Environmental Noise Assessment

Chico Towne Place Suites

City of Chico, California

September 7, 2021

Project #210801

Prepared for:

Continuum Hospitality, LLC
5080 California Ave, Suite 415
Bakersfield, CA 93311

Prepared by:

Saxelby Acoustics LLC

Luke Saxelby, INCE Bd. Cert.
Principal Consultant
Board Certified, Institute of Noise Control Engineering (INCE)

(916) 760-8821
www.SaxNoise.com | Luke@SaxNoise.com
915 Highland Pointe Drive, Suite 250
Roseville, CA 95678

Table of Contents

List of Figures

List of Tables

Appendices

INTRODUCTION

The Chico Towne Place Suites project includes the construction of a 16,655 square-foot, 4-story hotel on a vacant parcel in the city of Chico, California. The project includes an outdoor firepit on the northern side of the proposed building and an outdoor pool area on the southern side, adjacent to Highway 32. The project is located at the northeast corner of the intersection of Bruce Road and Highway 32, south of Sierra Sunrise Terrace.

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

ENVIRONMENTAL SETTING

BACKGROUND INFORMATION ON NOISE

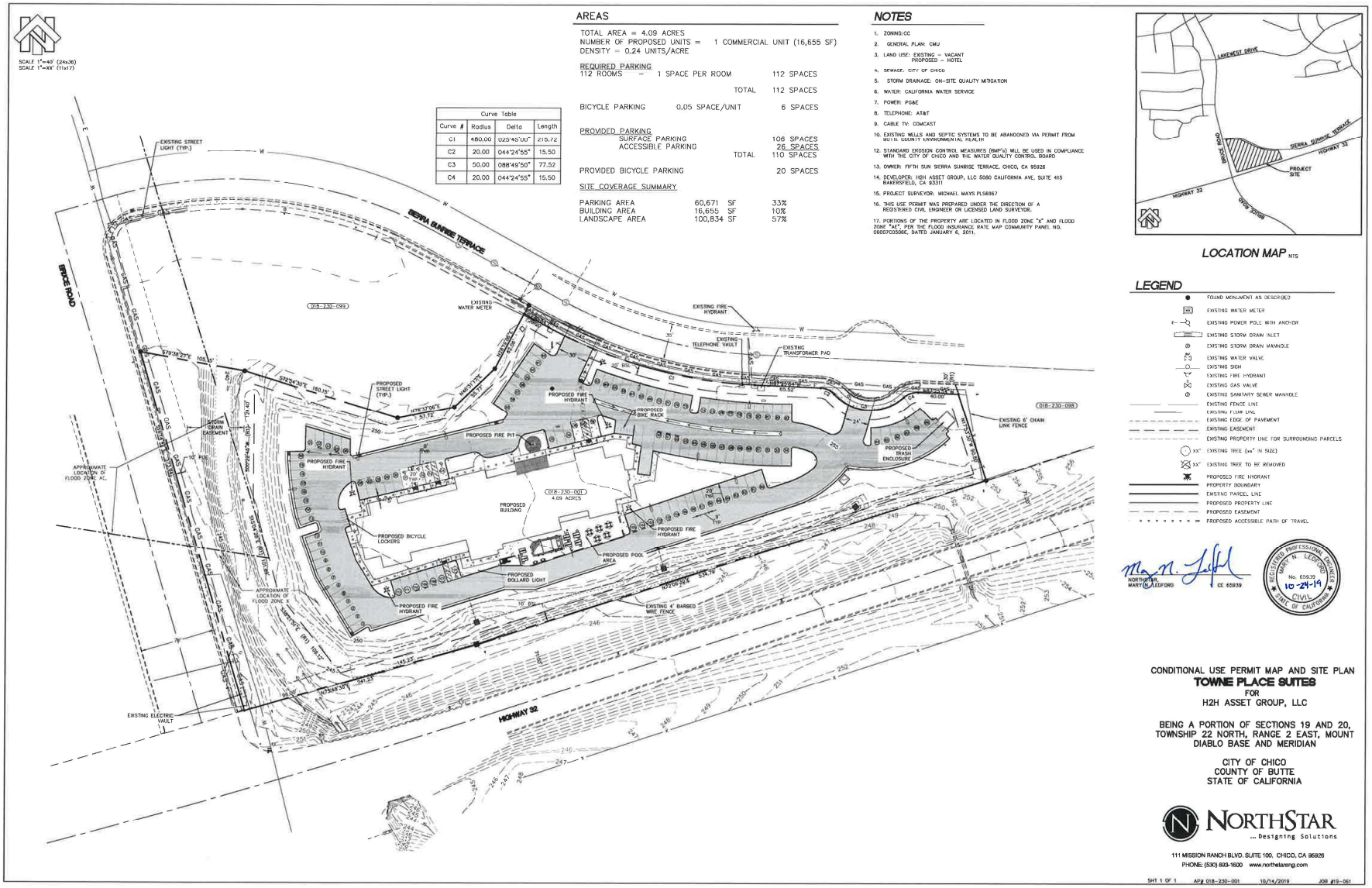
Fundamentals of Acoustics

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, but are expressed as dB, unless otherwise noted.



Chico Towne Place Suites
City of Chico, California

Figure 1
Project Site Plan

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Figure 2

Noise Measurement Sites

Legend

- Project Site
- Noise Measurement Site - Long Term
- Noise Measurement Site - Short Term

0 m 20 m 40 m 60 m 80 m

Projection: UTM Zone 10 / WGS84 / meters
Rev. Date: 08/25/2021

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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. September, 2013.

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.

EXISTING AMBIENT NOISE LEVELS

The existing noise environment in the project area is defined primarily by traffic on Highway 32 and Bruce Road.

To quantify the existing ambient noise environment on the project site, Saxelby Acoustics conducted a continuous noise measurement survey at two locations and a short-term noise level measurement at one location on the project site. The noise measurement locations are shown on **Figure 2.** A summary of the noise level measurement survey results is provided in **Table 2. Appendix B** contains the complete results of the noise monitoring.

The sound level meters were programmed to record the maximum, median, and average noise levels at each site during the survey. The maximum value, denoted L_{max}, represents the highest noise level measured. The average value, denoted L_{eq}, represents the energy average of all of the noise received by the sound level meter microphone during the monitoring period. The median value, denoted L_{50}, represents the sound level exceeded 50 percent of the time during the monitoring period.

Larson Davis Laboratories (LDL) Models 820 and 831 precision integrating sound level meters were used for the ambient noise level measurement survey. The meters were calibrated before and after use with a CAL200 acoustical calibrator to ensure the accuracy of the measurements. The equipment used meets all pertinent specifications of the American National Standards Institute for Type 1 sound level meters (ANSI S1.4).

TABLE 2: SUMMARY OF EXISTING BACKGROUND NOISE MEASUREMENT DATA

Site	Date	Average Measured Hourly Noise Levels, dBA						
			Daytime (7:00 am - 10:00 pm)			Nighttime (10:00 pm – 7:00 am)		
		L_{dn}	L_{eq}	L_{50}	L_{max}	L_{eq}	L_{50}	L_{max}
LT-1	8/24/2021	64	61	58	75	56	46	73
LT-2	8/24/2021	69	69	64	85	59	47	79
ST-1	8/23/2021 – 11:49 a.m.	N/A	69	66	85	N/A	N/A	N/A

Notes:
- All values shown in dBA
- Daytime hours: 7:00 a.m. to 10:00 p.m.
- Nighttime Hours: 10:00 p.m. to 7:00 a.m.

Source: *Saxelby Acoustics – 2021.*

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 Chico General Plan

The Chico General Plan Noise Element Table N-1 establishes standards for maximum allowable noise exposure from transportation noise sources. The maximum allowable interior noise level is 45 dBA L_{dn} for transient lodging uses (General Plan Noise Element Table N-1 – shown below in **Table 3**). No exterior noise standard is established for transient lodging uses.

TABLE 3: MAXIMUM ALLOWABLE NOISE LEVELS FROM TRANSPORTATION NOISE SOURCES

Land Use	Outdoor Activity Areas[1] L_{dn}/CNEL, dB	Interior Spaces	
		L_{dn}/CNEL, dB	L_{eq}, dB[2]
Residential	65[3]	45	--
Transient Lodging	--	45	--
Hospitals, Nursing Homes	65[3]	45	--
Theaters, Auditoriums, Music Halls	--	--	35
Churches, Meeting Halls	65[3]	--	40
Office Buildings	--	--	45
Schools, Libraries, Museums	65[3]	--	45
Playgrounds, Neighborhood Parks	70	--	--

Notes:

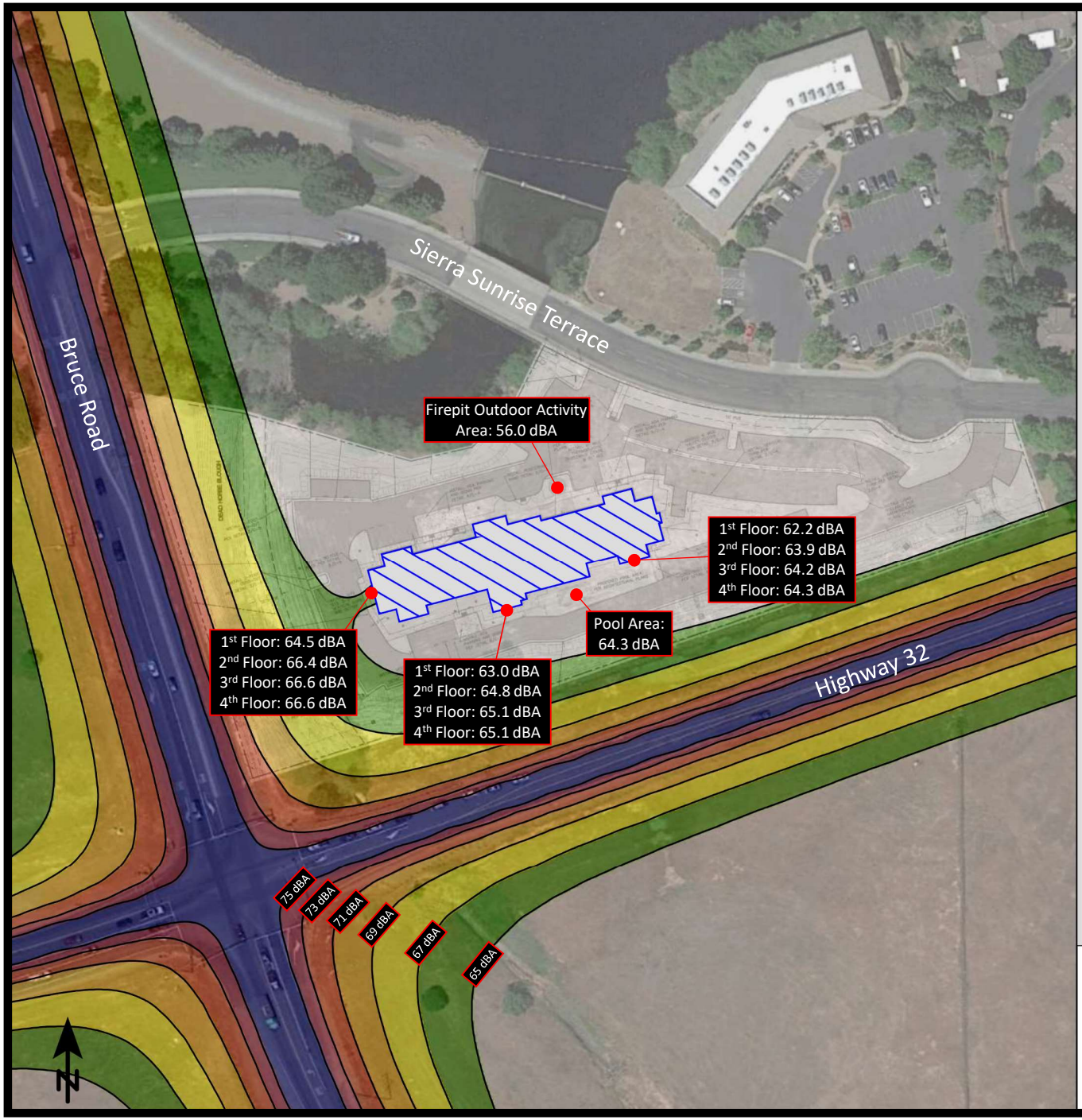
1. Noise standards are to be applied at outdoor activity areas with the greatest exposure to the noise source. When it is not practical to mitigate exterior noise levels at the patios or balconies of multi-family dwellings, a common area or onsite park may be designated as the outdoor activity area. For noise-sensitive land uses that do not include outdoor activity areas, only the interior noise standard shall apply.
2. As determined for a typical worst-case hour during periods of use.
3. Where it is not possible to reduce noise in outdoor activity areas to 65 dB L_{dn}/CNEL or less using all feasible noise reduction measures, an exterior noise level of up to 70 dB L_{dn}/CNEL may be allowed provided that interior noise levels are in compliance with this table.

Source: Chico General Plan, Table N-1

EVALUATION OF FUTURE TRANSPORTATION NOISE ON THE PROJECT SITE

On-Site Traffic Noise Prediction Methodology

Saxelby Acoustics used the SoundPLAN noise model to calculate traffic noise levels at the proposed transient lodging use due to traffic on Highway 32, Bruce Road, and Sierra Sunrise Terrace. Traffic noise levels were predicted for existing conditions with a +1 dBA adjustment for future conditions. The results of this analysis are shown graphically on **Figure 3.**



Chico Towne Place Suites

City of Chico, California

Figure 3

Future (2042) Traffic Noise Contours (dBA L_{dn})

Signs and symbols

Proposed Building

Levels in dB(A)

<= 65
65 - 67
67 - 69
69 - 71
71 - 73
73 - 75
> 75

1 : 1600

0 10 20 40 60 80 m

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Exterior Traffic Noise

As shown on **Figure 3**, traffic noise levels reached levels of 56 dBA L_{dn} at the outdoor firepit area and 64 dBA L_{dn} at the outdoor pool area of the project. However, the Chico General Plan does not include an outdoor activity area standard for transient lodging. Therefore, this data is included for informational purposes only.

Interior Traffic Noise

As shown on **Figure 3**, traffic noise levels are predicted to be a maximum of 67 dBA L_{dn} at the fourth-floor building façade facing the intersection of Bruce Road and Highway 32. Based upon a typical 25 dB exterior-to-interior noise level reduction achieved by modern building construction, an interior noise level of 42 dBA L_{dn} would be expected. This would meet the City's 45 dBA L_{dn} interior noise level standard. Therefore, no additional noise control measures would be required to achieve compliance with the City's interior noise level standards for transient lodging.

CONCLUSIONS

The primary noise source on the project site is transportation noise emanating from Bruce Road and Highway 32. Future transportation noise levels at interior areas are predicted to be 42 dBA L_{dn} or less, which meets the City of Chico's interior noise level standard of 45 dBA L_{dn}. Therefore, the proposed project is predicted to meet the City of Chico interior noise standards with no additional noise control measures.

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.
ASTC	Apparent Sound Transmission Class. Similar to STC but includes sound from flanking paths and correct for room reverberation. A larger number means more attenuation. The scale, like the decibel scale for sound, is logarithmic.
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 +5 dBA and nighttime hours weighted by +10 dBA.
DNL	See definition of Ldn.
IIC	Impact Insulation Class. An integer-number rating of how well a building floor attenuates impact sounds, such as footsteps. A larger number means more attenuation. The scale, like the decibel scale for sound, is logarithmic.
Frequency	The measure of the rapidity of alterations of a periodic signal, expressed in cycles per second or hertz (Hz).
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.
L(n)	The sound level exceeded a described percentile over a measurement period. For instance, an hourly L50 is the sound level exceeded 50% of the time during the one-hour period.
Loudness	A subjective term for the sensation of the magnitude of sound.
NIC	Noise Isolation Class. A rating of the noise reduction between two spaces. Similar to STC but includes sound from flanking paths and no correction for room reverberation.
NNIC	Normalized Noise Isolation Class. Similar to NIC but includes a correction for room reverberation.
Noise	Unwanted sound.
NRC	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.
RT60	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	Sound Exposure Level. SEL is a rating, in decibels, of a discrete event, such as an aircraft flyover or train pass by, that compresses the total sound energy into a one-second event.
SPC	Speech Privacy Class. SPC is a method of rating speech privacy in buildings. It is designed to measure the degree of speech privacy provided by a closed room, indicating the degree to which conversations occurring within are kept private from listeners outside the room.
STC	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. The STC rating is typically used to rate the sound transmission of a specific building element when tested in laboratory conditions where flanking paths around the assembly don't exist. A larger number means more attenuation. The scale, like the decibel scale for sound, is logarithmic.
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.
Impulsive	Sound of short duration, usually less than one second, with an abrupt onset and rapid decay.
Simple Tone	Any sound which can be judged as audible as a single pitch or set of single pitches.

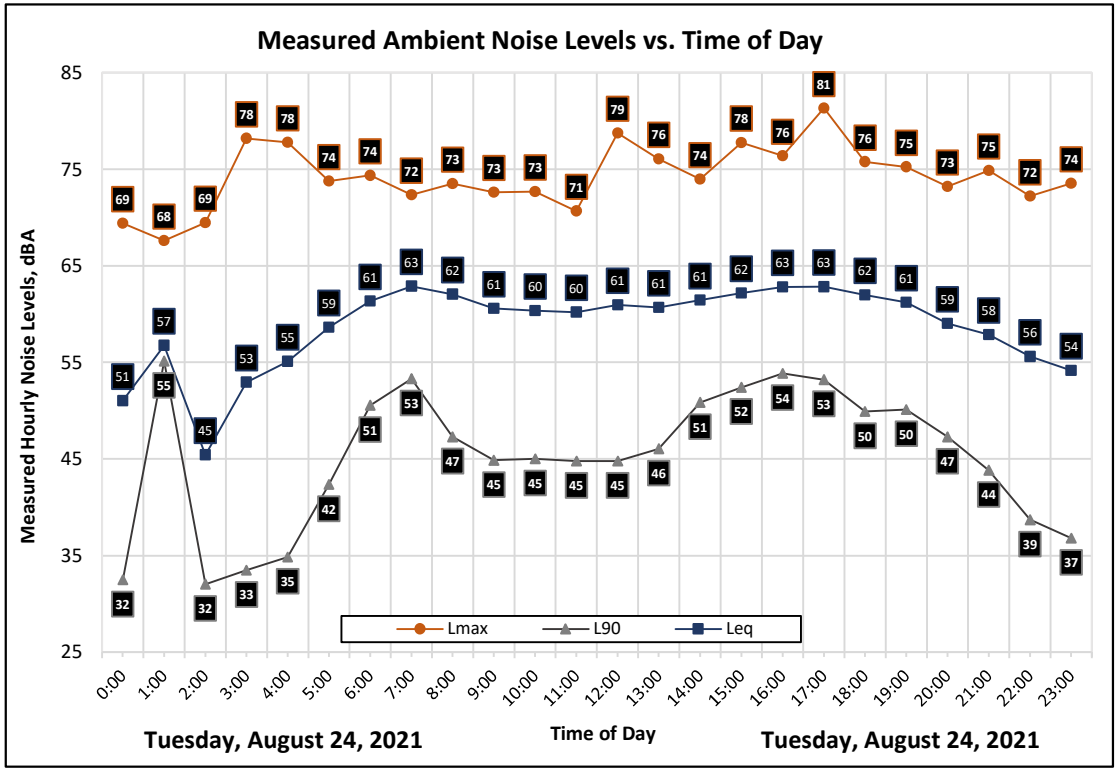
Appendix B: Continuous and Short-Term Ambient Noise Measurement Results

Appendix B1: Continuous Noise Monitoring Results

Site: LT-1
Project: Chico Towne Place Suites
Meter: LDL 820-5
Location: Eastern Project Site
Calibrator: CAL200
Coordinates: 39.7429387°, -121.7892060°

Date	Time	Measured Level, dBA			
		L_{eq}	L_{max}	L_{50}	L_{90}
Tuesday, August 24, 2021	0:00	51	69	40	32
Tuesday, August 24, 2021	1:00	57	68	56	55
Tuesday, August 24, 2021	2:00	45	69	35	32
Tuesday, August 24, 2021	3:00	53	78	40	33
Tuesday, August 24, 2021	4:00	55	78	41	35
Tuesday, August 24, 2021	5:00	59	74	52	42
Tuesday, August 24, 2021	6:00	61	74	58	51
Tuesday, August 24, 2021	7:00	63	72	61	53
Tuesday, August 24, 2021	8:00	62	73	60	47
Tuesday, August 24, 2021	9:00	61	73	57	45
Tuesday, August 24, 2021	10:00	60	73	57	45
Tuesday, August 24, 2021	11:00	60	71	57	45
Tuesday, August 24, 2021	12:00	61	79	57	45
Tuesday, August 24, 2021	13:00	61	76	57	46
Tuesday, August 24, 2021	14:00	61	74	59	51
Tuesday, August 24, 2021	15:00	62	78	60	52
Tuesday, August 24, 2021	16:00	63	76	61	54
Tuesday, August 24, 2021	17:00	63	81	61	53
Tuesday, August 24, 2021	18:00	62	76	59	50
Tuesday, August 24, 2021	19:00	61	75	58	50
Tuesday, August 24, 2021	20:00	59	73	55	47
Tuesday, August 24, 2021	21:00	58	75	52	44
Tuesday, August 24, 2021	22:00	56	72	47	39
Tuesday, August 24, 2021	23:00	54	74	43	37

Statistics	Leq	Lmax	L50	L90
Day Average	61	75	58	48
Night Average	56	73	46	40
Day Low	58	71	52	44
Day High	63	81	61	54
Night Low	45	68	35	32
Night High	61	78	58	55
Ldn	64	Day %		85
CNEL	64	Night %		15

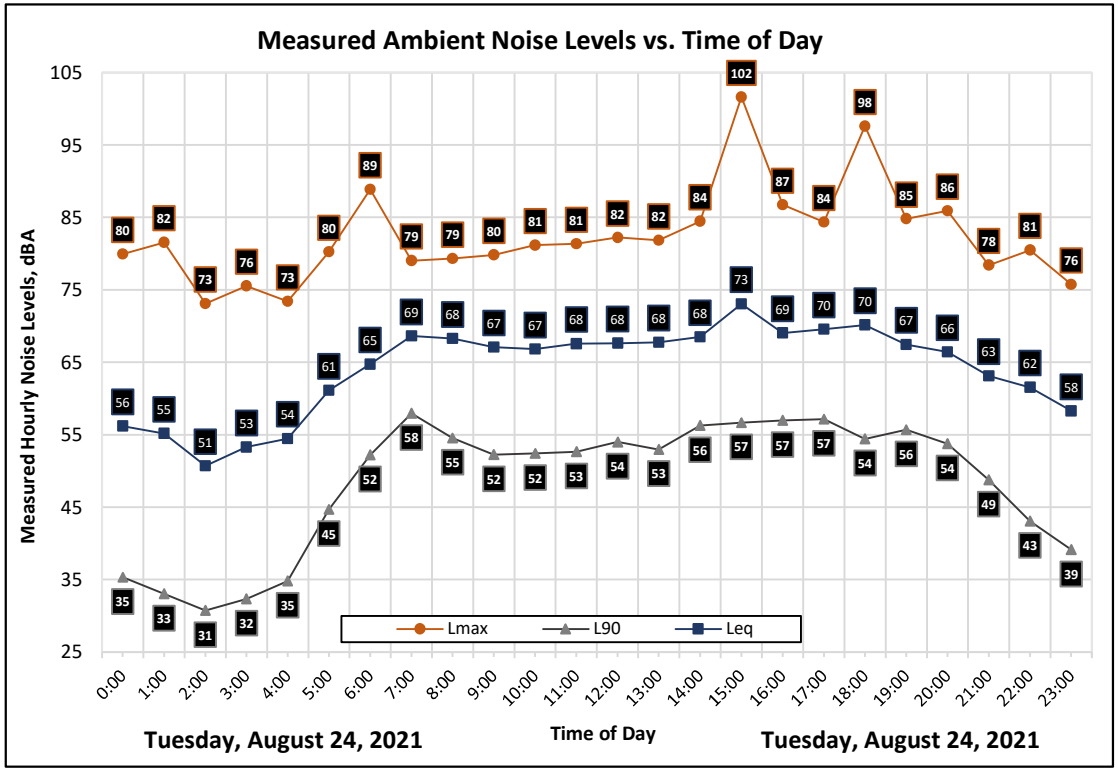


Appendix B2: Continuous Noise Monitoring Results

Site: LT-2
Project: Chico Towne Place Suites
Meter: LDL 820-1
Location: Northwestern Project Site
Calibrator: CAL200
Coordinates: 39.7432597°, -121.7920692°

Date	Time	Measured Level, dBA			
		L_{eq}	L_{max}	L_{50}	L_{90}
Tuesday, August 24, 2021	0:00	56	80	44	35
Tuesday, August 24, 2021	1:00	55	82	41	33
Tuesday, August 24, 2021	2:00	51	73	37	31
Tuesday, August 24, 2021	3:00	53	76	41	32
Tuesday, August 24, 2021	4:00	54	73	45	35
Tuesday, August 24, 2021	5:00	61	80	53	45
Tuesday, August 24, 2021	6:00	65	89	60	52
Tuesday, August 24, 2021	7:00	69	79	65	58
Tuesday, August 24, 2021	8:00	68	79	65	55
Tuesday, August 24, 2021	9:00	67	80	63	52
Tuesday, August 24, 2021	10:00	67	81	63	52
Tuesday, August 24, 2021	11:00	68	81	63	53
Tuesday, August 24, 2021	12:00	68	82	64	54
Tuesday, August 24, 2021	13:00	68	82	64	53
Tuesday, August 24, 2021	14:00	68	84	65	56
Tuesday, August 24, 2021	15:00	73	102	66	57
Tuesday, August 24, 2021	16:00	69	87	66	57
Tuesday, August 24, 2021	17:00	70	84	67	57
Tuesday, August 24, 2021	18:00	70	98	63	54
Tuesday, August 24, 2021	19:00	67	85	63	56
Tuesday, August 24, 2021	20:00	66	86	61	54
Tuesday, August 24, 2021	21:00	63	78	56	49
Tuesday, August 24, 2021	22:00	62	81	54	43
Tuesday, August 24, 2021	23:00	58	76	49	39

Statistics	Leq	Lmax	L50	L90
Day Average	69	85	64	54
Night Average	59	79	47	38
Day Low	63	78	56	49
Day High	73	102	67	58
Night Low	51	73	37	31
Night High	65	89	60	52
Ldn	69	Day %		94
CNEL	69	Night %		6



Appendix B3 : Short Term Noise Monitoring Results

Site: ST-1
Project: Chico Towne Place Suites
Location: Southwest Corner of Project Site
Coordinates: 39.7421988°, -121.791745°

Meter: LDL 831-3
Calibrator: CAL200

Start: 2021-08-23 11:49:34
Stop: 2021-08-23 11:59:34
SLM: Model 831
Serial: 1329

Measurement Results, dBA

Duration:	0:10
L_{eq}:	69
L_{max}:	85
L_{min}:	54
L_{50}:	66
L_{90}:	60

Notes

Primary noise source is traffic on Highway 32 and Bruce Road.