying elevated noise environment associated with existing and projected increased future rail activity. Provided disclosure statements are provided to all residences located within this development, interior noise levels within second-row residences and beyond are predicted to be ***less than significant***.

Impact 6: Existing Railroad Vibration within Residences

Vibration measurements conducted on the project site during railroad passbys indicate that peak particle velocity vibration levels (Table 9) were well 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 railroad 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 railroad tracks may be able to detect vibration during rail passages. Because annoyance is highly subjective, it is not possible to predict with certainty the extent by which persons living in the row of residences nearest the railroad tracks would be annoyed by perceptible railroad vibration. Although construction of the residences located adjacent to the railroad tracks will utilize slab construction with upgraded wall and window assemblies, which would tend to reduce vibration levels, BAC recommends that disclosure statements be provided to prospective residents informing them that vibration may be periodically perceptible during railroad passages. This impact is considered ***less than significant***.

Impact 7: Noise Generated by Future Passenger and Freight Train Operations

As noted previously, future operations were assumed to include 10 additional daily freight trains and, if the Capitol Corridor expansion project is completed, 18 additional Capitol Corridor trains per day. In addition, the Capitol Corridor trains on new tracks would be up to 45-feet closer to the project site. This increased number of operations and decreased distance to Capitol Corridor trains would cause an overall increase in railroad noise exposure at the project site of approximately 3 dB. The resulting day/night average noise level at the nearest proposed residences to the project site would be approximately 73 dB Ldn.

This increase in railroad noise exposure from the increased passenger and freight trips would cause a 3 dB increase in railroad noise exposure in the proposed private yards of the residences located closest to the railroad tracks. However, future railroad noise exposure would still be expected to be 60 dB Ldn or less within the private yard areas of the residences proposed adjacent to the tracks. Although it is unclear if the Capitol Corridor expansion will be completed, this impact would, nonetheless, be considered ***less than significant***.

Impacts Associated with Existing and Future Traffic Noise

Impact 8: Increases in Off-Site Traffic Noise Levels due to the Project

Offsite 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 Caltrans and Fehr & Peers Transportation Consultants. To determine the relative differences between project and no project traffic noise conditions, the predicted traffic noise levels at a standardized distance of 75 feet from the centerline of Business Route 80, and 50 feet from the centerlines of the arterial roadways were computed. The predicted traffic noise levels and the project related changes in noise levels for existing conditions are presented in Table 13. A complete listing of the FHWA model inputs, predicted noise levels, and distances to traffic noise contours is presented in Appendices C and D for existing conditions and Appendices I and J for cumulative.

Table 13
Predicted Baseline and Cumulative Traffic Noise Levels
McKinley Village EIR – Sacramento, California

		L_{dn}, dB[1] (Change, dB)	
Roadway	**Segment**	**Baseline + Project**	**Cumulative + Project**
Bus. Rte. 80	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)
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: FHWARD77108 with inputs from Fehr & Peers and Bollard Acoustical Consultants, Inc.

1 – Ldn Values are computed distances of 75 feet from the Business Route 80 Centerline and 50 feet from the arterial roadway centerlines.

Table 13 indicates that the proposed project would result in increases in traffic noise levels on project-area roadways ranging from 0-2 dB Ldn. Table 11 provides the City of Sacramento allowable incremental noise increases for new projects affecting existing sensitive receptors. Table 11 indicates that the allowable increase is a function of the existing, or baseline, noise environment present prior to the project. With the exception of Business Route 80, the existing baseline noise level is below 65 dB Ldn. As a result, the allowable noise increase due to the project would be 2 dB or more. Because the increases in existing traffic noise levels reported in Table 13 do not exceed the 2 dB threshold, this impact is considered ***less than significant***.

Impact 9: Future Traffic Noise Levels at Proposed Private Yards of Residences Proposed Adjacent to Business Route 80

On-site traffic noise impacts are identified at exterior areas of noise-sensitive project components where future traffic noise levels are predicted to exceed the applicable City of Sacramento noise level standards. The only source of traffic noise which appreciably affects the project site is the Business Route 80, which borders the entire northern boundary of the project site. As a result, I-80 traffic noise is the focus of onsite traffic noise impacts for this project. 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 Business Route 80.

Cross-sections from the project site to the centerline of Business Route 80 were prepared by the project engineer and are provided in Figures 8-10. Those figures illustrate that center of the nearest proposed outdoor activity areas (private yard areas) of the residences located adjacent to Business Route 80 (Bus. 80) would be approximately 135 to 215 feet (+/-) from the centerline between the eastbound and westbound traffic lanes. At these distances, traffic noise exposure is predicted to range from 70 to 72 dB Ldn, not including shielding by proposed earthen berms and noise barriers, but including partial shielding of Business Route 80 traffic noise by the residential structures on each side of the private yard areas (-5 dB). The Federal Highway Administration Traffic Noise Prediction Model worksheets are provided in Appendices F-H. Appendices F-H also show the detailed noise barrier results for Sections D-F. These attachments indicate the noise reduction which would be obtained from either increased or decreased noise barrier heights.

Cross-sections provided by the project applicant indicate that combinations of earthen berms and noise barriers are proposed adjacent to the Business Route 80 right of way to reduce traffic noise exposure at the project site. BAC conducted noise barrier analyses 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 Ldn or less at the outdoor activity areas proposed nearest to Business Route 80.

Maximum noise levels associated with traffic on Business Route 80 are predicted to be approximately equal to the Ldn values corresponding to the ultimate barrier heights constructed for the project. After barrier construction, typical maximum noise levels in the backyard areas associated with I-80 traffic would be approximately 60 dB Lmax. 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.

Because existing and future traffic noise levels would satisfy the City of Sacramento noise standards applicable to new residential developments, and because maximum traffic noise levels would not interfere with outdoor communication, this impact would be considered ***less than significant***.

Figure 8
Traffic Section D
Source: Wood Rogers – August 2013

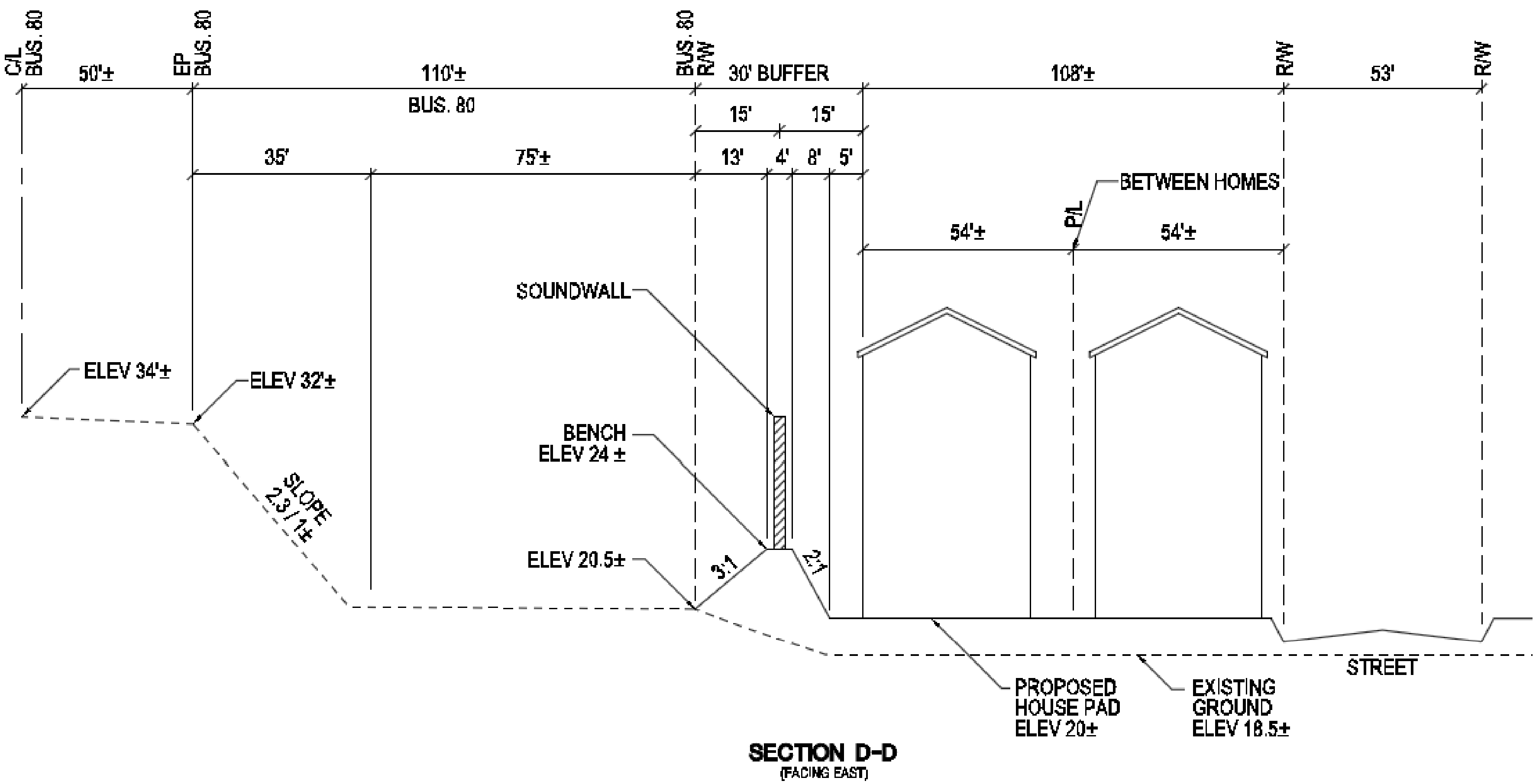

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Figure 9
Traffic Section E
Source: Wood Rogers – August 2013

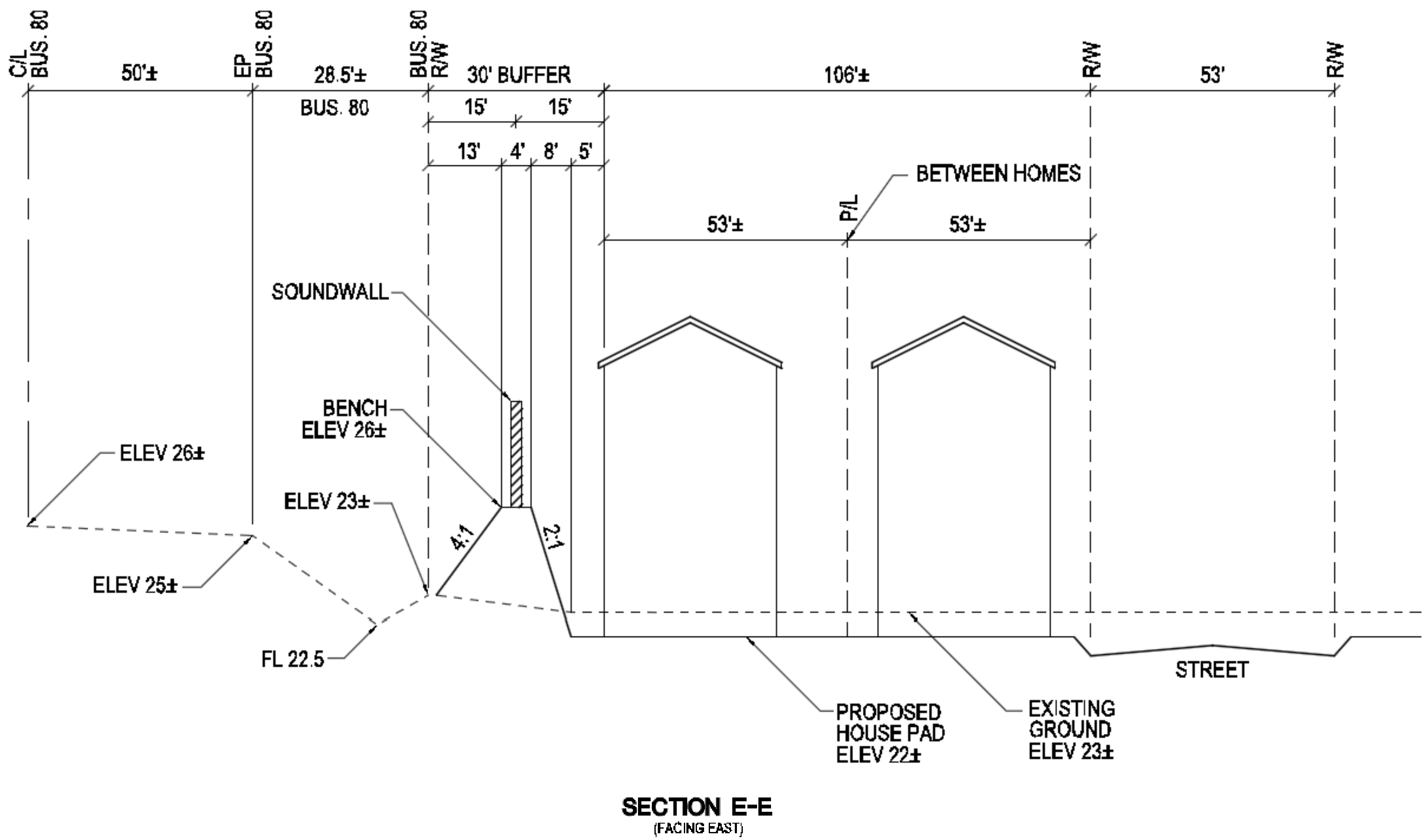

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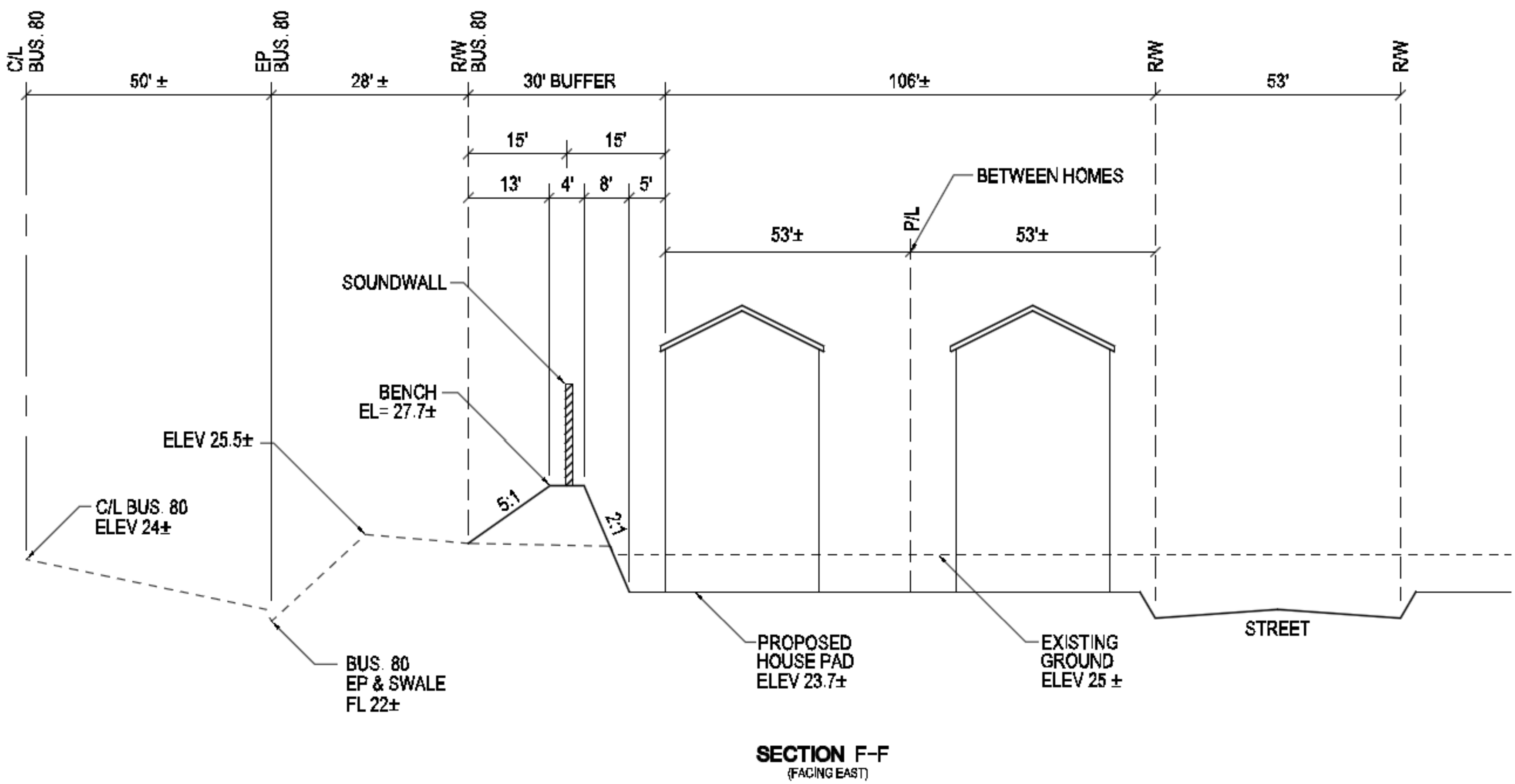
Figure 10
Traffic Section F
Source: Wood Rogers – August 2013



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Impact 10: Traffic Noise Levels at Second Tier of Residences

According to project site plans, the second tier of residences (the residences to the south of the northernmost road), would be located approximately 275 feet or more from the highway centerline. At that distance, traffic noise would be attenuated to approximately 74 dB by distance alone, without even considering the shielding provided by intervening residential structures to the north or the proposed berm/wall combinations. That shielding is anticipated to further reduce traffic noise exposure by at least 15 dB, resulting in exterior noise exposure of less than 60 dB Ldn for the outdoor activity areas of the second row of residences. This exposure would be considered acceptable by the City of Sacramento for new residential developments, without the need for additional exterior noise mitigation measures such as noise barriers. As a result, this impact is considered ***less than significant***.

Impact 11: Traffic Noise Levels at Park Sites

According to project site plans, the west, center and east parks would be located approximately 350 feet, 500 feet, and 270 feet from the highway centerline, respectively. At that distance, traffic noise would be attenuated to approximately 71, 69, and 73 dB Ldn, respectively by distance alone, without even considering the shielding provided by intervening residential structures to the north or the proposed berm/wall combinations. That shielding is anticipated to further reduce traffic noise exposure by at least 15 dB at the park sites, resulting in exterior traffic noise exposure below 60 dB Ldn for each of the park sites. This exposure would be considered acceptable relative to the City of Sacramento 70 dB Ldn exterior standard applied to park uses without the need for additional exterior noise mitigation measures. As a result, this impact is considered ***less than significant***.

Impact 12: Traffic Noise Levels within Residential Interiors Adjacent to Business Route 80

According to City of Sacramento noise standards, traffic noise impacts would occur at interior spaces of this development if traffic noise levels will exceed 45 dB Ldn within any area of the proposed residences.

The predicted traffic noise levels at the exterior building facades proposed nearest to the Business Route 80 would range from 74-77 dB Ldn at upper floor facades not shielded by the proposed berm/wall combination, and 65-68 at first-floor facades which would be shielded by the proposed berm/wall combination. To achieve satisfaction with the City's interior noise level standard at upper floor facades, a building façade traffic noise reduction of 32 dB Ldn would be required. At first-floor facades, a building façade traffic noise reduction of 23 dB Ldn would be required.

The degree of exterior to interior noise level reduction provided by the various building facades is a function of their construction. Important factors which affect the building façade noise reduction include exterior wall thickness (i.e. 2x4-inch versus 2x6-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 2x4-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. BAC test data 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 25 dB exterior to interior traffic noise reduction for all proposed residences within the project area with windows in the closed position.

When windows are in the open position, much of the noise reducing benefits of the façade are lost as sound will enter the sensitive rooms through the path of least resistance (the open window). With windows in the open configuration, the degree of noise reduction provided by the building façade depends on the window size, wall size, room volume, proximity to open window, and sound absorption present within the room. Although this number is highly variable, building façade noise reduction with windows open is often considered to be at least 10 dB. Although it is recognized that interior noise levels are considerably higher with windows open, the City of Sacramento, as with most jurisdictions, applies the interior noise level standards assuming windows in the closed position.

Based on a required 23 dB of building façade traffic noise attenuation for first-floor facades, standard residential construction practices would be acceptable provided those facades are shielded by the proposed berm/wall combination. At elevated second-floor facades which would not be shielded by the proposed berm/wall combination adjacent to the highway, 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.

To provide sufficient exterior to interior traffic noise reduction to ensure compliance with the City of Sacramento 45 dB Ldn interior noise level standard, the following specific measures are recommended for residences located adjacent to the Business Route 80 (Lots 1-80):

a) All windows from which Business Route 80 traffic would be visible (not just bedroom windows) shall have a minimum Sound Transmission Class Rating of 35. All other windows shall have a minimum Sound Transmission Class Rating of 30.

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.

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

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

d) 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 that highway.

Following implementation of these measures, this impact would be ***less than significant.***

Impact 13: Traffic Noise Levels within Second Tier Residential Interiors

At the second tier of residences south of business 80, exterior traffic noise exposure is predicted to be less than 70 dB Ldn due to the additional distance from the roadway and shielding of those residences lots by the intervening residences to the north and the proposed berm/wall combination. As a result, interior traffic noise levels within the interior lots of this development are predicted to be 45 dB Ldn or less with standard construction practices. Should Business Route 80 traffic be visible from elevated windows of the 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.***

Impacts of Combined Future (Cumulative) Traffic and Railroad Noise Exposure

Impact 14: Combined Future (Cumulative) Traffic and Railroad Noise Exposure

As indicated in Figure 2, no residential uses are proposed in the extreme southwest portion of the project site. This is because of the A-Street site access and detention basin proposed in that area. 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 Business Route 80 and the UPRR overcrossing. At these locations, residences will be exposed to both traffic and railroad noise exposure.

To quantify noise generated by combined traffic and railroad noise exposure at the project site, BAC selected the residence proposed in the northeast corner of the project site for analysis. According to Figure 2, that residence would be located approximately 200 feet from the Business Route 80 centerline 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 Ldn. After construction of the Business Route 80 berm and barrier combination, and the connected residences which will screen railroad noise exposure, the traffic and railroad noise exposure is predicted to be 58 dB Ldn and 55 dB Ldn, respectively. When combined, the total traffic and railroad noise exposure at this residence would be 60 dB Ldn, which would satisfy the City of Sacramento 60 dB Ldn 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 Ldn exterior noise standard. As a result, this impact is considered ***less than significant***.

Impacts Associated with Park Usage

Impact 15: Park Noise Impacts at Existing and Proposed Residences

As noted previously, the project proposes 3 parks. The east and west parks will be used primarily for passive recreation and fairly quiet activities like bocce ball. The central park would include a pool and larger lawn areas where active recreation would occur.

The nearest existing residences to the proposed park site are located south of the UPRR tracks, approximately 600 feet from the park sites and shielded by the UPRR embankment. At that distance with that shielding, noise generated by activities at any of the three parks is predicted to be inaudible over background noise levels, and well within compliance with the Sacramento Noise Ordinance standards shown in Table 12. As a result, no off-site noise impacts are anticipated due to park usage.

The proposed residences located within the McKinley Village development located nearest to the main (central) park, would be located across a street and facing that park, as indicated in Figure 2. As a result, the private rear yard areas of those nearest residences would be shielded from view of park activities by the residential structures themselves. As a result of this shielding, noise generated within the central park area is predicted to be satisfactory relative to the City of Sacramento Noise Ordinance standards shown in Table 12. Furthermore, park noise is exempt from the City's Noise Ordinance standards. As a result, this impact is considered ***less than significant.***

Impacts Associated with Project Construction

Impact 16: Construction Noise Impacts at Existing Residences

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 14, ranging from 70 to 90 dB at a distance of 50 feet.

Noise would also be generated during the construction phase by increased truck traffic on area roadways. A significant 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.

Table 15
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
Flat bed truck	84
Front end loader	80
Generator (25 kilovoltamperes [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: Federal Highway Administration 2006.

Construction noise levels would likely be very low to imperceptible at the nearest existing residences to the project site due to the substantial railroad embankment separating the project site from those existing residential neighborhoods to the south. In addition, construction would be temporary in nature and is proposed to occur during normal daytime working hours. Because the City of Sacramento exempts construction noise from the Noise Ordinance provisions if construction activity is limited to daytime hours, this impact is considered ***less than significant***.

Appendix A

Acoustical Terminology

Acoustics The science of sound.

Ambient Noise The distinctive acoustical characteristics of a given space consisting of all noise sources audible at that location. In many cases, the term ambient is used to describe an existing or pre-project condition such as the setting in an environmental noise study.

Attenuation The reduction of an acoustic signal.

A-Weighting A frequency-response adjustment of a sound level meter that conditions the output signal to approximate human response.

Decibel or dB Fundamental unit of sound, A Bell is defined as the logarithm of the ratio of the sound pressure squared over the reference pressure squared. A Decibel is one-tenth of a Bell.

CNEL Community Noise Equivalent Level. Defined as the 24-hour average noise level with noise occurring during evening hours (7 - 10 p.m.) weighted by a factor of three and nighttime hours weighted by a factor of 10 prior to averaging.

Frequency The measure of the rapidity of alterations of a periodic signal, expressed in cycles per second or hertz.

Ldn Day/Night Average Sound Level. Similar to CNEL but with no evening weighting.

Leq Equivalent or energy-averaged sound level.

Lmax The highest root-mean-square (RMS) sound level measured over a given period of time.

Loudness A subjective term for the sensation of the magnitude of sound.

Masking The amount (or the process) by which the threshold of audibility is for one sound is raised by the presence of another (masking) sound.

Noise Unwanted sound.

Peak Noise The level corresponding to the highest (not RMS) sound pressure measured over a given period of time. This term is often confused with the Maximum level, which is the highest RMS level.

RT_{60} The time it takes reverberant sound to decay by 60 dB once the source has been removed.

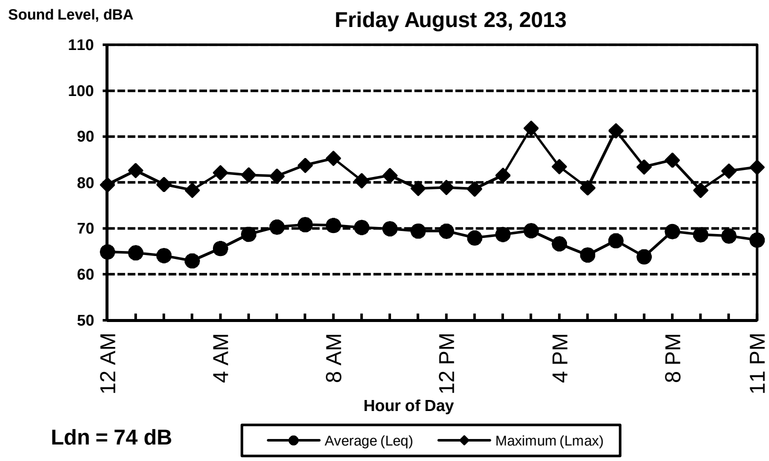
Sabin The unit of sound absorption. One square foot of material absorbing 100% of incident sound has an absorption of 1 sabin.

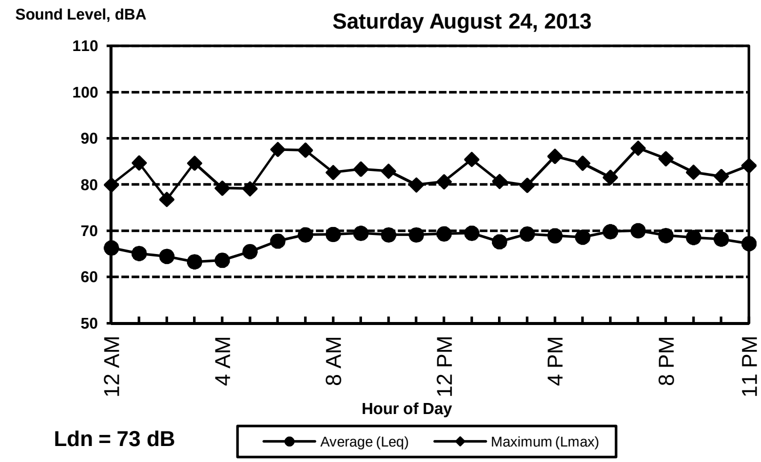
SEL A rating, in decibels, of a discrete event, such as an aircraft flyover or train passby, that compresses the total sound energy of the event into a 1-s time period.

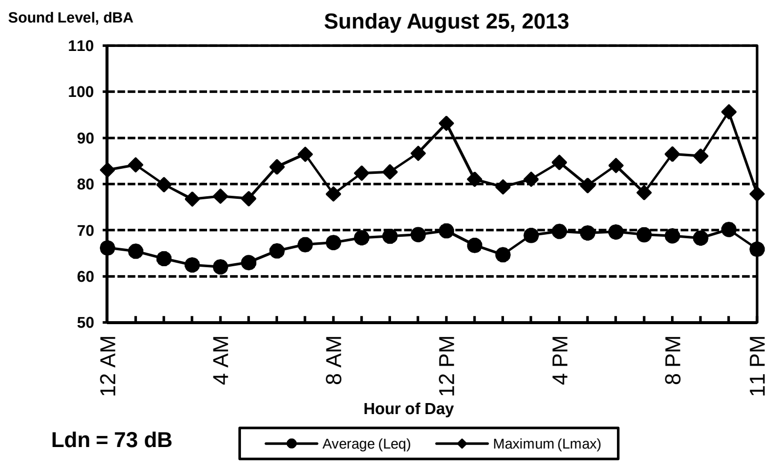
Threshold of Hearing The lowest sound that can be perceived by the human auditory system, generally considered to be 0 dB for persons with perfect hearing.

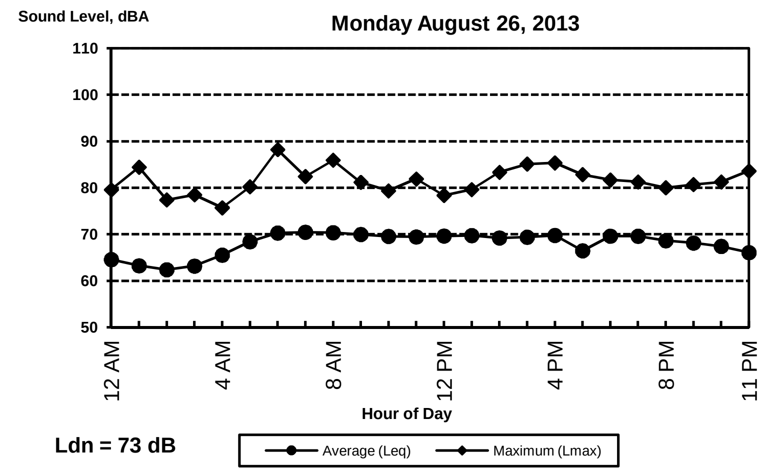
Threshold of Pain Approximately 120 dB above the threshold of hearing.

Appendix B-1
McKinley Village EIR - Sacramento, California
Site #1: August 23-26, 2013









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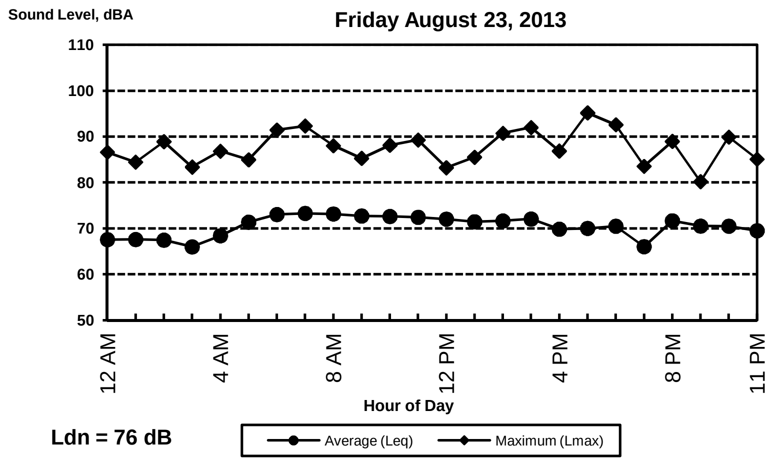
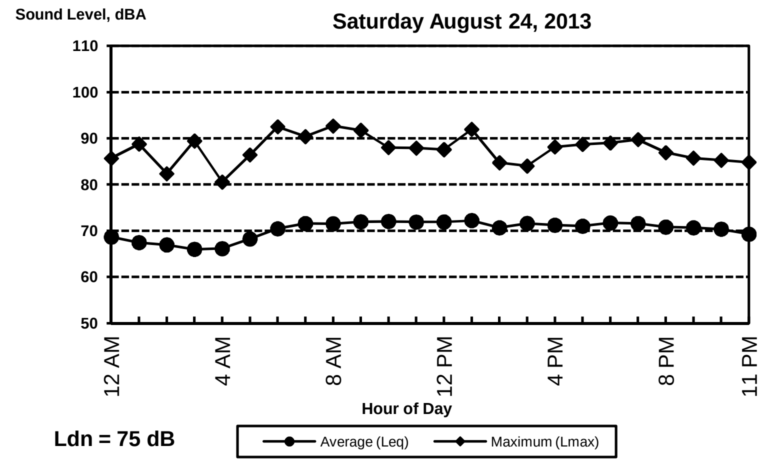
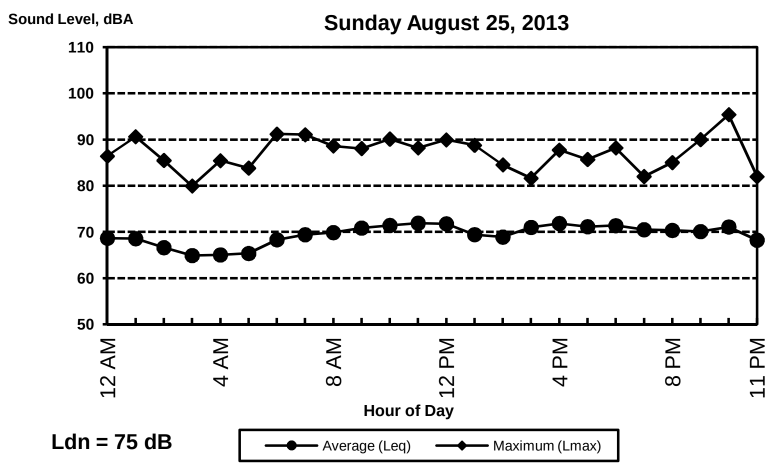
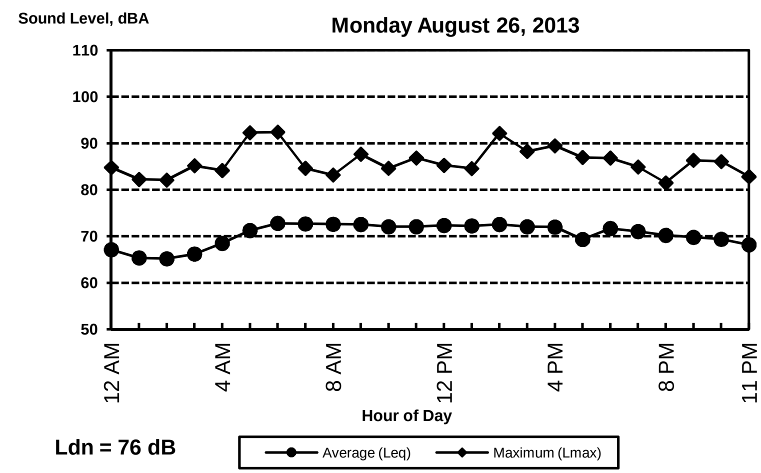
Appendix B-2
McKinley Village EIR - Sacramento, California
Site #2: August 23-26, 2013









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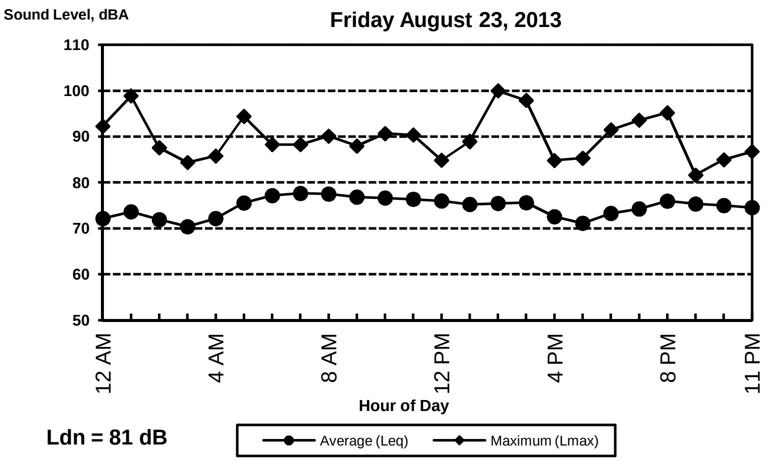
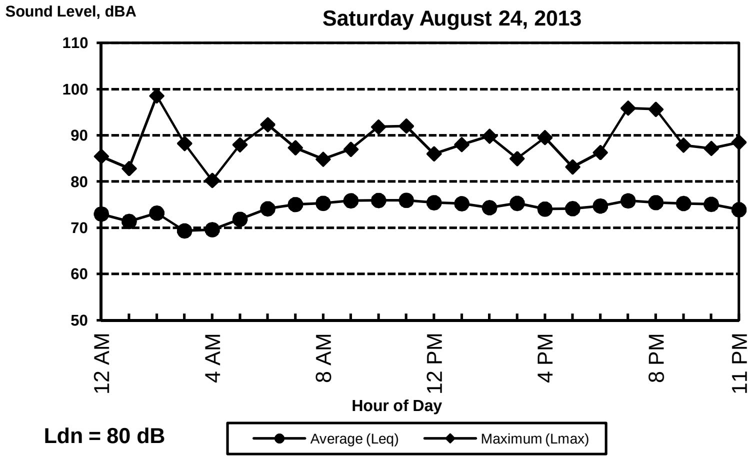
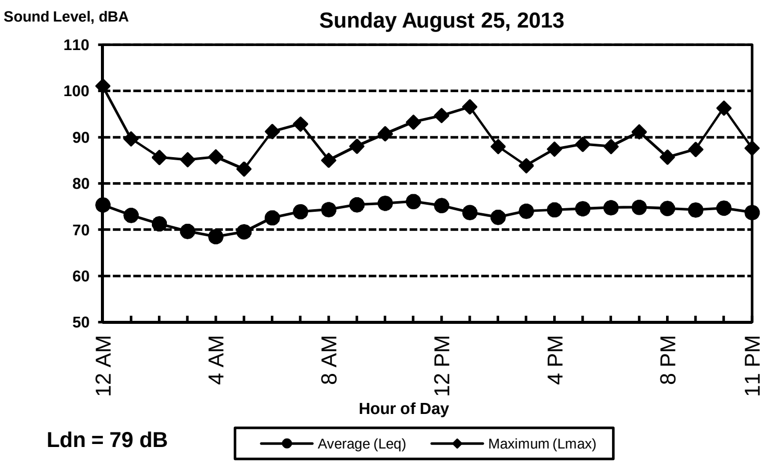
Appendix B-3
McKinley Village EIR - Sacramento, California
Site #3: August 23-26, 2013



Ldn = 81 dB



Ldn = 80 dB



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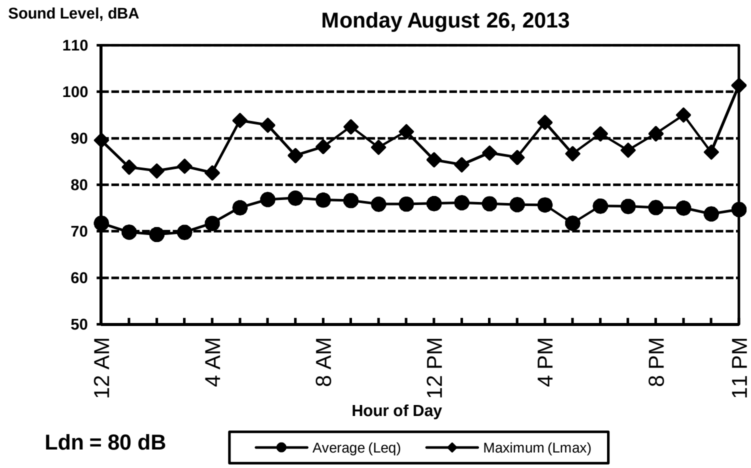

Ldn = 80 dB

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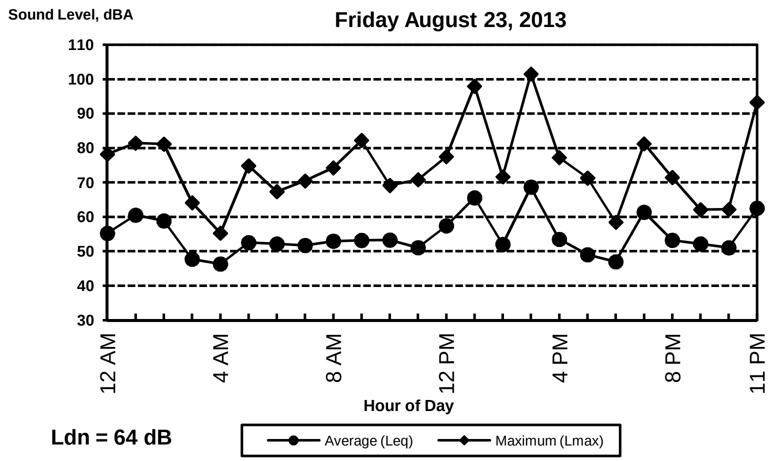
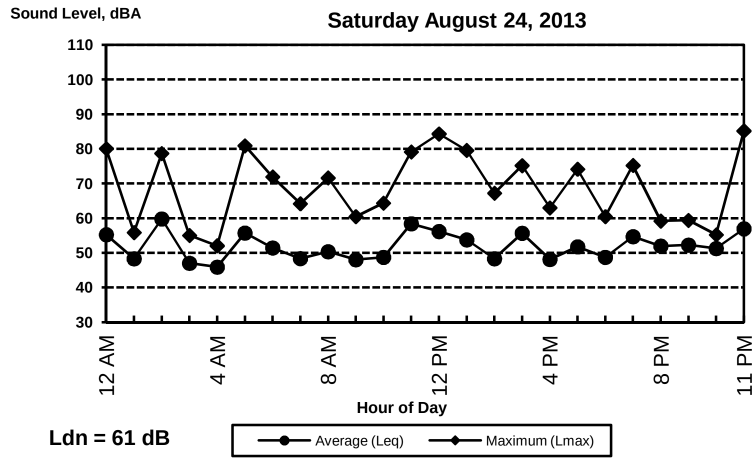
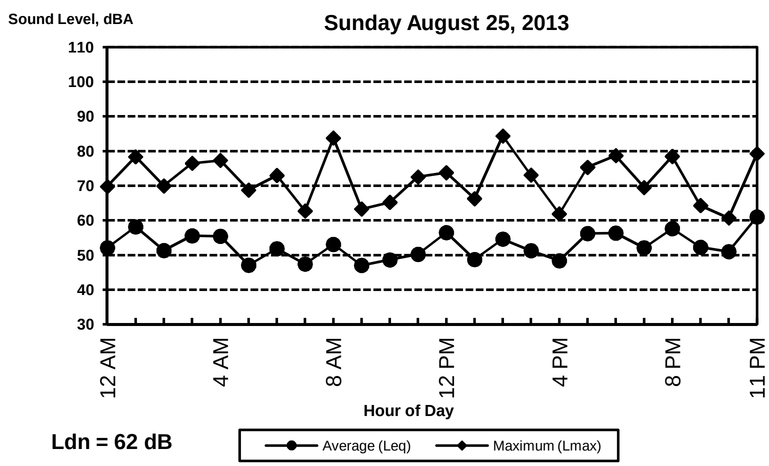
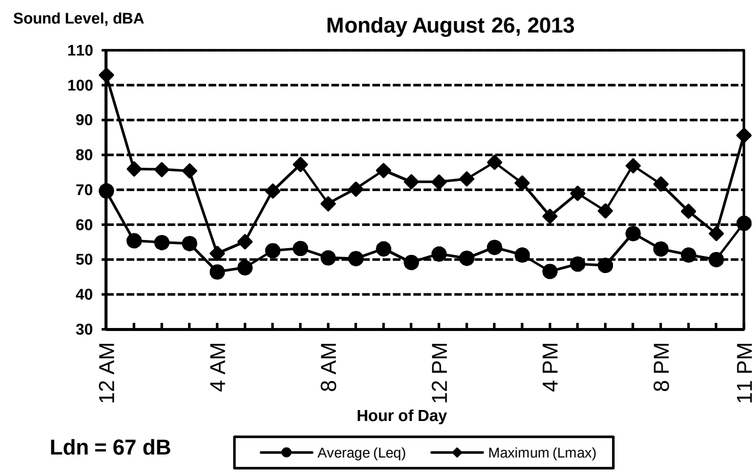
Appendix B-4
McKinley Village EIR - Sacramento, California
Site #4: August 23-26, 2013









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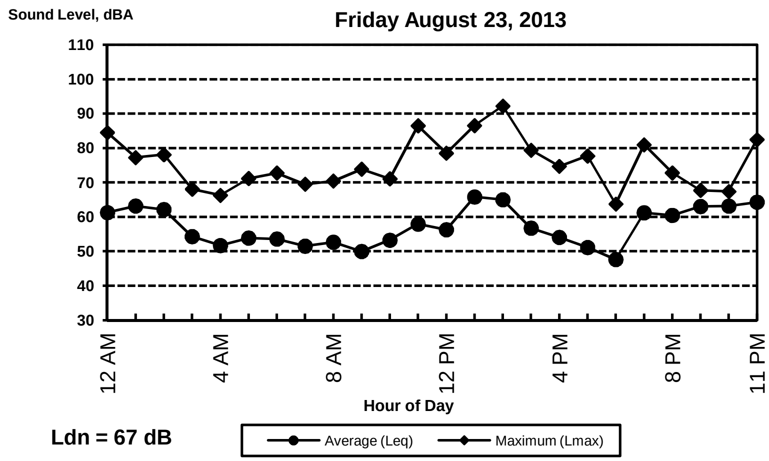
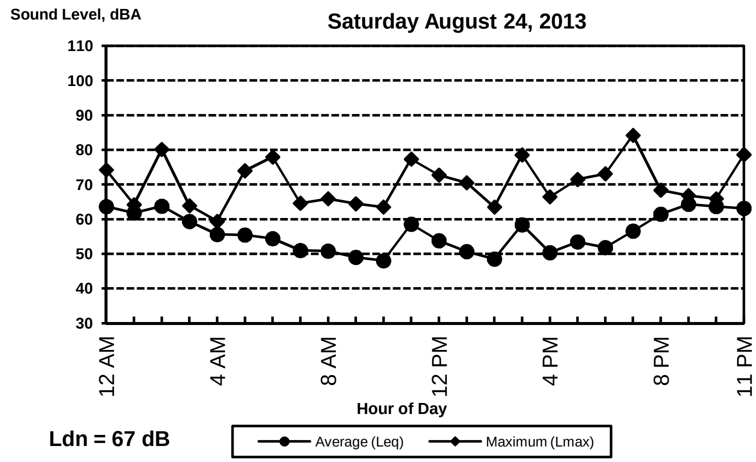
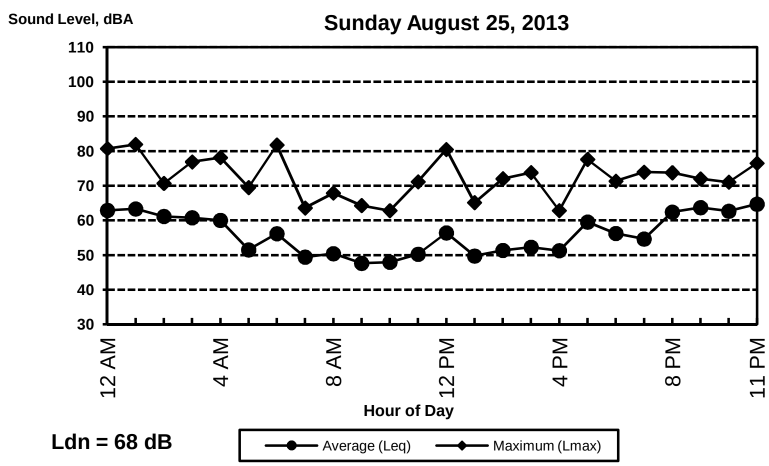
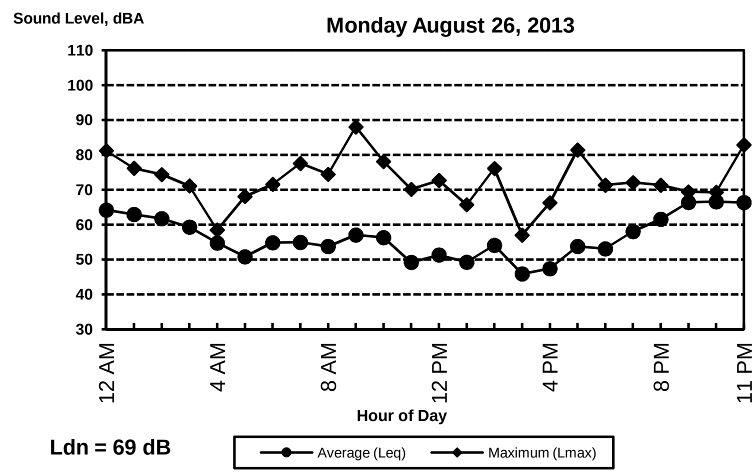
Appendix B-5
McKinley Village EIR - Sacramento, California
Site #5: August 23-26, 2013









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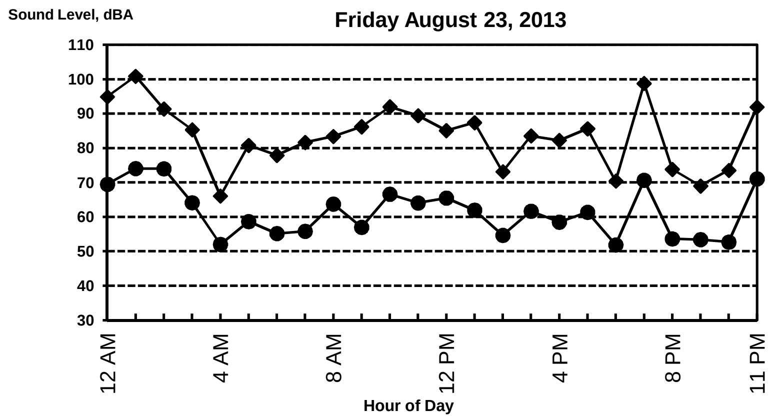
Appendix B-6
McKinley Village EIR - Sacramento, California
Site #6: August 23-26, 2013



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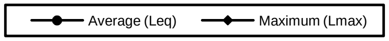
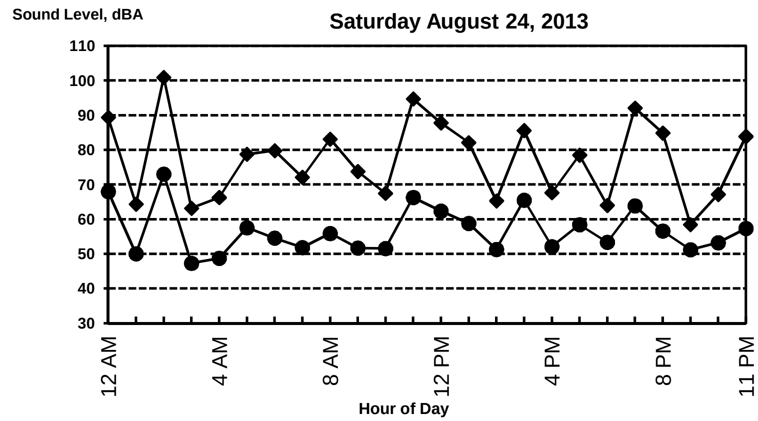
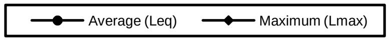
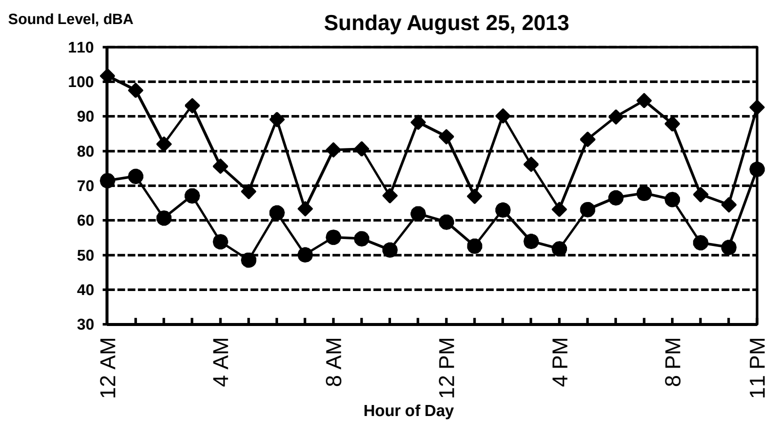


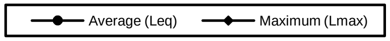


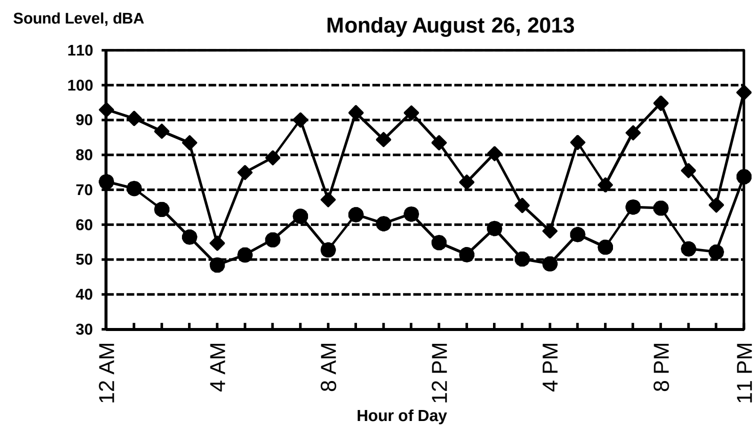
Ldn = 71 dB



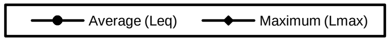


Ldn = 75 dB





Ldn = 74 dB



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Appendix C-1

FHWA-RD-77-108 Highway Traffic Noise Prediction Model
Data Input Sheet

Project #: 2013-078 McKinley Village Project
Description: Existing (Baseline) Conditions
Ldn/CNEL: Ldn
Hard/Soft: Soft

Segment	Roadway Name	Segment Description	ADT	Day %	Eve %	Night %	% Med. Trucks	% Hvy. Trucks	Speed	Distance	Offset (dB)
1	Bus. Rte. 80	Entire Span of Project Site	162,000	75		25	2	1	60	75	
2	28th Street	C Street to E Street	3,850	83		17	2	1	35	50	
3	28th Street	E Street to H Street	2,380	83		17	2	1	35	50	
4	C Street	Alhambra Blvd to 33rd Street	4,400	83		17	2	1	35	50	
5	C Street	33rd Street to 39th Street	5,020	83		17	2	1	35	50	
6	C Street	39th Street to 40th Street	4,830	83		17	2	1	35	50	
7	C Street	40th Street to Lanatt Street	4,500	83		17	2	1	35	50	
8	Elvas Avenue	Lanatt Street to McKinley Blvd	4,290	83		17	2	1	35	50	
9	Elvas Avenue	McKinley Blvd to C Street	6,030	83		17	2	1	35	50	
10	39th Street	C Street to McKinley Blvd	480	83		17	2	1	35	50	
11	40th Street	C Street to McKinley Blvd	70	83		17	2	1	35	50	
12	Meister Way	C Street to McKinley Blvd	280	83		17	2	1	35	50	
13	McKinley Blvd	35th Street to D Street	4,540	83		17	2	1	35	50	
14	McKinley Blvd	D Street to Meister Way	2,050	83		17	2	1	35	50	
15	McKinley Blvd	Meister Way to Elvas Avenue	1,500	83		17	2	1	35	50	
16	C Street	West of 28th Street	3,520	83		17	2	1	35	50	
17	Tivoli Way	C Street to McKinley Blvd	120	83		17	2	1	35	50	
18	San Antonio Way	C Street to McKinley Blvd	210	83		17	2	1	35	50	
19	San Miguel Way	C Street to 36th Way	110	83		17	2	1	35	50	
20	36th Way	McKinley Blvd to Meister Way	550	83		17	2	1	35	50	

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Appendix C-2

FHWA-RD-77-108 Highway Traffic Noise Prediction Model
Predicted Levels

Project #: 2013-078 McKinley Village Project
Description: Existing (Baseline) Conditions
Ldn/CNEL: Ldn
Hard/Soft: Soft

Segment	Roadway Name	Segment Description	Autos	Medium Trucks	Heavy Trucks	Total
1	Bus. Rte. 80	Entire Span of Project Site	80	70	71	81
2	28th Street	C Street to E Street	59	52	54	61
3	28th Street	E Street to H Street	57	50	52	59
4	C Street	Alhambra Blvd to 33rd Street	60	52	55	61
5	C Street	33rd Street to 39th Street	60	53	55	62
6	C Street	39th Street to 40th Street	60	53	55	62
7	C Street	40th Street to Lanatt Street	60	53	55	61
8	Elvas Avenue	Lanatt Street to McKinley Blvd	59	52	55	61
9	Elvas Avenue	McKinley Blvd to C Street	61	54	56	63
10	39th Street	C Street to McKinley Blvd	50	43	45	52
11	40th Street	C Street to McKinley Blvd	42	34	37	43
12	Meister Way	C Street to McKinley Blvd	48	40	43	49
13	McKinley Blvd	35th Street to D Street	60	53	55	62
14	McKinley Blvd	D Street to Meister Way	56	49	51	58
15	McKinley Blvd	Meister Way to Elvas Avenue	55	48	50	57
16	C Street	West of 28th Street	59	51	54	60
17	Tivoli Way	C Street to McKinley Blvd	44	37	39	46
18	San Antonio Way	C Street to McKinley Blvd	46	39	41	48
19	San Miguel Way	C Street to 36th Way	44	36	39	45
20	36th Way	McKinley Blvd to Meister Way	51	43	46	52

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Appendix C-3

FHWA-RD-77-108 Highway Traffic Noise Prediction Model
Noise Contour Output

Project #: 2013-078 McKinley Village Project
Description: Existing (Baseline) Conditions
Ldn/CNEL: Ldn
Hard/Soft: Soft

			------- Distances to Traffic Noise Contours -------				
Segment	Roadway Name	Segment Description	75	70	65	60	55
1	Bus. Rte. 80	Entire Span of Project Site	196	423	911	1962	4227
2	28th Street	C Street to E Street	6	12	26	57	122
3	28th Street	E Street to H Street	4	9	19	41	89
4	C Street	Alhambra Blvd to 33rd Street	6	13	29	62	133
5	C Street	33rd Street to 39th Street	7	15	31	68	146
6	C Street	39th Street to 40th Street	7	14	31	66	142
7	C Street	40th Street to Lanatt Street	6	14	29	63	135
8	Elvas Avenue	Lanatt Street to McKinley Blvd	6	13	28	61	131
9	Elvas Avenue	McKinley Blvd to C Street	8	16	35	76	165
10	39th Street	C Street to McKinley Blvd	1	3	7	14	30
11	40th Street	C Street to McKinley Blvd	0	1	2	4	8
12	Meister Way	C Street to McKinley Blvd	1	2	5	10	21
13	McKinley Blvd	35th Street to D Street	6	14	29	63	136
14	McKinley Blvd	D Street to Meister Way	4	8	17	37	80
15	McKinley Blvd	Meister Way to Elvas Avenue	3	7	14	30	65
16	C Street	West of 28th Street	5	12	25	53	115
17	Tivoli Way	C Street to McKinley Blvd	1	1	3	6	12
18	San Antonio Way	C Street to McKinley Blvd	1	2	4	8	18
19	San Miguel Way	C Street to 36th Way	1	1	2	5	11
20	36th Way	McKinley Blvd to Meister Way	2	3	7	15	33

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Appendix D-1

FHWA-RD-77-108 Highway Traffic Noise Prediction Model
Data Input Sheet

Project #: 2013-078 McKinley Village Project
Description: Existing Plus Project
Ldn/CNEL: Ldn
Hard/Soft: Soft

Segment	Roadway Name	Segment Description	ADT	Day %	Eve %	Night %	% Med. Trucks	% Hvy. Trucks	Speed	Distance	Offset (dB)
1	Bus. Rte. 80	Entire Span of Project Site	162,000	75		25	2	1	60	75	
2	28th Street	C Street to E Street	4,972	83		17	2	1	35	50	
3	28th Street	E Street to H Street	2,801	83		17	2	1	35	50	
4	C Street	Alhambra Blvd to 33rd Street	4,985	83		17	2	1	35	50	
5	C Street	33rd Street to 39th Street	5,759	83		17	2	1	35	50	
6	C Street	39th Street to 40th Street	5,742	83		17	2	1	35	50	
7	C Street	40th Street to Lanatt Street	5,201	83		17	2	1	35	50	
8	Elvas Avenue	Lanatt Street to McKinley Blvd	4,955	83		17	2	1	35	50	
9	Elvas Avenue	McKinley Blvd to C Street	6,695	83		17	2	1	35	50	
10	39th Street	C Street to McKinley Blvd	516	83		17	2	1	35	50	
11	40th Street	C Street to McKinley Blvd	104	83		17	2	1	35	50	
12	Meister Way	C Street to McKinley Blvd	316	83		17	2	1	35	50	
13	McKinley Blvd	35th Street to D Street	4,540	83		17	2	1	35	50	
14	McKinley Blvd	D Street to Meister Way	2,084	83		17	2	1	35	50	
15	McKinley Blvd	Meister Way to Elvas Avenue	1,500	83		17	2	1	35	50	
16	C Street	West of 28th Street	3,678	83		17	2	1	35	50	
17	Tivoli Way	C Street to McKinley Blvd	120	83		17	2	1	35	50	
18	San Antonio Way	C Street to McKinley Blvd	228	83		17	2	1	35	50	
19	San Miguel Way	C Street to 36th Way	128	83		17	2	1	35	50	
20	36th Way	McKinley Blvd to Meister Way	586	83		17	2	1	35	50	

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Appendix D-2

FHWA-RD-77-108 Highway Traffic Noise Prediction Model
Predicted Levels

Project #: 2013-078 McKinley Village Project
Description: Existing Plus Project
Ldn/CNEL: Ldn
Hard/Soft: Soft

Segment	Roadway Name	Segment Description	Autos	Medium Trucks	Heavy Trucks	Total
1	Bus. Rte. 80	Entire Span of Project Site	80	70	71	81
2	28th Street	C Street to E Street	60	53	55	62
3	28th Street	E Street to H Street	58	50	53	59
4	C Street	Alhambra Blvd to 33rd Street	60	53	55	62
5	C Street	33rd Street to 39th Street	61	54	56	63
6	C Street	39th Street to 40th Street	61	54	56	63
7	C Street	40th Street to Lanatt Street	60	53	55	62
8	Elvas Avenue	Lanatt Street to McKinley Blvd	60	53	55	62
9	Elvas Avenue	McKinley Blvd to C Street	61	54	56	63
10	39th Street	C Street to McKinley Blvd	50	43	45	52
11	40th Street	C Street to McKinley Blvd	43	36	38	45
12	Meister Way	C Street to McKinley Blvd	48	41	43	50
13	McKinley Blvd	35th Street to D Street	60	53	55	62
14	McKinley Blvd	D Street to Meister Way	56	49	51	58
15	McKinley Blvd	Meister Way to Elvas Avenue	55	48	50	57
16	C Street	West of 28th Street	59	52	54	61
17	Tivoli Way	C Street to McKinley Blvd	44	37	39	46
18	San Antonio Way	C Street to McKinley Blvd	47	40	42	49
19	San Miguel Way	C Street to 36th Way	44	37	39	46
20	36th Way	McKinley Blvd to Meister Way	51	44	46	53

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Appendix D-3

FHWA-RD-77-108 Highway Traffic Noise Prediction Model
Noise Contour Output

Project #: 2013-078 McKinley Village Project
Description: Existing Plus Project
Ldn/CNEL: Ldn
Hard/Soft: Soft

			------- Distances to Traffic Noise Contours -------				
Segment	Roadway Name	Segment Description	75	70	65	60	55
1	Bus. Rte. 80	Entire Span of Project Site	196	423	911	1962	4227
2	28th Street	C Street to E Street	7	14	31	67	145
3	28th Street	E Street to H Street	5	10	21	46	99
4	C Street	Alhambra Blvd to 33rd Street	7	15	31	67	145
5	C Street	33rd Street to 39th Street	7	16	34	74	160
6	C Street	39th Street to 40th Street	7	16	34	74	159
7	C Street	40th Street to Lanatt Street	7	15	32	69	149
8	Elvas Avenue	Lanatt Street to McKinley Blvd	7	14	31	67	144
9	Elvas Avenue	McKinley Blvd to C Street	8	18	38	82	177
10	39th Street	C Street to McKinley Blvd	1	3	7	15	32
11	40th Street	C Street to McKinley Blvd	1	1	2	5	11
12	Meister Way	C Street to McKinley Blvd	1	2	5	11	23
13	McKinley Blvd	35th Street to D Street	6	14	29	63	136
14	McKinley Blvd	D Street to Meister Way	4	8	17	38	81
15	McKinley Blvd	Meister Way to Elvas Avenue	3	7	14	30	65
16	C Street	West of 28th Street	5	12	26	55	118
17	Tivoli Way	C Street to McKinley Blvd	1	1	3	6	12
18	San Antonio Way	C Street to McKinley Blvd	1	2	4	9	19
19	San Miguel Way	C Street to 36th Way	1	1	3	6	13
20	36th Way	McKinley Blvd to Meister Way	2	3	7	16	35

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Attachment E

Barrier Insertion Loss Calculation

Project Information:

Job Number: 2012-077
Project Name: McKinley Village
Location(s): Section B

Noise Level Data:

Source Description: Railroad Noise
Source Noise Level, dBA: 69
Source Frequency (Hz): 500
Source Height (ft): 55

Site Geometry:

Receiver Description: Backyard Area
Source to Barrier Distance (C_1): 100
Barrier to Receiver Distance (C_2): 10

Pad/Ground Elevation at Receiver: 19.5
Receiver Elevation[1]: 24.5
Base of Barrier Elevation: 19.5
Starting Barrier Height 16

Barrier Effectiveness:

Top of Barrier Elevation (ft)	Barrier Height (ft)	Insertion Loss, dB	Noise Level, dB	Barrier Breaks Line of Site to Source?
35.5	16	-13	56	Yes
36.5	17	-13	56	Yes
37.5	18	-14	55	Yes
38.5	19	-15	55	Yes
39.5	20	-15	54	Yes
40.5	21	-15	54	Yes
41.5	22	-15	54	Yes
42.5	23	-16	53	Yes
43.5	24	-16	53	Yes
44.5	25	-16	53	Yes
45.5	26	-17	52	Yes

Notes: Barrier height is specified relative to building pad elevation. The barrier provided by the residential structure is essentially 25 feet, with the back wall of the outdoor room or barrier alternative providing a 16-foot tall barrier. The table above shows 13 dB railroad noise reduction for the 16-foot portion and 16 dB reduciton for the 25-foo tall residence. Because the residence is longer than the 16-foot segment, the combined noise reduciton is 15 dB.

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Appendix F-1

FHWA Traffic Noise Prediction Model (FHWA-RD-77-108)
Noise Prediction Worksheet

Project Information:

Job Number:	2012-077
Project Name:	McKinley Village
Roadway Name:	Business 80

Traffic Data:

Year:	Cumulative
Average Daily Traffic Volume:	209,550
Percent Daytime Traffic:	80
Percent Nighttime Traffic:	20
Percent Medium Trucks (2 axle):	3
Percent Heavy Trucks (3+ axle):	3
Assumed Vehicle Speed (mph):	55
Intervening Ground Type (hard/soft):	**Soft**

Traffic Noise Levels:

				L_{dn}, dB			
Location:	**Description**	**Distance**	**Offset (dB)**	**Autos**	**Medium Trucks**	**Heavy Trucks**	**Total**
1	Section D Backyard	217	-7	66	58	62	68

Traffic Noise Contours (No Calibration Offset):

L_{dn} Contour, dB	Distance from Centerline, (ft)
75	208
70	449
65	967
60	2084

Note: A -2 dB offset was applied to account for differences between measured and modelled traffic noise levels at the site. A -5 dB offset was also applied to account for the sheilding provided by the proposed building structures.

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Appendix F-2

FHWA Traffic Noise Prediction Model (FHWA-RD-77-108)
Noise Barrier Effectiveness Prediction Worksheet

Project Information:

Job Number: 2012-077
Project Name: McKinley Village
Roadway Name: Business 80
Location(s): Section D

Noise Level Data:

Year: Cumulative
Auto L_{dn}, dB: 66
Medium Truck L_{dn}, dB: 58
Heavy Truck L_{dn}, dB: 62

Site Geometry:

Receiver Description: Residence at Section D
Centerline to Barrier Distance (C_1): 167
Barrier to Receiver Distance (C_2): 50
Automobile Elevation: 34
Medium Truck Elevation: 36
Heavy Truck Elevation: 42
Pad/Ground Elevation at Receiver: 20
Receiver Elevation[1]: 25
Base of Barrier Elevation: 24
Starting Barrier Height 6

Barrier Effectiveness:

Top of Barrier Elevation (ft)	Barrier Height[2] (ft)	L_{dn}, dB				Barrier Breaks Line of Sight to…		
		Autos	Medium Trucks	Heavy Trucks	Total	Autos?	Medium Trucks?	Heavy Trucks?
30	6	60	52	57	**62**	Yes	Yes	Yes
31	7	59	52	56	**61**	Yes	Yes	Yes
32	8	58	51	56	**61**	Yes	Yes	Yes
33	9	58	50	55	**60**	Yes	Yes	Yes
34	10	57	49	54	**59**	Yes	Yes	Yes
35	11	56	49	54	**59**	Yes	Yes	Yes
36	12	56	48	53	**58**	Yes	Yes	Yes
37	13	55	47	52	**57**	Yes	Yes	Yes
38	14	55	47	52	**57**	Yes	Yes	Yes

Notes:
1. Standard receiver elevation is five feet above grade/pad elevations at the receiver location(s).
2. Barrier heights are specified relative to base barrier elevation shown above.

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Appendix G-1

FHWA Traffic Noise Prediction Model (FHWA-RD-77-108)
Noise Prediction Worksheet

Project Information:

Job Number:	2012-077
Project Name:	McKinley Village
Roadway Name:	Business 80

Traffic Data:

Year:	Cumulative
Average Daily Traffic Volume:	209,550
Percent Daytime Traffic:	80
Percent Nighttime Traffic:	20
Percent Medium Trucks (2 axle):	3
Percent Heavy Trucks (3+ axle):	3
Assumed Vehicle Speed (mph):	55
Intervening Ground Type (hard/soft):	**Soft**

Traffic Noise Levels:

				L_{dn}, dB			
Location:	**Description**	**Distance**	**Offset (dB)**	**Autos**	**Medium Trucks**	**Heavy Trucks**	**Total**
1	Section E Backyard	135	-7	69	61	65	71

Traffic Noise Contours (No Calibration Offset):

L_{dn} Contour, dB	Distance from Centerline, (ft)
75	208
70	449
65	967
60	2084

Note: A -2 dB offset was applied to account for differences between measured and modelled traffic noise levels at the site. A -5 dB offset was also applied to account for the sheilding provided by the proposed building structures.

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Appendix G-2

FHWA Traffic Noise Prediction Model (FHWA-RD-77-108)
Noise Barrier Effectiveness Prediction Worksheet

Project Information:

Job Number: 2012-077
Project Name: McKinley Village
Roadway Name: Business 80
Location(s): Section E

Noise Level Data:

Year: Cumulative
Auto L_{dn}, dB: 69
Medium Truck L_{dn}, dB: 61
Heavy Truck L_{dn}, dB: 65

Site Geometry:

Receiver Description: Residence at Section E
Centerline to Barrier Distance (C_1): 95
Barrier to Receiver Distance (C_2): 40
Automobile Elevation: 26
Medium Truck Elevation: 28
Heavy Truck Elevation: 34
Pad/Ground Elevation at Receiver: 22
Receiver Elevation[1]: 27
Base of Barrier Elevation: 26
Starting Barrier Height 6

Barrier Effectiveness:

Top of Barrier Elevation (ft)	Barrier Height[2] (ft)	L_{dn}, dB Autos	Medium Trucks	Heavy Trucks	Total	Barrier Breaks Line of Sight to… Autos?	Medium Trucks?	Heavy Trucks?
32	6	60	53	59	**63**	Yes	Yes	Yes
33	7	60	52	58	**62**	Yes	Yes	Yes
34	8	59	51	57	**61**	Yes	Yes	Yes
35	9	58	51	56	**61**	Yes	Yes	Yes
36	10	58	50	55	**60**	Yes	Yes	Yes
37	11	57	50	55	**59**	Yes	Yes	Yes
38	12	56	49	54	**59**	Yes	Yes	Yes
39	13	56	48	53	**58**	Yes	Yes	Yes
40	14	55	48	53	**58**	Yes	Yes	Yes

Notes:
1. Standard receiver elevation is five feet above grade/pad elevations at the receiver location(s).
2. Barrier heights are specified relative to base barrier elevation shown above.

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Appendix H-1

FHWA Traffic Noise Prediction Model (FHWA-RD-77-108)
Noise Prediction Worksheet

Project Information:

Job Number:	2012-077
Project Name:	McKinley Village
Roadway Name:	Business 80

Traffic Data:

Year:	Cumulative
Average Daily Traffic Volume:	209,550
Percent Daytime Traffic:	80
Percent Nighttime Traffic:	20
Percent Medium Trucks (2 axle):	3
Percent Heavy Trucks (3+ axle):	3
Assumed Vehicle Speed (mph):	55
Intervening Ground Type (hard/soft):	**Soft**

Traffic Noise Levels:

				----------------- L_{dn}, dB -----------------			
Location:	**Description**	**Distance**	**Offset (dB)**	**Autos**	**Medium Trucks**	**Heavy Trucks**	**Total**
1	Section F Backyard	135	-5	71	63	67	73

Traffic Noise Contours (No Calibration Offset):

L_{dn} Contour, dB	Distance from Centerline, (ft)
75	208
70	449
65	967
60	2084

Note: A -5 dB offset was applied to account for the sheilding provided by the proposed building structures.

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Appendix H-2

FHWA Traffic Noise Prediction Model (FHWA-RD-77-108)
Noise Barrier Effectiveness Prediction Worksheet

Project Information:

Job Number: 2012-077
Project Name: McKinley Village
Roadway Name: Business 80
Location(s): Section F

Noise Level Data:

Year: Cumulative
Auto L_{dn}, dB: 71
Medium Truck L_{dn}, dB: 63
Heavy Truck L_{dn}, dB: 67

Site Geometry:

Receiver Description: Residence at Section F
Centerline to Barrier Distance (C_1): 93
Barrier to Receiver Distance (C_2): 42
Automobile Elevation: 24
Medium Truck Elevation: 26
Heavy Truck Elevation: 32
Pad/Ground Elevation at Receiver: 23.7
Receiver Elevation[1]: 28.7
Base of Barrier Elevation: 27.7
Starting Barrier Height 6

Barrier Effectiveness:

Top of Barrier Elevation (ft)	Barrier Height[2] (ft)	-------------------- L_{dn}, dB -------------------- Autos	Medium Trucks	Heavy Trucks	Total	Barrier Breaks Line of Sight to… Autos?	Medium Trucks?	Heavy Trucks?
33.7	6	62	54	60	**64**	Yes	Yes	Yes
34.7	7	61	53	59	**63**	Yes	Yes	Yes
35.7	8	60	53	58	**63**	Yes	Yes	Yes
36.7	9	60	52	57	**62**	Yes	Yes	Yes
37.7	10	59	52	57	**61**	Yes	Yes	Yes
38.7	11	58	51	56	**61**	Yes	Yes	Yes
39.7	12	58	50	55	**60**	Yes	Yes	Yes
40.7	13	57	50	55	**60**	Yes	Yes	Yes
41.7	14	57	49	54	**59**	Yes	Yes	Yes

Notes:
1. Standard receiver elevation is five feet above grade/pad elevations at the receiver location(s).
2. Barrier heights are specified relative to base barrier elevation shown above.

Appendix I-1

FHWA-RD-77-108 Highway Traffic Noise Prediction Model
Data Input Sheet

Project #: 2013-078 McKinley Village Project
Description: Cumulative Conditions
Ldn/CNEL: Ldn
Hard/Soft: Soft

Segment	Roadway Name	Segment Description	ADT	Day %	Eve %	Night %	% Med. Trucks	% Hvy. Trucks	Speed	Distance	Offset (dB)
1	Bus. Rte. 80	Entire Span of Project Site	209,550	75		25	2	1	60	75	
2	28th Street	C Street to E Street	6,500	83		17	2	1	35	50	
3	28th Street	E Street to H Street	2,600	83		17	2	1	35	50	
4	C Street	Alhambra Blvd to 33rd Street	8,600	83		17	2	1	35	50	
5	C Street	33rd Street to 39th Street	8,900	83		17	2	1	35	50	
6	C Street	39th Street to 40th Street	7,500	83		17	2	1	35	50	
7	C Street	40th Street to Lanatt Street	7,100	83		17	2	1	35	50	
8	Elvas Avenue	Lanatt Street to McKinley Blvd	6,800	83		17	2	1	35	50	
9	Elvas Avenue	McKinley Blvd to C Street	7,000	83		17	2	1	35	50	
10	39th Street	C Street to McKinley Blvd	500	83		17	2	1	35	50	
11	40th Street	C Street to McKinley Blvd	100	83		17	2	1	35	50	
12	Meister Way	C Street to McKinley Blvd	400	83		17	2	1	35	50	
13	McKinley Blvd	35th Street to D Street	7,100	83		17	2	1	35	50	
14	McKinley Blvd	D Street to Meister Way	3,500	83		17	2	1	35	50	
15	McKinley Blvd	Meister Way to Elvas Avenue	2,000	83		17	2	1	35	50	
16	C Street	West of 28th Street	8,000	83		17	2	1	35	50	
17	Tivoli Way	C Street to McKinley Blvd	150	83		17	2	1	35	50	
18	San Antonio Way	C Street to McKinley Blvd	250	83		17	2	1	35	50	
19	San Miguel Way	C Street to 36th Way	150	83		17	2	1	35	50	
20	36th Way	McKinley Blvd to Meister Way	600	83		17	2	1	35	50	

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Appendix I-2

FHWA-RD-77-108 Highway Traffic Noise Prediction Model
Predicted Levels

Project #: 2013-078 McKinley Village Project
Description: Cumulative Conditions
Ldn/CNEL: Ldn
Hard/Soft: Soft

Segment	Roadway Name	Segment Description	Autos	Medium Trucks	Heavy Trucks	Total
1	Bus. Rte. 80	Entire Span of Project Site	82	71	72	82
2	28th Street	C Street to E Street	61	54	56	63
3	28th Street	E Street to H Street	57	50	52	59
4	C Street	Alhambra Blvd to 33rd Street	63	55	58	64
5	C Street	33rd Street to 39th Street	63	55	58	64
6	C Street	39th Street to 40th Street	62	55	57	64
7	C Street	40th Street to Lanatt Street	62	55	57	63
8	Elvas Avenue	Lanatt Street to McKinley Blvd	61	54	57	63
9	Elvas Avenue	McKinley Blvd to C Street	62	54	57	63
10	39th Street	C Street to McKinley Blvd	50	43	45	52
11	40th Street	C Street to McKinley Blvd	43	36	38	45
12	Meister Way	C Street to McKinley Blvd	49	42	44	51
13	McKinley Blvd	35th Street to D Street	62	55	57	63
14	McKinley Blvd	D Street to Meister Way	59	51	54	60
15	McKinley Blvd	Meister Way to Elvas Avenue	56	49	51	58
16	C Street	West of 28th Street	62	55	57	64
17	Tivoli Way	C Street to McKinley Blvd	45	38	40	47
18	San Antonio Way	C Street to McKinley Blvd	47	40	42	49
19	San Miguel Way	C Street to 36th Way	45	38	40	47
20	36th Way	McKinley Blvd to Meister Way	51	44	46	53

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Appendix I-3

FHWA-RD-77-108 Highway Traffic Noise Prediction Model
Noise Contour Output

Project #: 2013-078 McKinley Village Project
Description: Cumulative Conditions
Ldn/CNEL: Ldn
Hard/Soft: Soft

Segment	Roadway Name	Segment Description	------- Distances to Traffic Noise Contours ------- 75	70	65	60	55
1	Bus. Rte. 80	Entire Span of Project Site	233	502	1081	2329	5018
2	28th Street	C Street to E Street	8	17	37	80	173
3	28th Street	E Street to H Street	4	9	20	44	94
4	C Street	Alhambra Blvd to 33rd Street	10	21	45	97	209
5	C Street	33rd Street to 39th Street	10	21	46	99	213
6	C Street	39th Street to 40th Street	9	19	41	88	190
7	C Street	40th Street to Lanatt Street	9	18	40	85	184
8	Elvas Avenue	Lanatt Street to McKinley Blvd	8	18	38	83	178
9	Elvas Avenue	McKinley Blvd to C Street	8	18	39	84	182
10	39th Street	C Street to McKinley Blvd	1	3	7	15	31
11	40th Street	C Street to McKinley Blvd	0	1	2	5	11
12	Meister Way	C Street to McKinley Blvd	1	3	6	13	27
13	McKinley Blvd	35th Street to D Street	9	18	40	85	184
14	McKinley Blvd	D Street to Meister Way	5	11	25	53	115
15	McKinley Blvd	Meister Way to Elvas Avenue	4	8	17	37	79
16	C Street	West of 28th Street	9	20	43	92	199
17	Tivoli Way	C Street to McKinley Blvd	1	1	3	7	14
18	San Antonio Way	C Street to McKinley Blvd	1	2	4	9	20
19	San Miguel Way	C Street to 36th Way	1	1	3	7	14
20	36th Way	McKinley Blvd to Meister Way	2	4	8	16	35

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Appendix J-1

FHWA-RD-77-108 Highway Traffic Noise Prediction Model
Data Input Sheet

Project #: 2013-078 McKinley Village Project
Description: Cumulative Plus Project Conditions
Ldn/CNEL: Ldn
Hard/Soft: Soft

Segment	Roadway Name	Segment Description	ADT	Day %	Eve %	Night %	% Med. Trucks	% Hvy. Trucks	Speed	Distance	Offset (dB)
1	Bus. Rte. 80	Entire Span of Project Site	209,550	75		25	2	1	60	50	
2	28th Street	C Street to E Street	7,616	83		17	2	1	35	50	
3	28th Street	E Street to H Street	3,021	83		17	2	1	35	50	
4	C Street	Alhambra Blvd to 33rd Street	9,095	83		17	2	1	35	50	
5	C Street	33rd Street to 39th Street	9,530	83		17	2	1	35	50	
6	C Street	39th Street to 40th Street	8,289	83		17	2	1	35	50	
7	C Street	40th Street to Lanatt Street	7,801	83		17	2	1	35	50	
8	Elvas Avenue	Lanatt Street to McKinley Blvd	7,465	83		17	2	1	35	50	
9	Elvas Avenue	McKinley Blvd to C Street	7,665	83		17	2	1	35	50	
10	39th Street	C Street to McKinley Blvd	536	83		17	2	1	35	50	
11	40th Street	C Street to McKinley Blvd	134	83		17	2	1	35	50	
12	Meister Way	C Street to McKinley Blvd	436	83		17	2	1	35	50	
13	McKinley Blvd	35th Street to D Street	7,100	83		17	2	1	35	50	
14	McKinley Blvd	D Street to Meister Way	3,534	83		17	2	1	35	50	
15	McKinley Blvd	Meister Way to Elvas Avenue	2,000	83		17	2	1	35	50	
16	C Street	West of 28th Street	8,158	83		17	2	1	35	50	
17	Tivoli Way	C Street to McKinley Blvd	150	83		17	2	1	35	50	
18	San Antonio Way	C Street to McKinley Blvd	268	83		17	2	1	35	50	
19	San Miguel Way	C Street to 36th Way	168	83		17	2	1	35	50	
20	36th Way	McKinley Blvd to Meister Way	636	83		17	2	1	35	50	

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Appendix J-2

FHWA-RD-77-108 Highway Traffic Noise Prediction Model
Predicted Levels

Project #: 2013-078 McKinley Village Project
Description: Cumulative Plus Project Conditions
Ldn/CNEL: Ldn
Hard/Soft: Soft

Segment	Roadway Name	Segment Description	Autos	Medium Trucks	Heavy Trucks	Total
1	Bus. Rte. 80	Entire Span of Project Site	84	74	75	85
2	28th Street	C Street to E Street	62	55	57	64
3	28th Street	E Street to H Street	58	51	53	60
4	C Street	Alhambra Blvd to 33rd Street	63	56	58	65
5	C Street	33rd Street to 39th Street	63	56	58	65
6	C Street	39th Street to 40th Street	62	55	57	64
7	C Street	40th Street to Lanatt Street	62	55	57	64
8	Elvas Avenue	Lanatt Street to McKinley Blvd	62	55	57	64
9	Elvas Avenue	McKinley Blvd to C Street	62	55	57	64
10	39th Street	C Street to McKinley Blvd	50	43	45	52
11	40th Street	C Street to McKinley Blvd	44	37	39	46
12	Meister Way	C Street to McKinley Blvd	50	42	45	51
13	McKinley Blvd	35th Street to D Street	62	55	57	63
14	McKinley Blvd	D Street to Meister Way	59	51	54	60
15	McKinley Blvd	Meister Way to Elvas Avenue	56	49	51	58
16	C Street	West of 28th Street	62	55	57	64
17	Tivoli Way	C Street to McKinley Blvd	45	38	40	47
18	San Antonio Way	C Street to McKinley Blvd	47	40	42	49
19	San Miguel Way	C Street to 36th Way	45	38	40	47
20	36th Way	McKinley Blvd to Meister Way	51	44	46	53

Appendix J-3

FHWA-RD-77-108 Highway Traffic Noise Prediction Model
Noise Contour Output

Project #: 2013-078 McKinley Village Project
Description: Cumulative Plus Project Conditions
Ldn/CNEL: Ldn
Hard/Soft: Soft

			------- Distances to Traffic Noise Contours -------				
Segment	Roadway Name	Segment Description	75	70	65	60	55
1	Bus. Rte. 80	Entire Span of Project Site	233	502	1081	2329	5018
2	28th Street	C Street to E Street	9	19	41	89	192
3	28th Street	E Street to H Street	5	10	22	48	104
4	C Street	Alhambra Blvd to 33rd Street	10	22	47	101	217
5	C Street	33rd Street to 39th Street	10	22	48	104	223
6	C Street	39th Street to 40th Street	9	20	44	94	204
7	C Street	40th Street to Lanatt Street	9	20	42	91	196
8	Elvas Avenue	Lanatt Street to McKinley Blvd	9	19	41	88	190
9	Elvas Avenue	McKinley Blvd to C Street	9	19	42	90	193
10	39th Street	C Street to McKinley Blvd	2	3	7	15	33
11	40th Street	C Street to McKinley Blvd	1	1	3	6	13
12	Meister Way	C Street to McKinley Blvd	1	3	6	13	29
13	McKinley Blvd	35th Street to D Street	9	18	40	85	184
14	McKinley Blvd	D Street to Meister Way	5	12	25	54	115
15	McKinley Blvd	Meister Way to Elvas Avenue	4	8	17	37	79
16	C Street	West of 28th Street	9	20	43	93	201
17	Tivoli Way	C Street to McKinley Blvd	1	1	3	7	14
18	San Antonio Way	C Street to McKinley Blvd	1	2	4	10	21
19	San Miguel Way	C Street to 36th Way	1	2	3	7	15
20	36th Way	McKinley Blvd to Meister Way	2	4	8	17	37