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## INTRODUCTION

The Rocklin Gateway multi-family residential project includes development of a 6.5 acre undeveloped parcel bounded to the southeast by Pacific Street, the southwest by East Midas Avenue, the northwest by the Union Pacific railroad tracks, and to the northeast by United Rentals. The project will involve the construction of 204 multi-family residential units. The project is located in the City of Rocklin, California.

Figure 1 shows an aerial photo of the project site. Figure 2 shows the project site plan.

The purpose of this study is to determine whether noise levels from the adjacent Pacific Street, East Midas Avenue, and the adjacent UP railroad would exceed the City of Rocklin exterior or interior noise level standards at the proposed residential uses. Predicted noise levels will be compared to the noise level standards of the City of Rocklin General Plan Noise Element. If necessary, noise control measures will be recommended for the proposed project.





**Rocklin Gateway Residential**

Figure: 1

Project Location and Noise Measurement Locations



Figure Prepared: August 2015



: 24-hr Noise Measurement Location

: Traffic Noise Calibration Location



UNIT MIX			
UNIT TYPE	COUNT	AREA	PERCENTAGE
1BR-1BA	102	672 GSF	50%
2BR-1BA-L	54	864 GSF	26%
2BR-1BA-S	48	807 GSF	24%
	204		

PARKING MIX			
TYPE	COUNT		
ADA 9'x18'	7		
COMPACT 8'x16'	221		
STANDARD 9'x18'	230		

ACCESSIBLE PARKING SPACES: 2013 CALIFORNIA BUILDING CODE TABLE 11B-209.2  
MINIMUM OF 7 ACCESSIBLE SPACES REQUIRED FOR 201-300 PARKING SPACES

PARKING REQUIREMENTS PER ROCKLIN CODE OF ORDINANCES 17.66.020  
1 BEDROOM=15 PARKING SPACES AND 3 BEDROOM=2 PARKING SPACES PLUS ADDTL 25% VISITOR PARKING SPACES AND ONE SPACE PER UNIT SHALL BE COVERED\*

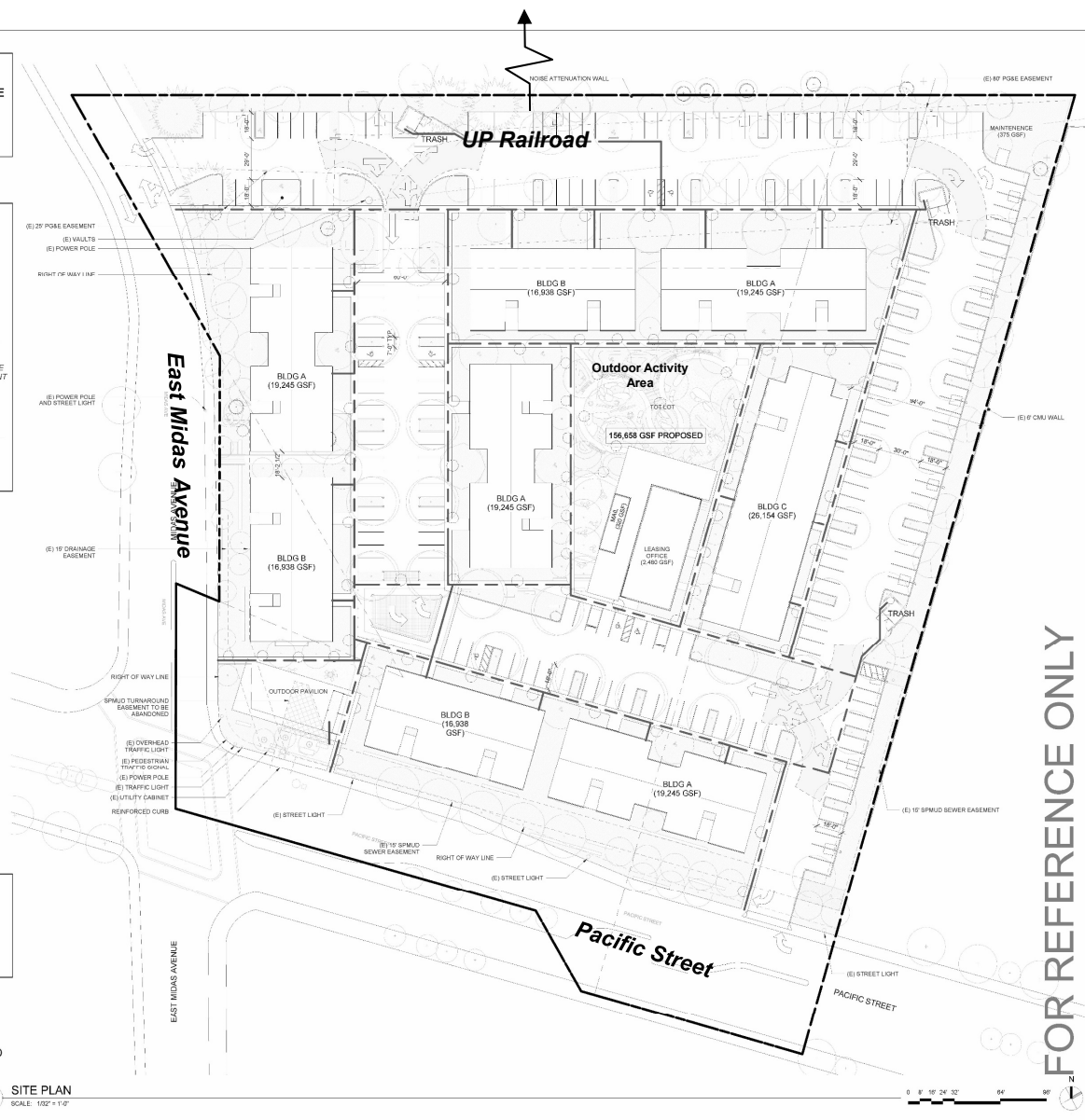
\*REQUIREMENTS FOR COVERED PARKING AND REQUIRED VISITOR PARKING SHALL BE WAIVED FOR ALL UNITS THAT ARE MADE AFFORDABLE BY ROCKLIN HOUSING ELEMENT

TYPE	UNIT COUNT	PARKING	PROVIDED
1 BR	102 x1.5	153+26 VISITOR	102+13 VISITOR
2 BR	102 x2.0	204+26 VISITOR	102+13 VISITOR
	204	409	230

LEGEND	
	ADA PATH OF ACCESSIBILITY
	PROPERTY LINE
	EASEMENT

- SITE PLAN NOTES**
1. REFERENCE LAND TITLE SURVEY FOR PARCEL NUMBERS, LEGAL DESCRIPTIONS, AND AREAS.
  2. REFERENCE LANDSCAPE SITE PLAN FOR (E) TREES TO REMAIN AND TO BE REMOVED.
  3. REFERENCE A000 FOR ADDITIONAL PROJECT INFORMATION.

1 SITE PLAN  
SCALE: 1/32" = 1'-0"



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**ROCKLIN GATEWAY**  
MIDAS AVE & PACIFIC ST  
ROCKLIN, CA 95677

Project Manager: TB  
Project Team: CCTB\_A00R  
Job Number: 1002  
Date: 9/19/2016

Revisions:  
# Date  
NOT FOR CONSTRUCTION  
VOLUME 1: SITE WORK  
9/19/2016

SITE PLAN  
A100

FOR REFERENCE ONLY

**Rockling Gateway Residential**  
Figure: 2 - Site Plan



Figure Prepared: Nov. 2016

## ENVIRONMENTAL SETTING

### ***Fundamentals of Acoustics***

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

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

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

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

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

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

The day/night average level ( $L_{dn}$ ) is based upon the average noise level over a 24-hour day, with a +10 decibel 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.

Table 1 lists several examples of the noise levels associated with common situations. Appendix A provides a summary of acoustical terms used in this report.

**TABLE 1  
TYPICAL NOISE LEVELS**

Common Outdoor Activities	Noise Level (dBA)	Common Indoor Activities
	--110--	Rock Band
Jet Fly-over at 300 m (1,000 ft)	--100--	
Gas Lawn Mower at 1 m (3 ft)	--90--	
Diesel Truck at 15 m (50 ft), at 80 km/hr (50 mph)	--80--	Food Blender at 1 m (3 ft) Garbage Disposal at 1 m (3 ft)
Noisy Urban Area, Daytime Gas Lawn Mower, 30 m (100 ft)	--70--	Vacuum Cleaner at 3 m (10 ft)
Commercial Area Heavy Traffic at 90 m (300 ft)	--60--	Normal Speech at 1 m (3 ft)
Quiet Urban Daytime	--50--	Large Business Office Dishwasher in Next Room
Quiet Urban Nighttime	--40--	Theater, Large Conference Room (Background)
Quiet Suburban Nighttime	--30--	Library
Quiet Rural Nighttime	--20--	Bedroom at Night, Concert Hall (Background)
	--10--	Broadcast/Recording Studio
Lowest Threshold of Human Hearing	--0--	Lowest Threshold of Human Hearing

Source: Caltrans, Technical Noise Supplement, Traffic Noise Analysis Protocol. November, 2009.

## ***Effects of Noise on People***

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

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

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

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

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

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

Stationary point sources of noise – including stationary mobile sources such as idling vehicles – attenuate (lessen) at a rate of approximately 6 dB per doubling of distance from the source, depending on environmental conditions (i.e. atmospheric conditions and either vegetative or manufactured noise barriers, etc.). Widely distributed noises, such as a large industrial facility spread over many acres, or a street with moving vehicles, would typically attenuate at a lower rate.

## REGULATORY CONTEXT

### FEDERAL

There are no federal regulations related to noise that apply to the Proposed Project.

### STATE

There are no state regulations related to noise that apply to the Proposed Project.

### LOCAL

#### ***City of Rocklin General Plan Noise Element***

The City of Rocklin General Plan (October 2012) includes criteria for stationary (non-transportation) and transportation noise sources. Tables 2 and 3 below show the stationary and transportation noise source criteria, respectively (Tables 2-1 and 2-2 of the General Plan).

**TABLE 2  
EXTERIOR NOISE LEVEL DESIGN STANDARDS FOR NEW PROJECTS  
AFFECTED BY OR INCLUDING STATIONARY NOISE SOURCES**

Noise Level Descriptor	Daytime (7 a.m. to 10 p.m.)	Nighttime (10 p.m. to 7 a.m.)																						
Hourly $L_{eq}$ , dB	55 dBA	45 dBA																						
<p>The City can impose noise level standards that are more restrictive than those specified above based upon determination of existing low ambient noise levels.</p> <p>“Fixed” noise sources which are typically of concern include, but are not limited to the following:</p> <table style="width: 100%; border: none;"> <tr> <td style="width: 50%;">HVAC Systems</td> <td style="width: 50%;">Cooling Towers/Evaporative Condensers</td> </tr> <tr> <td>Pump Stations</td> <td>Lift Stations</td> </tr> <tr> <td>Emergency Generators</td> <td>Boilers</td> </tr> <tr> <td>Steam Valves</td> <td>Steam Turbines</td> </tr> <tr> <td>Generators</td> <td>Fans</td> </tr> <tr> <td>Air Compressors</td> <td>Heavy Equipment</td> </tr> <tr> <td>Conveyor Systems</td> <td>Transformers</td> </tr> <tr> <td>Pile Drivers</td> <td>Grinders</td> </tr> <tr> <td>Drill Rigs</td> <td>Gas or Diesel Motors</td> </tr> <tr> <td>Welders</td> <td>Cutting Equipment</td> </tr> <tr> <td>Outdoor Speakers</td> <td>Blowers</td> </tr> </table> <p>The types of uses which may typically produce the noise sources described above include but are not limited to: industrial facilities including pump stations, trucking operations, tire shops, auto maintenance shops, metal fabricating shops, shopping centers, drive-up windows, car washes, loading docks, batch plants, bottling and canning plants, recycling centers, electric generating stations, race tracks, landfills, sand and gravel operations, and athletic fields.</p>			HVAC Systems	Cooling Towers/Evaporative Condensers	Pump Stations	Lift Stations	Emergency Generators	Boilers	Steam Valves	Steam Turbines	Generators	Fans	Air Compressors	Heavy Equipment	Conveyor Systems	Transformers	Pile Drivers	Grinders	Drill Rigs	Gas or Diesel Motors	Welders	Cutting Equipment	Outdoor Speakers	Blowers
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Welders	Cutting Equipment																							
Outdoor Speakers	Blowers																							



**TABLE 3  
MAXIMUM ALLOWABLE NOISE EXPOSURE  
TRANSPORTATION NOISE SOURCES**

Land Use	Outdoor Activity Areas <sup>1</sup> L <sub>dn</sub> /CNEL, dB	Interior Spaces	
		L <sub>dn</sub> /CNEL, dB	L <sub>eq</sub> , dB <sup>2</sup>
Residential	60 <sup>3</sup>	45	--
Transient Lodging	65 <sup>4</sup>	45	--
Hospitals, Nursing Homes	60 <sup>3</sup>	45	--
Theaters, Auditoriums, Music Halls	--	--	35
Non-Commercial Places of Public Assembly	60 <sup>3</sup>	--	40
Office Buildings	--	--	45
Schools, Libraries, Museums	--	--	45
Playgrounds, Neighborhood Parks	70	--	--

<sup>1</sup> The outdoor activity area is generally considered to be the location where individuals may generally congregate for relaxation, or where individuals may require adequate speech intelligibility. Such places may include patios of residences, picnic facilities, or instructional areas.

Where it is not practical to mitigate exterior noise levels at patio or balconies of apartment complexes, a common area such as a pool or recreation area may be designated as the outdoor activity area.

At the discretion of the City, where no outdoor activity areas are provided or known, only the interior noise level criteria can be applied to the project.

<sup>2</sup> As determined for a typical worst-case hour during periods of use.

<sup>3</sup> Where it is not possible to reduce noise in outdoor activity areas to 60 dB L<sub>dn</sub>/CNEL or less using a practical application of the best-available noise reduction measures, an exterior noise level of up to 65 dB L<sub>dn</sub>/CNEL may be allowed provided that available exterior noise level reduction measures have been implemented and interior noise levels are in compliance with this table.

## EVALUATION OF FUTURE TRAFFIC NOISE LEVELS AT THE PROJECT SITE

### Traffic Noise Prediction Methodology

j.c. brennan & associates, Inc., utilizes the Federal Highway Administration (FHWA) Highway Traffic Noise Prediction Model (FHWA RD-77-108) for the prediction of traffic noise levels. The model is based upon the CALVENO noise emission 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.

On August 11-12, 2015 j.c. brennan & associates, Inc. conducted continuous (24-hour) noise measurements of traffic on Pacific Street. Figure 1 shows the continuous noise measurement location, labeled as Site B. Short-term noise measurements were also conducted at Site 1 and Site 2, located near Pacific Street and East Midas Avenue, respectively.

Instrumentation used for the measurement was a Larson Davis Laboratories (LDL) Model 820 precision integrating sound level meter which was calibrated in the field before use with an LDL CAL-200 acoustical calibrator.

The short-term noise measurement data was used to determine the accuracy of the FHWA model in describing the existing noise environment on the project site, while accounting for site conditions, travel speeds, roadway geometry, etc. Noise measurement results were compared to the FHWA model results by entering the existing traffic volume, speeds, and distances of Pacific Street and East Midas Avenue as inputs to the FHWA model. The model was found to accurately predict the measured noise levels at Site 1 (0.0 dB difference). The model was found to over-predict traffic noise levels at Site 2 by 1.0 dB. This over-prediction is negligible. Therefore, no offsets were applied to the FHWA model.

Appendix B graphically shows the results of the continuous noise monitoring conducted at Site B. A complete listing of FHWA Model Calibration inputs are provided in Appendix C.

## Future Traffic Noise Levels

To determine the future traffic noise levels on the project site, j.c. brennan & associates, Inc., utilized Cumulative Plus Project traffic predictions for University Avenue prepared by DKS Transportation consultants for the City of Rocklin General Plan Update (August, 2011).

Table 4 shows the predicted future traffic noise levels at the proposed residential uses located closest to Pacific Street and Midas Avenue. A complete listing of the FHWA Traffic Noise Prediction Model inputs is provided in Appendix D.

It should be noted that the City of Rocklin 60 dB  $L_{dn}$  exterior noise level standard applies specifically to outdoor use areas or “outdoor activity” areas. In addition to outdoor activity areas, noise levels are predicted at the project building facades located closest to each of the project-area roadways. These building façade noise levels are used for predicting interior noise levels are not subject to the City’s exterior noise level standard. For example, the 2<sup>nd</sup>/3<sup>rd</sup> floor façades of the units along Pacific Street would be exposed to exterior noise levels of 69 dB  $L_{dn}$ . This is not an exceedance of the City’s 60 dB  $L_{dn}$  exterior noise level standard as no outdoor use occurs at this location.

**TABLE 4  
PREDICTED FUTURE TRAFFIC NOISE LEVELS**

Location	Distance (ft)	Traffic Noise Levels, $L_{dn}$ (dB)
<i>Pacific Street – East of Midas Avenue (ADT 26,200)</i>		
1st Floor Façade	80'	66 dB
2 <sup>nd</sup> /3 <sup>rd</sup> Floor Façade	80'	69 dB
Courtyards ( <b>Outdoor Activity Area</b> )	350'	47 dB
<i>East Midas Avenue – Northwest of Pacific Street (ADT 14,200)</i>		
1st Floor Façade	50'	60 dB
2 <sup>nd</sup> /3 <sup>rd</sup> Floor Façade	50'	63 dB
Courtyards ( <b>Outdoor Activity Area</b> )	340'	37 dB
Sources: j.c. brennan & associates, Inc., City of Rocklin General Plan, and FHWA RD-77-108		

The Table 4 data indicates that future traffic noise levels at outdoor activity areas of the proposed project are predicted to comply with the City of Rocklin 60 dB  $L_{dn}$  exterior noise level standard, as proposed. Therefore, no additional exterior traffic noise reduction measures would be required.

### **Interior Traffic Noise Levels:**

Standard construction practices, consistent with the uniform building code typically provides an exterior-to-interior noise level reduction of approximately 25 dB, assuming that air conditioning is included for each unit, which allows residents to close windows for the required acoustical isolation. Based upon an exterior noise exposure of up to 69 dB  $L_{dn}$ , interior noise levels of up to 44 dB  $L_{dn}$  are predicted along Pacific Street. This complies with the City of Rocklin 45 dB  $L_{dn}$  interior noise level standard.

### **EVALUATION OF RAILROAD NOISE LEVELS AT THE PROJECT SITE**

In order to quantify the number and distribution of daily train operations along the Union Pacific Railroad (UPRR) line, j.c. brennan & associates, Inc., conducted continuous (24-hour) noise level measurements of railroad operations on August 11<sup>th</sup> – 12<sup>th</sup>, 2015. Figure 1 shows the noise measurement site, labeled as Site A. The sound level meter was programmed to collect single event noise level data due to train passbys. The data indicated that a single train operation resulted in an average sound exposure level (SEL) of 100 dB at a distance of 170 feet from the centerline of the two UP railroad tracks.

Based upon the noise measurement data and results, approximately 22 train events occurred along the tracks during a 24-hour period, with approximately 10 during nighttime (10:00 pm to 7:00 am) hours. Appendix B shows the complete results of the 24-hour noise monitoring at Site A.

To determine the day/night average ( $L_{dn}$ ) exterior noise level associated with the railroad operations on the project site, the following formula can be used:

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

SEL is the mean measured SEL of the train events (100 dB at a distance of 170 feet), Neq is the sum of the daytime (7 a.m. to 10 p.m.) train events plus 10 times the number of nighttime (10 p.m. to 7 a.m.) train events, and 49.4 is ten times the logarithm of the number of seconds per day.

Based upon this information, the exterior noise level due to train operations is predicted to be approximately 72 dB  $L_{dn}$  at a distance of 170 feet. Predicted noise levels associated with railroad activity are shown in Table 5. Future railroad operations data was not available. The existing railroad operations data and analysis are used for the analysis of future railroad operations.

**TABLE 5  
PREDICTED UNMITIGATED RAILROAD NOISE LEVELS**

Location	Predicted Exterior Noise Level, L <sub>dn</sub>	Distance
Facades – 1 <sup>st</sup> Floor	65 dB (Includes shielding from proposed property line sound wall, see Appendix E for barrier calculations)	245' – Direct line of site
Facades – 2 <sup>nd</sup> / 3 <sup>rd</sup> Floor	73 dB	
Courtyards	56 dB	400' – Shielded by buildings
Source: j.c. brennan & associates, Inc., 2016		

Based upon the Table 5 data, outdoor activity areas are not predicted to be exposed to exterior noise levels exceeding the City of Rocklin 60 dB L<sub>dn</sub> exterior noise level standard. Therefore, no exterior noise reduction measures would be required.

**Prediction of Interior Noise Levels:**

The City of Rocklin applies a 45 dB L<sub>dn</sub> interior noise level standard for residential uses exposed to transportation noise sources. The residential uses adjacent to the UPRR tracks are predicted to be exposed to first-floor exterior noise levels of approximately 65 dB L<sub>dn</sub>, based upon the Table 5 data. Second and third floor noise levels are typically 2-3 dB higher than first floor noise levels and do not receive shielding by . Therefore, exterior noise levels at the second floor facades are predicted to be 73 dB L<sub>dn</sub>.

Standard construction practices, consistent with the uniform building code typically provides an exterior to interior noise level reduction of approximately 25 dB, assuming that air conditioning is included for each unit, which allows residents to close windows for the required acoustical isolation. Based upon an exterior noise exposure of up to 73 dB L<sub>dn</sub>, interior noise levels of up to 48 dB L<sub>dn</sub> are predicted. Therefore, interior noise control measures would be required.

In order to achieve compliance with the City of Rocklin 45 dB L<sub>dn</sub> interior noise level standard, j.c. brennan & associates, Inc. recommends the use of windows with a sound transmission class (STC) 35 rating, or higher, should be installed in all second and third floor facades with a view of the UPRR railroad tracks. These requirements would apply to the first row of units in the project, including facades with a perpendicular view of the UPRR line.



## CONCLUSIONS

The proposed project is predicted to be exposed to railroad noise levels exceeding the City of Rocklin 45 dB  $L_{dn}$  interior noise level standard. Therefore, the following noise control measures should be implemented:

- All second or third floor windows or glass doors with a view of the UP railroad line should be fitted with STC 35 minimum rated assemblies. This would apply specifically to the first row of units closest to the UP railroad line. Units in the second row and beyond may be fitted with STC 27 minimum rated assemblies.
- j.c. brennan & associates, Inc. recommends that mechanical ventilation penetrations for bath fans not face towards the UP railroad or Pacific Street. Where feasible these vents should be routed towards the opposite side of the building to minimize sound intrusion to sensitive areas of the building.

Where vents must face towards the UP railroad line or Pacific Street, it is recommended that the duct work be increased in length and it make as many “S” turns as feasible prior to exiting the dwelling. This separates the openings between the noise source and the living space with a long circuitous route. Each time the sound turns a corner, it is reduced slightly. Flexible duct work is the preferred ducting for this noise mitigation. Where the vent exits the building, a spring loaded flap with a gasket should be installed to reduce sound entering the duct work when the vent is not in use.

- Mechanical ventilation shall be provided to allow occupants to keep doors and windows closed for acoustic isolation.

## Appendix A Acoustical Terminology

<b>Acoustics</b>	The science of sound.
<b>Ambient Noise</b>	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.
<b>Attenuation</b>	The reduction of an acoustic signal.
<b>A-Weighting</b>	A frequency-response adjustment of a sound level meter that conditions the output signal to approximate human response.
<b>Decibel or dB</b>	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.
<b>CNEL</b>	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.
<b>Frequency</b>	The measure of the rapidity of alterations of a periodic signal, expressed in cycles per second or hertz (Hz).
<b>L<sub>dn</sub></b>	Day/Night Average Sound Level. Similar to CNEL but with no evening weighting.
<b>L<sub>eq</sub></b>	Equivalent or energy-averaged sound level.
<b>L<sub>max</sub></b>	The highest root-mean-square (RMS) sound level measured over a given period of time.
<b>L<sub>(n)</sub></b>	The sound level exceeded a described percentile over a measurement period. For instance, an hourly L <sub>50</sub> is the sound level exceeded 50% of the time during the one hour period.
<b>Loudness</b>	A subjective term for the sensation of the magnitude of sound.
<b>Noise</b>	Unwanted sound.
<b>NRC</b>	Noise Reduction Coefficient. NRC is a single-number rating of the sound-absorption of a material equal to the arithmetic mean of the sound-absorption coefficients in the 250, 500, 1000, and 2,000 Hz octave frequency bands rounded to the nearest multiple of 0.05. It is a representation of the amount of sound energy absorbed upon striking a particular surface. An NRC of 0 indicates perfect reflection; an NRC of 1 indicates perfect absorption.
<b>Peak Noise</b>	The level corresponding to the highest (not RMS) sound pressure measured over a given period of time. This term is often confused with the <b>Maximum</b> level, which is the highest RMS level.
<b>RT<sub>60</sub></b>	The time it takes reverberant sound to decay by 60 dB once the source has been removed.
<b>Sabin</b>	The unit of sound absorption. One square foot of material absorbing 100% of incident sound has an absorption of 1 Sabin.
<b>SEL</b>	Sound Exposure Level. SEL is a rating, in decibels, of a discrete event, such as an aircraft flyover or train passby, that compresses the total sound energy into a one-second event.
<b>STC</b>	Sound Transmission Class. STC is an integer rating of how well a building partition attenuates airborne sound. It is widely used to rate interior partitions, ceilings/floors, doors, windows and exterior wall configurations.
<b>Threshold of Hearing</b>	The lowest sound that can be perceived by the human auditory system, generally considered to be 0 dB for persons with perfect hearing.
<b>Threshold of Pain</b>	Approximately 120 dB above the threshold of hearing.
<b>Impulsive</b>	Sound of short duration, usually less than one second, with an abrupt onset and rapid decay.
<b>Simple Tone</b>	Any sound which can be judged as audible as a single pitch or set of single pitches.

**Appendix B-1**

2015-180 Pacific and Midas Multi-Family Residential

24hr Continuous Noise Monitoring - Site A

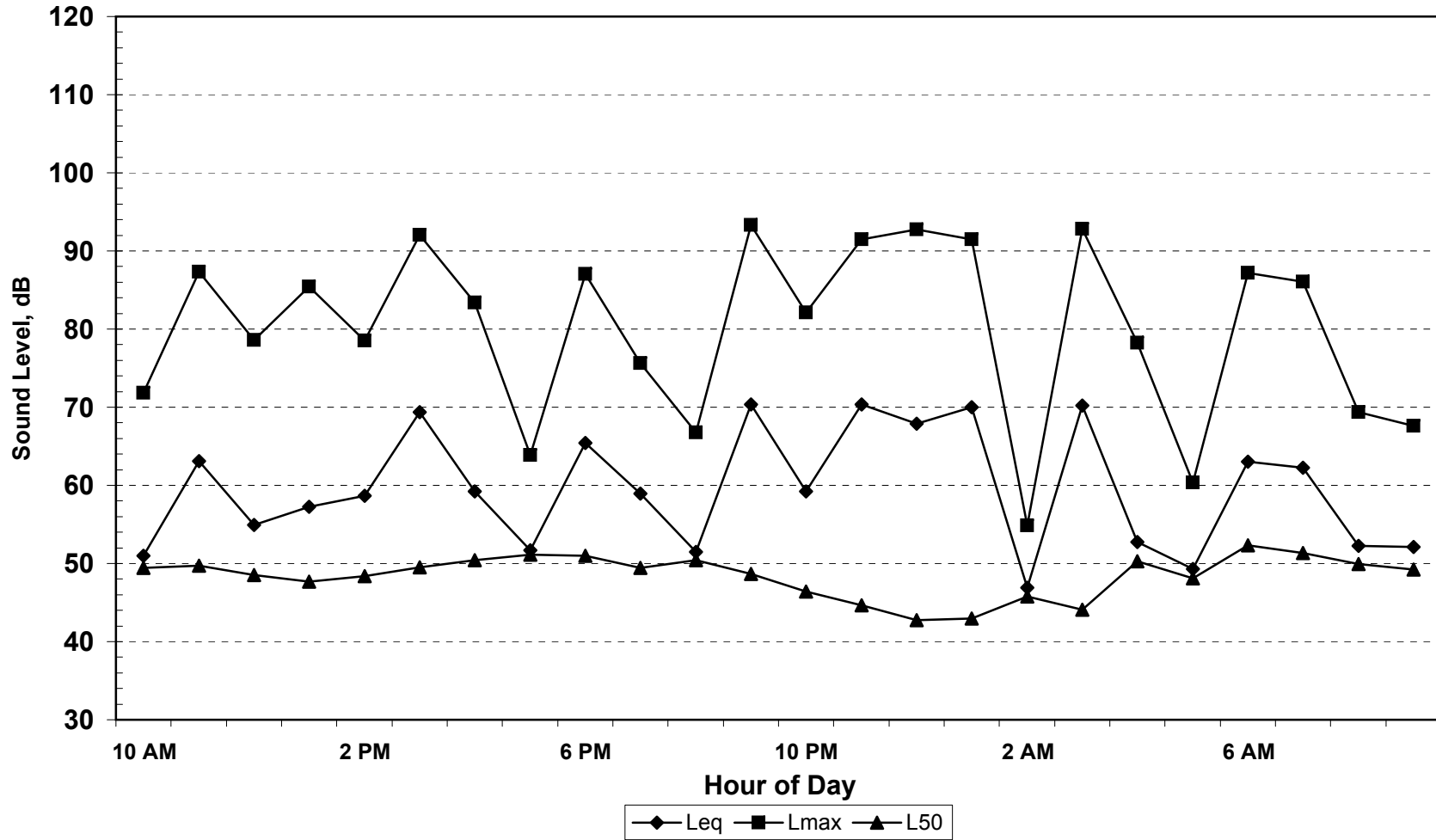
Tuesday, August 11, 2015 - Wednesday, August 12, 2015

Hour	Leq	Lmax	L50	L90
10:00	51	72	49	47
11:00	63	87	50	46
12:00	55	79	49	45
13:00	57	85	48	45
14:00	59	79	48	45
15:00	69	92	49	46
16:00	59	83	50	47
17:00	52	64	51	48
18:00	65	87	51	47
19:00	59	76	49	46
20:00	52	67	50	47
21:00	70	93	49	45
22:00	59	82	46	44
23:00	70	91	45	43
0:00	68	93	43	40
1:00	70	92	43	40
2:00	47	55	46	44
3:00	70	93	44	41
4:00	53	78	50	48
5:00	49	60	48	45
6:00	63	87	52	49
7:00	62	86	51	49
8:00	52	69	50	48
9:00	52	68	49	46

Statistical Summary						
	Daytime (7 a.m. - 10 p.m.)			Nighttime (10 p.m. - 7 a.m.)		
	High	Low	Average	High	Low	Average
Leq (Average)	70.4	51.0	63.1	70.4	46.9	66.6
Lmax (Maximum)	93.3	63.9	79.1	92.8	54.8	81.3
L50 (Median)	51.4	47.7	49.7	52.3	42.8	46.4
L90 (Background)	48.8	44.8	46.5	49.3	40.4	43.8

Leq (Average)	70.4
Lmax (Maximum)	93.3
L50 (Median)	51.4
L90 (Background)	48.8
Computed Ldn, dB	73
% Daytime Energy	43%
% Nighttime Energy	57%

**Appendix B-1**  
 24hr Continuous Noise Monitoring - Site A  
 2015-180 Pacific and Midas Multi-Family Residential  
 Tuesday, August 11, 2015 - Wednesday, August 12, 2015



**Ldn : 72.6 dB**

**Appendix B-2**

2015-180 Pacific and Midas Multi-Family Residential  
 24hr Continuous Noise Monitoring - Site B  
 Tuesday, August 11, 2015 - Wednesday, August 12, 2015

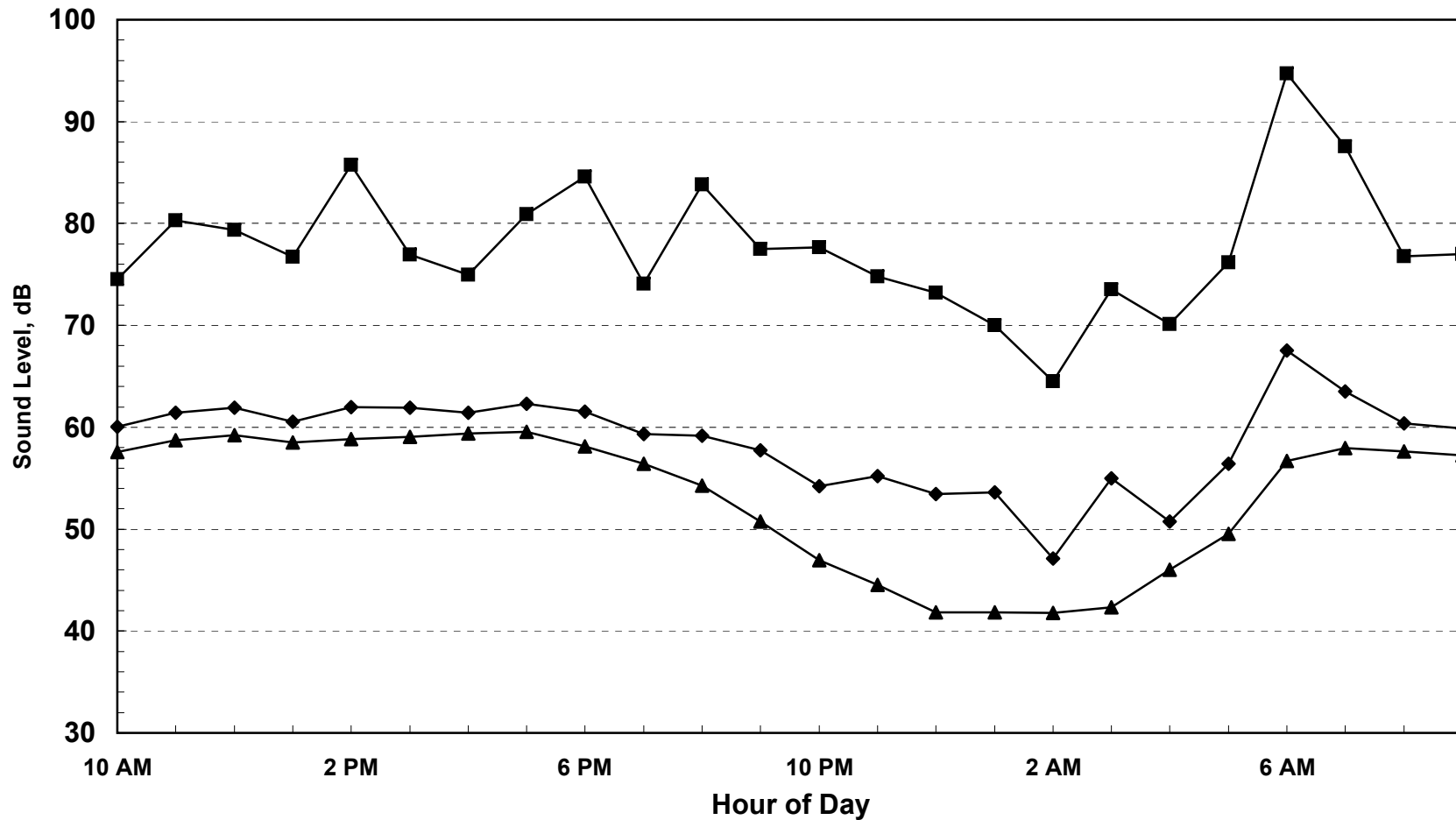
Hour	Leq	Lmax	L50	L90
10:00	60	75	58	52
11:00	61	80	59	53
12:00	62	79	59	53
13:00	61	77	59	52
14:00	62	86	59	52
15:00	62	77	59	53
16:00	61	75	59	53
17:00	62	81	60	53
18:00	62	85	58	52
19:00	59	74	56	50
20:00	59	84	54	48
21:00	58	77	51	45
22:00	54	78	47	44
23:00	55	75	45	42
0:00	53	73	42	38
1:00	54	70	42	39
2:00	47	64	42	39
3:00	55	74	42	40
4:00	51	70	46	44
5:00	56	76	50	45
6:00	68	95	57	51
7:00	64	88	58	51
8:00	60	77	58	51
9:00	60	77	57	50

	Statistical Summary					
	Daytime (7 a.m. - 10 p.m.)			Nighttime (10 p.m. - 7 a.m.)		
	High	Low	Average	High	Low	Average
Leq (Average)	64	58	61	68	47	59
Lmax (Maximum)	88	74	79	95	64	75
L50 (Median)	60	51	58	57	42	46
L90 (Background)	53	45	51	51	38	42

Computed Ldn, dB	66
% Daytime Energy	72%
% Nighttime Energy	28%



**Appendix B-2**  
2015-180 Pacific and Midas Multi-Family Residential  
24hr Continuous Noise Monitoring - Site B  
Tuesday, August 11, 2015 - Wednesday, August 12, 2015



Ldn = 66 dB

◆ Leq    ■ Lmax    ▲ L50

Appendix C-1

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

**Calibration Worksheet**

**Project Information:**

Job Number: 2015-180  
Project Name: Pacific and Midas Multi-Family Residential  
Roadway Tested: Pacific Street  
Test Location: Site 1  
Test Date: August 11, 2015

**Weather Conditions:**

Temperature (Fahrenheit): 70  
Relative Humidity: Dry  
Wind Speed and Direction: 0-5 mph  
Cloud Cover: Partly Cloudy

**Sound Level Meter:**

Sound Level Meter: LDL Model 820  
Calibrator: LDL Model CA200  
Meter Calibrated: Immediately before  
Meter Settings: A-weighted, slow response

**Microphone:**

Microphone Location: On Project Site  
Distance to Centerline (feet): 93  
Microphone Height: 5 feet above ground  
Intervening Ground (Hard or Soft): **Soft**  
Elevation Relative to Road (feet): 5

**Roadway Condition:**

Pavement Type Asphalt  
Pavement Condition: Good  
Number of Lanes: 4  
Posted Maximum Speed (mph): 40

**Test Parameters:**

Test Time: 10:00 AM  
Test Duration (minutes): 10  
Observed Number Automobiles: 122  
Observed Number Medium Trucks: 3  
Observed Number Heavy Trucks: 4  
Observed Average Speed (mph): 30

**Model Calibration:**

Measured Average Level ( $L_{eq}$ ): 60.7  
Level Predicted by FHWA Model: 60.7

**Difference: 0.0 dB**

**Conclusions:**

Appendix C-2

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

**Calibration Worksheet**

**Project Information:**

Job Number: 2015-180  
Project Name: Pacific and Midas Multi-Family Residential  
Roadway Tested: East Midas Avenue  
Test Location: Site 2  
Test Date: August 11, 2015

**Weather Conditions:**

Temperature (Fahrenheit): 70  
Relative Humidity: Dry  
Wind Speed and Direction: 0-5 mph  
Cloud Cover: Partly Cloudy

**Sound Level Meter:**

Sound Level Meter: LDL Model 820  
Calibrator: LDL Model CA200  
Meter Calibrated: Immediately before  
Meter Settings: A-weighted, slow response

**Microphone:**

Microphone Location: On Project Site  
Distance to Centerline (feet): 69  
Microphone Height: 5 feet above ground  
Intervening Ground (Hard or Soft): **Soft**  
Elevation Relative to Road (feet): 3

**Roadway Condition:**

Pavement Type: Asphalt  
Pavement Condition: Good  
Number of Lanes: 2  
Posted Maximum Speed (mph): 30

**Test Parameters:**

Test Time: 10:20 AM  
Test Duration (minutes): 10  
Observed Number Automobiles: 80  
Observed Number Medium Trucks: 0  
Observed Number Heavy Trucks: 1  
Observed Average Speed (mph): 20

**Model Calibration:**

Measured Average Level ( $L_{eq}$ ): 54.1  
Level Predicted by FHWA Model: 55.1

**Difference: 1.0 dB**

**Conclusions:**

**Appendix D-1**

**FHWA-RD-77-108 Highway Traffic Noise Prediction Model**

**Data Input Sheet**

Project #: 2015-180 Rocklin Gateway Multi-Family Residential

Description: Cumulative Plus Project

Ldn/CNEL: Ldn

Hard/Soft: Soft

Segment	Roadway Name	Location	ADT	Day %	Eve %	Night %	% Med. Trucks	% Hvy. Trucks	Speed	Distance	Offset (dB)
1	Pacific Street	1st Floor Façade	26,200	88		12	3	3	30	80	
2	Pacific Street	2nd/3rd Floor Façade	26,200	88		12	3	3	30	80	3
3	Pacific Street	Outdoor Activity Area	26,200	88		12	3	3	30	350	-10
4	East Midas Avenue	1st Floor Façade	14,200	88		12	1	0.5	20	50	
5	East Midas Avenue	2nd/3rd Floor Façade	14,200	88		12	1	0.5	20	50	3
6	East Midas Avenue	Outdoor Activity Area	14,200	88		12	1	0.5	20	340	-10
7											

Appendix D-2

**FHWA-RD-77-108 Highway Traffic Noise Prediction Model**

**Predicted Levels**

Project #: 2015-180 Rocklin Gateway Multi-Family Residential  
Description: Cumulative Plus Project  
Ldn/CNEL: Ldn  
Hard/Soft: Soft

Segment	Roadway Name	Location	Autos	Medium Trucks	Heavy Trucks	Total
1	Pacific Street	1st Floor Façade	61	57	64	66
2	Pacific Street	2nd/3rd Floor Façade	64	60	67	69
3	Pacific Street	Outdoor Activity Area	42	37	45	47
4	East Midas Avenue	1st Floor Façade	57	50	55	60
5	East Midas Avenue	2nd/3rd Floor Façade	60	53	58	63
6	East Midas Avenue	Outdoor Activity Area	34	27	33	37



Appendix E

**Barrier Insertion Loss Calculation**

**Project Information:**

Job Number: 2015-180  
Project Name: Rocklin Gateway Residential  
Location(s): 1st Floor Façade

**Noise Level Data:**

Source Description: Railroad  
Source Noise Level, dBA: 70  
Source Frequency (Hz): 500  
Source Height (ft): 266

**Site Geometry:**

Receiver Description: Building Façade  
Source to Barrier Distance (C<sub>1</sub>): 140  
Barrier to Receiver Distance (C<sub>2</sub>): 100  
  
Pad/Ground Elevation at Receiver: 256  
Receiver Elevation<sup>1</sup>: 261  
Base of Barrier Elevation: 256  
Starting Barrier Height 6

**Barrier Effectiveness:**

Top of Barrier Elevation (ft)	Barrier Height (ft)	Insertion Loss, dB	Noise Level, dB	Barrier Breaks Line of Site to Source?
262	6	-5	65	No
263	7	-5	65	No
264	8	-5	65	Yes
265	9	-5	65	Yes
266	10	-6	64	Yes
267	11	-6	64	Yes
268	12	-7	63	Yes
269	13	-7	63	Yes
270	14	-8	62	Yes
271	15	-8	62	Yes
272	16	-9	61	Yes

**Notes:** 1. Standard receiver elevation is five feet above grade/pad elevations at the receiver location(s)

