
Appendix F

Noise Technical Report

Noise Technical Report

Truckee Regional Library Town of Truckee, California

OCTOBER 2025

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Acronyms and Abbreviations

Acronym/Abbreviation	Definition
ACC	Air-cooled condensers
ADT	Average Daily Traffic
Caltrans	California Department of Transportation
CEQA	California Environmental Quality Act
Town	Town of Truckee
CNEL	Community Noise Equivalent Level
County	Nevada County
dB	decibel
dBA	A-weighted decibel
DOT	Department of Transportation
FAA	Federal Aviation Administration
FHWA	Federal Highway Administration
FTA	Federal Transit Administration
Hz	Hertz
HVAC	Heating, ventilation, and air conditioning
ips	inches per second
ISO	International Organization of Standardization
L _{dn}	day-night average sound level
L _{eq}	equivalent sound level
L _{max}	maximum sound level
L _{min}	minimum sound level
L _{xx}	Percentile-Exceeded Sound Levels
LT	Long-term
OBCF	Octave-band center frequency
OPR	Governor's Office of Planning and Research
Project	Truckee Library Project
PPV	peak particle velocity
PWL	Sound power level
RCNM	Roadway Construction Noise Model
SLM	Sound level meter
SPL	Sound pressure level
ST	Short-term
VdB	Velocity Decibel

1 Introduction

1.1 Report Purpose and Scope

The purpose of this technical report is to assess the potential noise impacts associated with construction and operation of the Truckee Regional Library project (project). This analysis uses the significance thresholds in Appendix G of the California Environmental Quality Act (CEQA) Guidelines (14 CCR 15000 et seq.). The Town of Truckee is the lead agency responsible for compliance with the California Environmental Quality Act (CEQA) for the project.

1.2 Project Description

The project is located on an approximately 6-acre lot in the Town of Truckee, California, along Old Brockway Road (Figure 1). The project proposes to construct a library with outdoor activity space, a park and picnic area, and 37 parking spaces.

1.3 Fundamentals of Noise and Vibration

The following is a brief discussion of fundamental noise concepts and terminology.

1.3.1 Sound, Noise, and Acoustics

Sound consists of three components: the sound source, sound path, and sound receptor. All three components must be present for sound to exist. Without a source to produce sound, there is no sound. Similarly, without a medium to transmit sound pressure waves, there is no sound. Finally, sound must be received; a hearing organ, sensor, or object must be present to perceive, register, or be affected by sound or noise. In most situations, there are multiple sound sources, paths, and receptors. Acoustics is the field of science that deals with the production, propagation, reception, effects, and control of sound. Noise is defined as sound that is loud, unpleasant, unexpected, or undesired.

1.3.2 Sound Pressure Levels and Decibels

The amplitude of a sound wave determines its loudness. Loudness of sound increases with increasing amplitude. Sound pressure amplitude is measured in units of micronewtons per square meter, also called micropascals. One micropascal is approximately one-hundred billionth (0.0000000001) of normal atmospheric pressure. The pressure of a very loud sound may be 200 million micropascals, or 10 million times the pressure of the weakest audible sound. Because expressing sound levels in terms of micropascals would be very cumbersome and the sensitivity of human hearing to changes in micropascals is rather coarse (e.g., a doubling of micropascals is just audible to most people), sound pressure level in logarithmic units is used instead to describe the ratio of actual sound pressure to a reference pressure squared. These units are called Bels. To provide a finer resolution, a Bel is subdivided into 10 decibels (dB).

1.3.3 A-Weighted Sound Level

Sound pressure level alone is not a reliable indicator of loudness. The frequency, or pitch, of a sound also has a substantial effect on how humans will respond. Although the intensity (energy per unit area) of the sound is a purely physical quantity, the loudness, or human response, is determined by the characteristics of the human ear.

Human hearing is limited not only in the range of audible frequencies, but also in the way it perceives the sound in that range. In general, the healthy human ear is most sensitive to sounds between 1,000 and 5,000 hertz, and it perceives a sound within that range as more intense than a sound of higher or lower frequency with the same magnitude. To approximate the frequency response of the human ear, a series of sound level adjustments is usually applied to the sound measured by a sound level meter. The adjustments (referred to as a weighting network) are frequency dependent.

The A-scale weighting network approximates the frequency response of the average young ear when listening to ordinary sounds. When people make judgments about the relative loudness or annoyance of a sound, their judgments correlate well with the A-scale sound levels of those sounds. Other weighting networks have been devised to address high noise levels or other special situations (e.g., B-scale, C-scale, and D-scale), but these scales are rarely used in conjunction with most environmental noise evaluations. Noise levels are typically reported in terms of A-weighted sound levels. All sound levels discussed in this report are A-weighted decibels (dBA). Examples of typical noise levels for common indoor and outdoor activities are depicted in Table 1.

Table 1. Typical Sound Levels in the Environment and Industry

Common Outdoor Activities	Noise Level (dBA)	Common Indoor Activities
—	110	Rock band
Jet fly over at 300 meters (1,000 feet)	100	—
Gas lawn mower at 1 meter (3 feet)	90	—
Diesel truck at 15 meters (50 feet), at 80 kilometers per hour (50 miles per hour)	80	Food blender at 1 meter (3 feet); garbage disposal at 1 meter (3 feet)
Noisy urban area, daytime; gas lawn mower at 30 meters (100 feet)	70	Vacuum cleaner at 3 meters (10 feet)
Commercial area; heavy traffic at 90 meters (300 feet)	60	Normal speech at 1 meter (3 feet)
Quiet urban, daytime	50	Large business office; dishwasher 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 2020.

1.3.4 Human Response to Changes in Noise Levels

Under controlled conditions in an acoustics laboratory, the trained, healthy human ear is able to discern changes in sound pressure levels of 1 dB when exposed to steady, single-frequency signals in the mid-frequency range. Outside such controlled conditions, the trained ear can detect changes of 2 dB in normal environmental noise. It is widely accepted that the average healthy ear, however, can barely perceive noise level changes of 3 dB. A change of 5 dB is readily perceptible, and a change of 10 dB is perceived as twice (if a gain) or half (if a loss) as loud. A doubling of sound energy results in a 3 dB increase in sound, which means that a doubling of sound energy (e.g., doubling the volume of traffic on a road) would result in a barely perceptible change in sound level.

1.3.5 Noise Descriptors

Additional units of measure have been developed to evaluate the long-term characteristics of sound. The energy-equivalent sound level (L_{eq}) is also referred to as the time-average sound level. It is the equivalent steady-state or constant sound level that in a stated period of time would contain the same acoustical energy as the time-varying sound level during the same time period. For instance, the 1-hour A-weighted equivalent sound level, $L_{eq(h)}$, is the energy average of the A-weighted sound levels occurring during a 1-hour period and is the basis for most of the Town Noise Ordinance standards. The statistical sound level (L_{xx}) is a statistical value corresponding with the decibel level exceeded for a cumulative percent (XX%) over a defined time period. By way of example, the “L-ninety” value (L_{90}) is a decibel level exceeded 90% during a given measurement period (such as 54 minutes out for an hour).

People are generally more sensitive and annoyed by noise occurring during the evening and nighttime hours. To account for this, community noise assessments commonly use the day-night sound level (L_{dn}) and Community Noise Equivalent Level (CNEL). The L_{dn} scale represents a time-weighted 24-hour average noise level based on the A-weighted sound level, with a 10 dB penalty applied to the most sensitive nighttime hours (10:00 p.m. to 7:00 a.m.). Similar to L_{dn} , the CNEL accounts for potential increased noise sensitivity during the nighttime and applies an additional 5 dB penalty for the evening hours (7:00 p.m. to 10:00 p.m.). Hence, for the same set of contributing twenty-four successive hours and their individual hourly L_{eq} values, the CNEL value would be 0.3 dB higher than the derived L_{dn} value. As a result, L_{dn} and CNEL are often used, considered, or implied to be used interchangeably as an acoustic descriptor for assessing community noise.

1.3.6 Sound Propagation

Sound propagation (i.e., the traverse of sound from a noise emission source position to a receptor location) is influenced by multiple factors that include geometric spreading, ground absorption, atmospheric effects, and occlusion by natural terrain and/or features of the built environment.

Sound levels attenuate (or diminish) geometrically at a rate of approximately 6 dB per doubling of distance from an outdoor stationary point-type source due to the spherical spreading of sound energy with increasing distance travelled and 3 dB per doubling of distance from an outdoor stationary line source (like vehicles traveling along a roadway). The effects of atmospheric conditions such as humidity, temperature, and wind gradients are typically distance-dependent and can also temporarily either increase or decrease sound levels measured or perceived at a receptor location. In general, the greater the distance the receptor is from the source of sound emission, the greater the potential for variation in sound levels at the receptor due to these atmospheric effects. Additional attenuation

can result from sound path occlusion and diffraction due to intervention of natural (ridgelines, dense forests, etc.) and built features (such as solid walls, buildings, and other structures).

1.3.7 Ground-borne Vibration Fundamentals

Ground-borne vibration is fluctuating or oscillatory motion transmitted through the ground mass (i.e., soils, clays, and rock strata). The strength of ground-borne vibration attenuates rapidly over distance. Some soil types transmit vibration quite efficiently; other types (primarily sandy soils) do not. Several basic measurement units are commonly used to describe the intensity of ground vibration. The descriptors used by the Federal Transit Administration (FTA) are peak particle velocity (PPV), in units of inches per second (ips), and velocity decibel (VdB) that is based on a root-mean square (RMS) of the vibration signal magnitude. Per the California Department of Transportation (Caltrans) Transportation and Construction Vibration Guidance Manual (Caltrans 2020), the calculation to determine PPV at a given vibration source to receptor distance is as follows:

$$PPV_{\text{distance}} = PPV_{\text{ref}} * (25/D)^{1.1}$$

Where:

PPV_{distance} = the peak particle velocity in inches per second of the equipment adjusted for distance

PPV_{ref} = the reference vibration velocity in inches per second at 25 feet

D = the distance from the equipment to the receptor

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2 Regulatory Setting

2.1 Federal

2.1.1 Federal Transit Administration

In its Transit Noise and Vibration Impact Assessment guidance manual, the FTA recommends a daytime construction noise level threshold of 80 dBA L_{eq} over an 8-hour period (FTA 2018) when detailed construction noise assessments are performed to evaluate potential impacts to community residences surrounding a project. Although this FTA guidance is not a regulation, it can serve as a quantified standard in the absence of such noise limits at the state and local jurisdictional levels.

2.2 State

2.2.1 California Code of Regulations, Title 24

Title 24 of the California Code of Regulations sets standards that new developments in California must meet. According to Title 24, interior noise levels are not to exceed 45 dBA CNEL in any habitable room (ICC 2019).

2.2.2 California Green Building Standards Code (Cal Green Code)

2022 California Green Building Standards Code (Cal Green Code). The State of California established exterior sound transmission control standards for new non-residential buildings as set forth in the 2022 California Green Building Standards Code (Section 5.507.4.1 and 5.507.4.2). Section 5.507 states that either the prescriptive (Section 5.507.4.1) or the performance method (Section 5.507.4.2) shall be used to determine environmental control at indoor areas. The prescriptive method is very conservative and not practical in most cases; however, the performance method can be quantitatively verified using exterior-to-interior calculations. For the purposes of this report, the performance method is utilized to determine consistency with the Cal Green Code. Both of the sections that pertain to this project are as follows:

5.507.4.1 Exterior noise transmission, prescriptive method. Wall and roof-ceiling assemblies making up the building envelope that are exposed to the noise source shall meet a composite STC rating of at least 50 or a composite OITC rating of no less than 40, with exterior windows of a minimum STC of 40 or OITC of 30 when the building falls within the 65 dBA L_{dn} or CNEL noise contour of a freeway or expressway, railroad, industrial source or fixed-guideway noise source, as determined by the local general plan noise element.

5.507.4.2 Performance method. For buildings located within the 65 dBA L_{dn} or CNEL noise contour of a freeway or expressway, railroad, industrial source or fixed-guideway noise source, wall and roof-ceiling assemblies making up the building envelope and exposed to the noise source shall be constructed to provide an interior noise environment attributable to exterior sources that does not exceed an hourly equivalent noise level ($L_{eq (1-hr)}$) of 50 dBA in occupied areas during any hour of operation.

The performance method, which establishes the acceptable interior noise level, is the method typically used when applying these standards.

2.2.2 California Department of Health Services Guidelines

The California Department of Health Services has developed guidelines of community noise acceptability for use by local agencies (OPR 2017). Selected relevant levels are listed here:

- Below 60 dBA CNEL: normally acceptable for low-density residential use
- 50 to 70 dBA CNEL: conditionally acceptable for low-density residential use
- Below 65 dBA CNEL: normally acceptable for high-density residential use and transient lodging
- 60 to 70 dBA CNEL: conditionally acceptable for high-density residential, transient lodging, churches, educational, and medical facilities

2.2.3 California Department of Transportation Vibration Standards

The California Department of Transportation (Caltrans) conducted extensive research on human annoyance and damage to structures caused by vibration from short term construction activities and from long term highway operations and has published criteria for vibration management (Transportation and Construction Vibration Guidance Manual 2020). These criteria established by Caltrans are commonly used to assess vibration impacts from all types of Projects and activities. Caltrans uses a threshold of 0.2 in/sec PPV for annoyance to persons, where a continuous vibration source is involved; for transient sources (represented by construction activities), Caltrans uses a threshold of 0.24 in/sec PPV (which equates to a distinctly perceptible level). For commercial buildings constructed of concrete and steel, Caltrans identifies a damage threshold of 0.5 in/sec PPV. For residential structures employing concrete foundation and wood frame construction, Caltrans identifies a conservative damage threshold vibration level standard of 0.3 in/sec PPV (Caltrans 2020).

2.3 Local

It is the policy of the Town that noise interference is a critical concern given the interest in preserving the Town's peaceful mountain environment by minimizing community exposure to noise. The Town of Truckee establishes local regulations concerning noise through noise compatibility guidelines set forth in the General Plan, as well as through the municipal Noise Ordinance.

2.3.1 Noise Ordinance

The Town's noise ordinance standards are set forth in Chapter 18.44 of the Truckee Municipal Code. The applicable standards are provided below in Table 2 for non-transportation noise sources, such as mechanical equipment or event noise, and Table 3 for ground transportation noise sources.

Exterior levels. Exterior noise levels, when measured at any receiving church, commercial, hospital, public library, residential or school property, do not conform to the provisions of this Section when they exceed the noise level standards established by Table 2.

Ambient noise level adjustment. In the event the measured ambient noise level exceeds the applicable noise level standard in any category above, the applicable standards shall be adjusted to equal the ambient noise level.

Simple tone noises. Each of the noise level standards specified above shall be reduced by five dB(A) for simple tone noises, noises consisting primarily of speech or music, or for recurring impulsive noises.

Intruding noise source. If the intruding noise source is continuous and cannot reasonably be discontinued or stopped for a time period to allow measurement of the ambient noise level, the noise level measured while the source is in operation shall be compared directly to the applicable noise level standards in Table 2.

Equipment noise. The noise level standard applicable to the emission of sound from regulators, transformers and associated equipment in electrical substations shall be 60 dB(A).

Public/Institutional exterior noise standard. Whenever a hospital, library, school, congregate care, or similar public or institutional use is proposed on a parcel where the existing ambient noise levels may exceed 65 dB(A) CNEL, the land use permit application shall include an acoustical analysis of the effect of noise sources on the use. The acoustical analysis shall identify appropriate mitigation measures that reduce noise levels to acceptable levels.

Sensitive land uses. Whenever a use is proposed on a parcel where the expected noise levels generated by the use, when measured at any receiving church, hospital, public library, residential or school property may exceed the noise level standards established by Table 2, the land use permit application shall include an acoustical analysis of the effect of the noise generated by the use on the sensitive land use property. The acoustical analysis shall identify appropriate mitigation measures that reduce exterior noise levels to acceptable levels established by Table 2. These mitigation measures shall be incorporated into the design, construction and operation of the use.

Mitigation. Reasonable noise mitigation measures including building setbacks, alternative site design techniques and alternative building orientation layouts shall be employed in lieu of sound walls, perimeter and/or barrier fencing, or earthen berms to mitigate noise impacts. Sound walls may only be used if the review authority finds that there are no other reasonable mitigation measures available and that the height, location, aesthetics and screening.

Table 2. Town of Truckee Municipal Code Noise Standards by Receiving Land Use (dBA)

Cumulative Number of Minutes in any Hour Hospital, Library, Religious, Institution, Residential, or School Uses	Day-7:00 a.m. to 10:00 p.m.	Night 10:00 p.m. to 7:00 a.m.
30	55	50
15	60	55
5	65	60
1	70	65
0	75	70
Commercial Uses		
30	65	60
15	70	65
5	75	70
1	80	75
0	85	80

Notes: – = not applicable.

Source: Town of Truckee Development Code, Truckee Municipal Code, Title 18, Amended Date, August 4, 2003, Chapter 18.44

The Truckee Municipal Code also provides this guidance on prohibited acts and exceptions in sections 18.44.060 and 18.44.070.

Section 18.44.060 – Prohibited Acts

Places of public entertainment. Operating or allowing to be operated any loudspeaker, musical instrument or other source of sound in any place of public entertainment that exceed 95 dB(A) at any point normally occupied by a customer, without a conspicuous and legible sign stating, “WARNING! Sound levels within may cause hearing impairment.”

Loading and unloading. Closing, loading, opening, unloading or other handling of boxes, building materials, containers, crates, garbage cans or similar objects between the hours of 10:00 p.m. and 7:00 a.m. in a manner that causes a noise disturbance beyond a residential property line.

Residential air conditioning, refrigeration, and heating. Notwithstanding the provisions of Section 18.44.040 (Exterior Noise Standards) where the intruding noise source is a residential air conditioning or a refrigeration system, heating system or associated equipment installed before the effective date of this Section, the exterior noise level shall not exceed 55 dB(A). For equipment installed after the effective date of this Section, the exterior noise level shall not

Section 18.44.070 - Exceptions

Construction. The provisions of this Chapter shall not apply to noise sources associated with non-single-family residential construction, provided the activities do not take place before 7:00 a.m. or after 9:00 p.m. on any day except Sunday, or before 9:00 a.m. or after 6:00 p.m. on Sunday. The review authority may impose further limitations on the hours and day of construction or other measures to mitigate significant noise impacts on sensitive uses

Maintenance of equipment. Notwithstanding the provisions of Sections A through C, above, no exceptions to the provisions of this Section shall apply where the equipment used for those activities is not maintained in good condition which would result in unnecessarily creating a noise disturbance or exceeding the standards in Section 18.44.040 (Exterior noise standards), above

Public health, safety, and welfare activities. The provisions of this Section shall not apply to construction or maintenance and repair operations conducted by public agencies and/or utility companies or their contractors which are deemed necessary to serve the best interests of the public and to protect the public health, safety and welfare, including debris and limb removal, removal of downed wires, repairing of gas lines, oil lines, roads, sewers, sidewalks, storm drains, traffic signals, water hydrants and mains, restoring electrical service, street sweeping, unplugging sewers, vacuuming catch basins, etc.

Town parks. The provisions of this Section shall not apply to public agency sanctioned recreational activities/programs conducted in public parks

2.3.2 Town of Truckee General Plan

The Town's General Plan Safety and Noise Element includes policies to "minimize community exposure to excessive noise and maintain Truckee's peaceful mountain environment by ensuring that land uses are compatible with surrounding noise sources and levels".

The following policies would be applicable to the project:

SN-8.1 Noise Compatibility Standards: Require new development to ensure the noise compatibility standards shown in Table 3 are met, using existing noise data (e.g., roadway noise contour map, available documentation) or a project-specific noise analysis/acoustical study. Require all feasible noise reduction measures identified by the study to be incorporated into the project.

SN-8.2 Normally Unacceptable Noise Exposure: Permit new development resulting in "normally unacceptable" noise level exposure only when the allowed new use can be shown to serve the greater public interests of the citizens of Truckee and all noise reduction measures identified by a noise analysis/acoustical study are incorporated into the project.

SN-8.3 Location of Noise-Sensitive Receptors: Discourage location of noise-sensitive uses (such as senior living, hospitals, churches, daycare centers, residences) in locations with noise exposure exceeding “normally acceptable” levels. If relocation is infeasible, require all feasible noise reduction measures identified by a noise analysis/acoustical study.

SN-8.4 Noise Reduction Techniques: Prohibit the construction of sound walls and require new development projects to evaluate site design techniques, building setbacks, earthen berms, alternative architectural layouts, and other means to meet noise reduction requirements.

SN-8.5 Insulation Standards for Interior Noise: Enforce the California Title 24 Noise Insulation Standards for interior noise levels attributable to exterior sources for all new residential uses to ensure interior noise levels for residential uses do not exceed a community noise equivalent level of 45 decibels.

SN-8.6 Retrofitting of Buildings with Unacceptable Interior Noise: Encourage retrofitting of noise-sensitive uses exposed to existing unacceptable interior noise levels, and those that become exposed to unacceptable interior noise in the future, with sound-insulating features.

SN-8.7 Groundborne Vibration: Require preparation of a vibration assessment for new development of vibration-sensitive uses or buildings within 200 feet from the centerline of the railroad tracks. Require that the assessment be conducted consistent with Federal Transit Administration vibration standards and include all feasible measures to reduce potential impacts from groundborne vibration.

SN-8.8 Transportation Noise Sources: Consider potential noise impacts when evaluating new developments for transportation noise sources, including roadway or transit projects. Require noise reduction measures to be incorporated to reduce noise exposure consistent with “normally acceptable” noise standards identified in Table 3 or incremental traffic noise standards according to the Federal Transit Administration guidelines.

SN-8.9 Vehicle and Diesel Equipment Noise: Investigate new alternative methods for reducing noise associated with vehicles and diesel equipment, and support efforts to reduce vehicle and equipment noise. Methods may include alternative road surfacing materials, fleet and equipment modernization or retrofits, use of alternative-fuel vehicles, and installation of mufflers or other noise-reducing equipment.

SN-8.13 Construction Hours: Continue to restrict construction hours in Truckee to reduce impacts to adjacent existing noise-sensitive uses.

SN-8.14 Construction Noise Control Measures: Require the following standard construction noise control measures to be included as requirements at construction sites in order to minimize construction noise impacts:

- equip all internal combustion engine-driven equipment with intake and exhaust mufflers that are in good condition and appropriate for the equipment;
- locate stationary noise generating equipment as far as possible from noise-sensitive uses when noise-sensitive uses adjoin or are near a construction project area;

- use “quiet” air compressors and other stationary noise-generating equipment where appropriate technology exists; and
- require the project sponsor to designate a “disturbance coordinator” who would be responsible for responding to any local complaints about construction noise.

SN-8.15 Temporary and Ongoing Outdoor Events and Activities: Limit noise impacts from temporary outdoor events (e.g., neighborhood parties, outdoor music) and on-going outdoor activities associated with a land use permit (e.g., weddings, concerts, fundraisers) on nearby noise-sensitive uses.

SN-8.16 Airport Land Use Compatibility When considering new development proposals in the vicinity of Truckee Tahoe Airport, enforce the noise compatibility criteria and policies set forth in the adopted Truckee Tahoe Airport Land Use Compatibility Plan. Source: Tahoe Quarterly.

SN-8.19 Additional Construction Noise Control Measures: Require the following additional construction noise control measures at construction sites where construction activity, excluding single-family construction, would take place outside of the timeframes exempt from the noise standards established in the Town Development Code and is anticipated to generate exterior noise levels at sensitive receptors that exceed the applicable nighttime noise standards of 50 L_{eq} or 70 L_{max} .

- Temporary noise barriers, such as curtains, piled snow, or hay bales.
- Noise-reducing enclosures and techniques around stationary noise-generating equipment (e.g., concrete mixers, generators, compressors) to break the line of sight between the noise source and receiver.
- Operation of heavy-duty construction equipment at the lowest operating power possible.

SN-8.20 Construction Vibration: Require construction projects involving pile driving, within 920 feet of vibration sensitive uses when considering vibration decibels (VdB) for human annoyance and 100 feet of vibration sensitive buildings when considering peak particle velocity (PPV) for structural damage, and construction projects not involving pile driving, within 45 feet of vibration sensitive uses and 15 feet of vibration sensitive buildings when considering VdB and PPV, respectively, to evaluate all potential vibration-inducing activities with the potential to result in structural damage or exposure of sensitive receptors to excessive groundborne vibration. Include various measures such as setback distances, phasing ground-impacting operations, monitoring programs, and alternative methods to traditional construction activities (i.e., predrilling holes and other alternatives to traditional pile driving) to reduce potential effects.

Table 3. Town of Truckee Land Use Compatibility Standards for Community Noise Environment (dBA)

Land Use Category	Community Noise Exposure - L_{dn} or CNEL (db)					
	55	60	65	70	75	80
Residential – Low-Density Single Family, Duplex, Mobile Homes	Normally Acceptable	Normally Acceptable	Conditionally Acceptable	Conditionally Acceptable	Normally Unacceptable	Clearly Unacceptable
Residential - Multi-Family (including mixed-use development)	Normally Acceptable	Normally Acceptable	Conditionally Acceptable	Conditionally Acceptable	Normally Unacceptable	Clearly Unacceptable
Transient Lodging – Motels, Hotels	Normally Acceptable	Normally Acceptable	Conditionally Acceptable	Conditionally Acceptable	Normally Unacceptable	Clearly Unacceptable
Schools, Libraries, Churches, Hospitals, Nursing Homes	Normally Acceptable	Normally Acceptable	Conditionally Acceptable	Conditionally Acceptable	Normally Unacceptable	Clearly Unacceptable
Auditoriums, Concert Halls	Conditionally Acceptable	Conditionally Acceptable	Conditionally Acceptable	Conditionally Acceptable	Normally Unacceptable	Clearly Unacceptable
Sports Arenas, Outdoor Spectator Sports	Conditionally Acceptable	Conditionally Acceptable	Conditionally Acceptable	Conditionally Acceptable	Normally Unacceptable	Clearly Unacceptable
Playgrounds, Neighborhood Parks	Normally Acceptable	Normally Acceptable	Conditionally Acceptable	Conditionally Acceptable	Normally Unacceptable	Clearly Unacceptable
Community and Regional Parks, Golf Courses, Riding Stables, Water Recreation, Other Recreation, Cemeteries	Normally Acceptable	Normally Acceptable	Conditionally Acceptable	Conditionally Acceptable	Normally Unacceptable	Clearly Unacceptable
Offices, Industrial, Manufacturing, Utilities, Agriculture	Normally Acceptable	Normally Acceptable	Conditionally Acceptable	Conditionally Acceptable	Normally Unacceptable	Clearly Unacceptable

- Normally Acceptable:** Specified land use is satisfactory, based upon the assumption that any buildings involved are of normal conventional construction, without any special noise insulation requirements.
- Conditionally Acceptable:** New construction or development should be undertaken only after a detailed analysis of the noise reduction requirements is made and needed noise insulation features are included in the design. Conventional construction, but with closed windows and fresh air supply systems or air conditioning, will normally suffice.
- Normally Unacceptable:** New construction or development should generally be discouraged. If new construction or development does proceed, a detailed analysis of the noise reduction requirements must be made and needed noise insulation features included in the design.
- Clearly Unacceptable:** New construction or development generally should not be undertaken.

Notes: Each of the noise levels specified above shall be lowered by 5 dB for simple tone noises, noises consisting primarily of speech or music, or recurring impulsive noises. These noise-level standards do not apply to residential units established in conjunction with industrial or commercial uses (e.g., caretaker dwelling).

Source: Town of Truckee, 2023.

3 Existing Conditions

3.1 Sound Monitoring Survey

A sound pressure level (SPL) measurement survey was conducted at six (6) representative positions on the project site on October 17 and 18, 2024 to characterize the existing outdoor ambient sound levels. The short-term and long-term sound measurement locations are shown in Figure 2.

Short term and long-term sound measurements were conducted using a Rion NL-62 and SoftdB “Piccolo II” model sound level meters (SLMs), each equipped with a windscreen-protected, 0.5-inch diameter pre-polarized condenser microphone with pre-amplifier. The SLMs meets the current American National Standards Institute (ANSI) standard for a Type 2 (General Use) SLM. The accuracy of all sound level meters was verified using a field calibrator before and after the measurements, and the measurements were conducted with the microphone positioned approximately five feet above the ground.

Table 4 provides a summary of the sound measurement results as well as the location and time that an individual measurement was performed.

Appendix A provides photographs of the sound measurement locations, followed by Dudek investigator field notes and a chart of the LT measurement data.

Figure 2 Sound Measurement Locations



FIGURE 2
Noise Sampling Site Locations
Truckee Regional Library Project

Table 4. Measured Baseline Outdoor Ambient Sound Levels

Site	Location	Primary sound source	Time	L _{eq} (dBA)	L ₅₀ (dBA)	L ₉₀ (dBA)
ST1	On West River Street, along the railroad	Traffic on West River Street	10:55 a.m. to 11:10 a.m.	58	52	51
ST2	Along Old Brockway Road, near the intersection with West River Street	Traffic on Old Brockway Road	11:19 a.m. to 11:34 a.m.	66	65	60
ST3	Along Southeast River Street, northwest of project site	Distant traffic on Old Brockway Road and I-80	12:33 p.m. to 12:48 p.m.	56	55	54
ST4	On Old Brockway Road, across from project site	Traffic on Old Brockway Road	1:09 p.m. to 1:24 p.m.	73	72	66
ST5	On Palisades Drive, southeast of project site	Traffic on Palisades Drive	1:38 p.m. to 1:53 p.m.	66	60	53
ST6	On Estates Drive, east of project site	Traffic on Estates Drive	2:02 p.m. to 2:00 p.m.	54	53	49

Notes: L_{eq} = equivalent continuous sound level (time-averaged sound level); L₅₀ = 50th percentile sound level; L₉₀ = 90th percentile sound level; dBA = A-weighted decibels; ST = short-term measurement location. LT = long-term measurement location. See Figure 2 for measurement locations.

Table 5. Measured Baseline Outdoor Ambient Sound Levels

Site	Location	Primary sound source	Time	Daytime L _{eq} (dBA)	Nighttime L _{eq} (dBA)	L _{dn} (dBA)
LT1	On West River Street north of the project site and along the railroad	Traffic on West River Street and adjacent railroad	11:00 a.m. to 11:00 a.m.	64	63	69

Notes: L_{eq} = equivalent continuous sound level (time-averaged sound level); dBA = A-weighted decibels; L_{dn} = day-night average sound level; ST = short-term measurement location. LT = long-term measurement location. See Figure 2 for measurement locations.

(a) Long-term measurement was conducted for a 24-hour period on October 17 and 18, 2024.

(b) Calculated based on long-term measurement results.

3.2 Sensitive Receptors

Noise- and vibration-sensitive land uses are typically locations where people reside or where the presence of unwanted sound could adversely affect the use of the land. Residences, schools, hospitals, guest lodging, libraries, and some passive recreation or open space areas would be considered noise- and vibration-sensitive and may warrant unique measures for protection from intruding noise. The nearest existing sensitive receptors to the Project site are residences located 120 feet to the northwest of the project site along SE River Street and 270 feet to the southwest of the project site along Old Brockway Road.

4 Noise and Land Use Compatibility

The impacts of site constraints such as exposure to excessive levels of noise and vibration are not considered under CEQA. This section addresses the project’s consistency with the policies set forth in the Truckee General Plan, which considers library land uses to be normally acceptable with exterior sound levels of 65 dBA L_{dn} or less.

Prediction Methodology and Parameters

Exterior sound levels at project site primarily result from vehicles traveling along Old Brockway Road. Based on traffic modeling conducted for an adjacent project (Rocker Memorial Skatepark, 2021), vehicles on Old Brockway Road generated a 2021 Existing traffic noise level of 65 dBA L_{dn} at a distance of 80 feet from the center line of the road. Sound monitoring at ST4 was consistent with this prediction (see Table 2). The sound exposure of the outdoor use areas at the project site are show in Table 6, calculated based on the results of the sound monitoring survey, assuming soft ground type and a 1 dB increase in traffic noise levels under future conditions.

Table 6. Exterior Background Sound Levels at Proposed Use Areas

Location	Distance to centerline of Old Brockway Road, feet	Future Exterior Sound Level, dBA L _{dn}
Outdoor Area, West (Children’s Patio)	180	61
Outdoor Area, East	180	61
North Patio – shielded by Library	250	<60
Entry Patio	160	61
Library	160	61

Notes: dBA = A-weighted decibels; L_{dn} = day-night average sound level
Source: Dudek 2025.

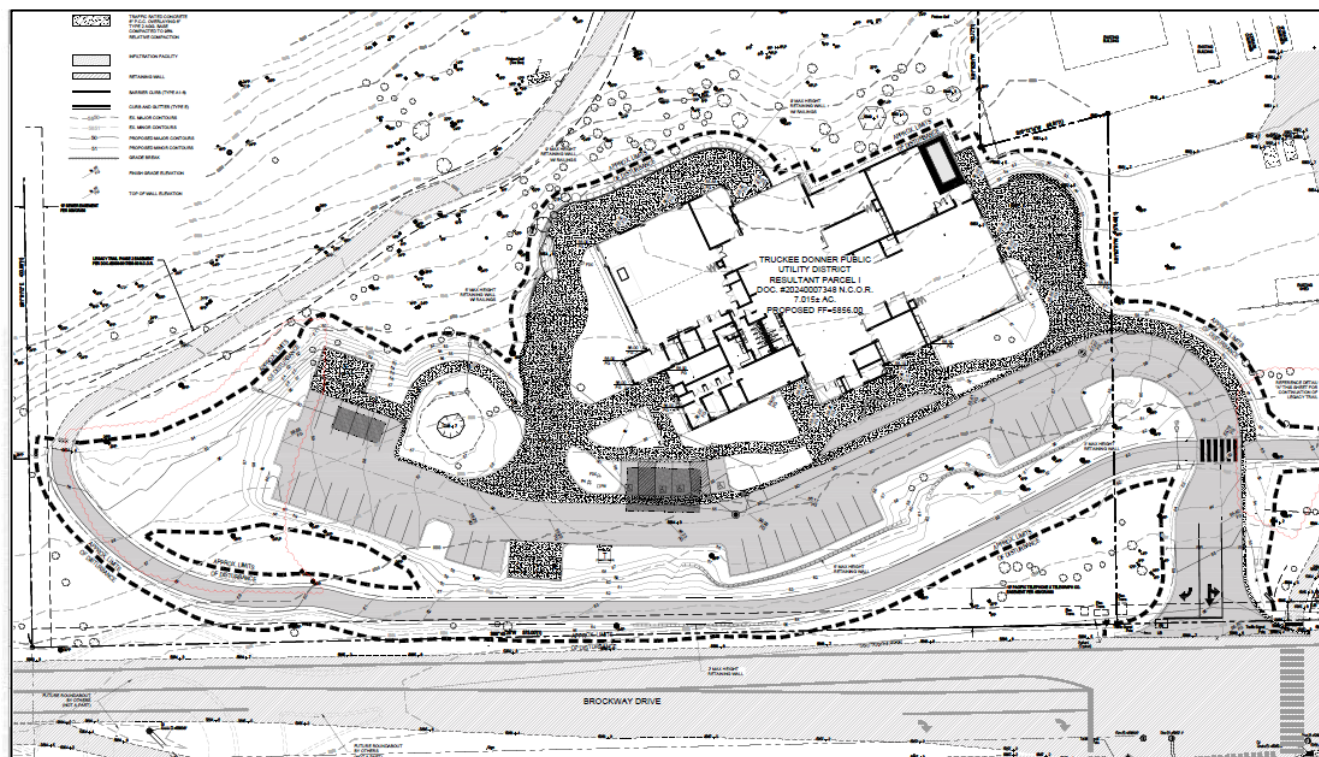
Future Exterior Sound Levels

Outdoor use areas proposed for the project include outdoor activity spaces to the east, west, and north of the library and an entry patio with seating located just south of the library, as seen in Figure 3. Based on sound modeling, the outdoor activity areas would experience future traffic noise levels of approximately 61 dBA L_{dn}, with lower levels experienced at the northern patio due to shielding provided by the library structure. Exterior sound levels are not anticipated to exceed the 65 dBA L_{dn} standard for library land uses at any proposed exterior use area and would be considered ‘normally acceptable’ throughout the site.

Future Interior Sound Levels

Exterior noise levels at library’s southern façade, which is the edge closest to Old Brockway Road, are calculated to be 61 dBA L_{dn}. The loudest hour L_{eq} traffic noise levels would be anticipated to be within 1 dB of the L_{dn}. Standard library construction provides approximately 25 dB of exterior-to-interior noise reduction with windows closed. Therefore, interior noise levels are calculated to be 36 dBA L_{eq} with standard construction only and windows in the closed position. This is below the CalGreen interior requirement of 50 dBA L_{eq} for non-residential land uses. Forced-air ventilation would be required to allow occupants the options of keeping windows closed. No additional noise insulation features are needed.

Figure 3 Site Plan



SOURCE:

FIGURE 3

Site Plan

Truckee Regional Library Project



5 Thresholds of Significance

The following significance criteria are based on Appendix G of the California Environmental Quality Act Guidelines (14 CCR 15000 et seq.) and will be used to determine the significance of potential noise and vibration impacts. Impacts associated with noise and vibration would be significant if the proposed project would result in:

- Generation of a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies.
- Generation of excessive ground-borne vibration or ground-borne noise levels.
- For a project located within the vicinity of a private airstrip or an airport land use plan, or where such a plan has not been adopted, within 2 miles of a public airport or public use airport, exposing people residing or working in the project area to excessive noise levels.

In light of these above significance criteria, this analysis uses the following standards to evaluate potential noise and vibration impacts.

- Construction noise – The Town’s Municipal Code exempts construction occurring between the hours of 7:00 a.m. and 9:00 p.m. on Mondays through Saturdays and between the hours of 9:00 a.m. and 6:00 p.m. on Sundays. Construction occurring within these hours is exempt from the Town’s noise limits. For informational purposes, this analysis compares project construction generated sound levels to the Federal Transit Administration construction noise level threshold of 80 dBA L_{eq} over an 8-hour period.
- Transportation noise – For purposes of this analysis, a noise impact due to transportation noise would be considered significant if project-generated traffic causes the existing levels to increase by more than 3 dB (a barely perceptible change in audibility).
- Stationary operations noise – The Town limits operational noise exposure at adjacent uses to the levels given in Table 2. For residences, the limit is 55 dBA L_{50} during daytime hours (7:00 a.m. to 10:00 p.m.) and 50 dBA L_{50} at night (10:00 p.m. to 7:00 a.m.). The maximum allowable single-event noise at any residential property line is 75 dBA L_{max} during daytime hours 70 dBA L_{max} at night.
- Construction vibration – For construction projects not involving pile driving, the Town’s General Plan requires construction within 45 feet of vibration sensitive uses and 15 feet of vibration sensitive buildings to evaluate all potential vibration-inducing activities with the potential to result in structural damage or exposure of sensitive receptors to excessive groundborne vibration. To protect against structural damage, this analysis applies the Caltrans thresholds for building damage risk. Caltrans Guidance recommends that a vibration level of 0.3 ips PPV be used as the threshold for building damage risk to residential structures and 0.5 ips PPV be used as the damage threshold for non-residential structures.

6 Impact Discussion

Potential noise and vibration impacts attributed to project construction and operation are studied in the following subsections that are categorized by the CEQA Guidelines Appendix G significance for noise.

- a) *Would the project result in generation of a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?*

Short-Term Construction

Less-Than-Significant. Construction activities include temporary noise and vibration sources with emission levels varying from hour to hour and day to day, depending on the equipment in use, the operations performed, and the distance between the source and receptor. Equipment that would be anticipated to be used during construction would include, graders, backhoes, rubber-tired dozers, cranes, forklifts, pavers, rollers, concrete mixer trucks, and air compressors.

One of the most extensive and widely used databases for sound levels from motorized or powered construction equipment is the Noise Source Database developed under National Cooperative Highway Research Program 25-49 (NCHRP 25-49), Development of a Highway Construction Noise Prediction Model (NASEM 2022). While the focus of data compilation was for equipment that would typically be employed for the construction of transportation facilities, the list is comprehensive enough to be useful in assessing sound levels for nearly every activity for which powered equipment is used. Table 7 provides a list of the hourly average and maximum sound levels generated by various powered equipment that could be associated with construction of the project, measured at a distance of 50 feet using a “slow” response time constant (1 second). Usually, construction equipment operates in alternating cycles of full power and low power, producing average noise levels over time that are less than the maximum noise level. The average sound level of construction activity also depends on the amount of time that the equipment operates and the intensity of construction activities during that time.

Table 7. Sound Levels of Typical Construction Equipment

Equipment	Average Sound Level (dBA L_{eq}) – 50 feet from Source	Maximum Sound Level (dBA L_{max}) – 50 feet from Source
Air Compressor	66	67
Aerial Lift (Man Lift)	72	73
Backhoe	76	84
Compactor (Plate)	—	75
Compactor (Roller)	82	83
Concrete Mixer	81	82
Concrete Saw	85	88
Crane, Mobile	74	76
Dozer	80	86
Forklift	—	88
Generator	67	68
Grader	—	79

Table 7. Sound Levels of Typical Construction Equipment

Equipment	Average Sound Level (dBA L_{eq}) – 50 feet from Source	Maximum Sound Level (dBA L_{max}) – 50 feet from Source
Horizontal Bore Drill	87	88
Loader	72	81
Paving - Asphalt	—	83
Paving - Concrete	85	88
Pump	73	74
Scraper	—	92
Flatbed Truck	—	74
Welding Machine	71	72

Notes: dBA = A-weighted decibel; L_{eq} = average noise level equivalent; L_{max} = maximum instantaneous noise level; — = Equipment without average (L_{eq}) noise levels are non-stationary and best represented only by maximum instantaneous noise level (L_{max}).

Source: NASEM 2022.

Noise emissions from project construction were estimated based upon default construction scenario information provided by the California Emissions Estimator Model (CalEEMod) (Version 2016.3.1) for the type and size of the proposed development and included phasing, equipment mix, and vehicle trips. The anticipated equipment to be used for construction of the project is shown in Table 8 for each phase of the project construction.

Table 8. Construction Equipment Per Phase

Construction Phase (Duration)	On Site Equipment Types (and Quantities)	One-Way Vehicle Trips (by Type) per Day
Site Preparation	Grader (1), Backhoe (1)	Autos (6), Vendor Trucks (2)
Grading	Graders (1), Dozer (1), Backhoes (1)	Autos (8), Vendor Trucks (2)
Building Construction	Crane (1), Forklift (2), Backhoe (2)	Autos (18), Vendor Trucks (6)
Paving	Backhoe (1), Mixer Truck (4) Paver (1), Roller (1),	Autos (14)
Architectural Coating	Compressor (1)	Autos (4)

With the sound sources identified in Table 8 above, an analysis was performed with a Microsoft Excel-based noise prediction model using the National Cooperative Highway Research Program reference data shown in Table 7. Input variables include the equipment type (backhoe, crane, truck, etc.), the number of equipment pieces, the duty cycle for each piece of equipment (i.e., percentage of each hour the equipment typically works), and the distance from the sensitive receptor. Refer to Attachment B for the construction modeling inputs and results. Construction noise levels were predicted at the nearest sound-sensitive land uses (i.e., residences) from the project site, based on the distance between the closest project construction boundary and these residences. Aggregate sound emissions from project construction activities, broken down by sequential phase of construction, were predicted for the worst-case construction activity occurring along the closest construction boundary to the off-site closest sensitive receptors.

Construction activities are limited to between the Town's allowable hours of 7:00 a.m. and 9:00 p.m. Construction occurring within these hours is exempt from the Town's noise limits. For informational purposes, this analysis compares project construction-generated sound levels to the Federal Transit Administration construction noise level threshold of 80 dBA L_{eq} over an 8-hour period (FTA 2018). Although this FTA guidance is not a regulation, many

communities employ it as a quantified standard in the absence of such limits at the local jurisdictional level. Dudek compared predicted construction sound levels to the recommended FTA construction noise exposure limits and to measured background sound levels.

The nearest sound-sensitive uses in the general vicinity of the project site include residences that are adjacent to the project site to the north, located about 120 feet from the project boundary, 180 feet from the nearest project construction, 330 feet from the nearest building construction, and 430 feet from the center of construction. Using the provided construction information and the distance identified from the edge of a future construction zone boundary to the closest receivers, the construction noise model was used to predict sound levels from on-site construction activities. The construction noise was modeled at distances representative of these closest sound-sensitive receptors to the project site. The results are summarized in Table 9.

Table 9. Construction Noise Levels, Worst-Case

Task/Activity	Closest Residence from Project Boundary (180 feet)	Closest Residence from Center of Construction (430 feet)
	Leq 8hr	Leq 8hr
Site Preparation	66	57
Grading	68	60
Building Construction	71	68
Paving	72	64
Architectural Coating	45	42

Note: Leq 8hr = average noise level equivalent over an 8-hour period.
Source: Dudek 2024.

As indicated in Table 9, worst-case construction sound levels would range from 45 to 72 dBA Leq 8hr at the nearest residences when construction is located at the project boundary adjoining these residences. Worst-case construction sound levels would range from 42 to 68 dBA Leq 8hr at the nearest residences when construction is located at the center of the site.

All activities would comply with the FTA-recommended construction noise limit of 80 dBA Leq 8hr with the Town’s required construction noise control measures only, as follows:

- Equip all internal combustion engine–driven equipment with intake and exhaust mufflers that are in good condition and appropriate for the equipment;
- Locate stationary noise generating equipment as far as possible from noise-sensitive uses when noise-sensitive uses adjoin or are near a construction project area;
- Use “quiet” air compressors and other stationary noise-generating equipment where appropriate technology exists; and
- Require the project sponsor to designate a “disturbance coordinator” who would be responsible for responding to any local complaints about construction noise.

Sound levels inside homes would be anticipated to be about 15 dB lower with windows open and 25 dB lower with windows closed. Project generated noise would produce a **less than significant impact**.

Long-Term Operational

Off-Site Traffic Noise Exposure

A traffic study was not prepared for the project. Based on traffic modeling conducted for an adjacent project (Rocker Memorial Skatepark, 2021), Old Brockway Road carries an existing traffic volume ADT of 11,200 vehicles per day. The project proposes 37 parking spaces. Assuming each spot is occupied twice per day that would result in 74 vehicle trips per day. The addition of 74 vehicle trips onto a road that currently carries 11,200 vehicles per day would result in an increase of less than 1 dB and would not be measurable or distinguishable from existing traffic conditions. As that level of noise increase is below the level of perceptibility, project-generated changes to future traffic noise would be **less than significant**.

Project Sound Sources

The project would include sound producing equipment and activities that are associated with normal library use, such as roof-mounted air-conditioning equipment. This analysis compares these project generated sounds to the Town’s limits shown in Table 2. Recreational programs and activities conducted in Town parks are exempt from the Town’s noise limits. However, this analysis includes a discussion of these sound sources for informational purposes.

Rooftop HVAC

The proposed project building is anticipated to be served by roof-mounted air-conditioning equipment that includes outdoor-exposed packaged air-handling units and air-cooled condensers (ACC) that provide the expected cooling demand (expressed as refrigeration “tonnage”) for the building. Table 10 summarizes the modeled inputs for the HVAC unit. The HVAC reference sound levels were calculated based on the building square footage and usage and manufacturer sound power level data. The sound power levels in Table 10 take into account the estimated number of units that would be needed for the building. Detailed information supporting these summary descriptions and quantities appear in Appendix C.

Table 10. Modeled Sound Power Levels (PWL) for Stationary Roof-Mounted Sources (HVAC)

Building	Sound Source	Overall Leq (dBA)	A-Weighted dB at Octave Band Center Frequency (OBCF, Hz)							
			63	125	250	500	1000	2000	4000	8000
Library	Air Handling Unit	78	59	71	72	73	70	63	57	52
	Air Conditioning	79	73	73	75	77	75	68	66	62

Source: Appendix C.

The sound emission from rooftop HVAC equipment was modeled using the Datakustik CadnaA sound propagation program. CadnaA is a commercially available software program for the calculation, presentation, assessment, and prediction of environmental noise based on algorithms and reference data per International Organization of Standardization (ISO) Standard 9613-2, “Attenuation of Sound During Propagation Outdoors, Part 2: General Method of Calculation” (ISO 1996). The CadnaA computer software is a three-dimensional (3-D) sound propagation software that takes into account the project architectural plans and elevations, the location, level, and acoustic

characteristics of sound sources, ground effects, reflections, and shielding from structures. The modeling assumed continuous and simultaneous operation of all HVAC units.

The nearest sensitive receptors to the project site are residences to the west. Based on sound propagation modeling, these residences would be exposed to a project generated sound level of up to 33 dBA L_{eq} at the nearest property line with full continuous operation of all rooftop HVAC equipment. Assuming continuous operation of all equipment, the L_{eq} and L_{50} sound levels would be the same. These levels are well below the Town's daytime and nighttime residential limits for non-transportation sound sources (Table 2) of 55 and 50 dBA L_{50} , respectively. This is a **less-than-significant** impact.

Conversations in Outdoor Activity Area

Activities in the proposed outdoor activity areas would be anticipated to be limited to people conversing. Recreational activities in Town parks are exempt from the Town's noise limits. For informational purposes, sound levels generated by conversation in the outdoor activity areas at the nearest residences are shown in Table 11

Table 11. Sound levels Generated by Project Outdoor Recreational Activities

Source	Source Description	Sound Pressure Level at 3 feet	Sound Pressure Level at Closest Residence
Normal Conversation	4 people (+6 dB) "raised normal speaking" at 1m (60 dBA), half of the time (-3 dB)	72 dBA	32 dBA

Source: Hayne 2006.

Normal conversation typically generates a sound level of about 72 dBA at a distance of 3 feet. At the closest residence, located about 180 feet from the nearest outdoor use areas, the sound level would be 32 dBA. This level would be well below the Town's most conservative daytime and nighttime limits for non-transportation sound sources (Table 2) of 55 and 50 dBA L_{50} , respectively, and below existing background sound levels (see Table 4). This is a **less-than-significant** impact.

Emergency Generator

The Project proposes an emergency generator on the western side of the site, just north of the parking area. Operations and testing would occur during daytime hours only. Emergency operations, which would occur only during the library's business hours in case of a power outage, would be exempt from the Town's noise limits. However, the limits would apply to testing of the units, which would occur for 30 minutes per week during daytime hours under no load conditions.

Based on manufacturer data, the generator under level 1 conditions would produce a sound level of as much as 90 dBA under full load and 87 dBA under no load at a distance of 23 feet. At the nearest residence, located about 180 feet from the generator, this would equate to a sound level of about 72 dBA under full load and 69 dBA under no load. The proposed enclosure, which would be constructed of concrete filled CMU block with louvres facing to the south and away from residences, would be anticipated to provide an interior to exterior noise reduction of about 25 to 30 dB at the residence, resulting in a sound level of 47 dBA or less during full load and 44 dBA or less under no load. This would be below the daytime limits for non-transportation sound sources of 55 dBA L_{50} . This is a **less-than-significant** impact.

b) Would the project result in generation of excessive ground-borne vibration or ground-borne noise levels?

Less-Than-Significant Impact. Construction activity can result in varying degrees of ground vibration and ground-borne noise at local receptors, depending on the equipment and methods used, distance to the affected structures, and soil type. Caltrans has been assembling data for vibration and ground-borne noise levels generated by heavy construction equipment operation during the building of transportation projects for many years. The vibration and ground-borne noise levels from use of such equipment are representative for other types of construction efforts, not just transportation projects, and are therefore widely employed to assess vibration and ground-borne noise levels from heavy equipment use for any effort. According to Caltrans (2020), equipment relative to generation of vibration and ground-borne noise, and the vibration velocities produced by such equipment, is illustrated in Table 12.

Table 12. Vibration Velocities for Typical Construction Equipment

Equipment	PPV at 25 Feet (Inches Per Second)
Vibratory Roller	0.210
Large Bulldozer	0.089
Loaded Trucks	0.076
Small Bulldozer	0.003

Source: Caltrans 2020.

Note: PPV = peak particle velocity.

Ground-borne vibration attenuates rapidly, even over short distances. The attenuation of ground-borne vibration as it propagates from source to receptor through intervening soils and rock strata can be estimated with expressions found in Caltrans guidance (Caltrans 2020). The following equation is used to calculate PPV at any distance of interest from the operating construction equipment.

$$PPV_{rcvr} = PPV_{ref} * (25/D)^{1.1}$$

In the above equation, PPV_{rcvr} is the predicted vibration velocity at the receiver position, PPV_{ref} is the reference value at 25 feet from the vibration source (as listed in Table 12), and D is the actual horizontal distance to the receiver.

The Town's General Plan requires construction within 45 feet of vibration sensitive uses and 15 feet of vibration sensitive buildings to evaluate all potential vibration-inducing activities with the potential to result in structural damage or exposure of sensitive receptors to excessive groundborne vibration. The nearest structure to the project site is located about 120 feet to the south of construction and the nearest vibration sensitive use area is 180 feet to the northwest of the nearest construction activity. There are no vibration sensitive uses within 45 feet of the site or vibration sensitive buildings within 15 feet of the site.

The Town has not adopted an applicable threshold for project-attributed construction vibration; therefore, it is appropriate to employ a numeric standard adopted by another agency. The California Department of Transportation (Caltrans 2020) establishes a building damage construction limit of 0.25 in/sec PPV for historic and old buildings, 0.3 in/sec PPV for older residential structures, and 0.5 in/sec PPV for new residential and modern commercial/industrial structures. The applicable threshold for project-attributed construction vibration would be 0.3 in/sec PPV at the closest residences and 0.5 in/sec PPV at the closest non-residential building.

The closest structures to the project site are residences located 180 feet to the northwest of construction activity and non-residential buildings 120 feet to the south. Using the vibration source level of construction equipment provided in Table 12, the distance to the closest sensitive receiver, and the equation supplied in the Caltrans (2020) construction ground-borne noise assessment methodology (above), Dudek calculated the project construction-related vibration levels shown in Table 13.

Table 13. Construction Vibration Levels at Nearest Structures

Equipment	in/sec PPV at Nearest Residential Structures (180 feet)	in/sec PPV at Nearest Non-residential Structures (120 feet)
Vibratory Roller	0.024	0.037
Large Bulldozer	0.010	0.016
Loaded Trucks	0.009	0.014
Small Bulldozer	0.000	0.001

Note: PPV = peak particle velocity; VdB = vibration decibel.
Source: Caltrans 2020.

The applicable threshold for project-attributed construction vibration would be 0.3 in/sec PPV at the closest residences and 0.5 in/sec PPV at the closest non-residential building. As shown in Table 13, project construction would result in vibration levels well below these thresholds and also below the human annoyance level of 0.24 in/sec PPV. Vibration impacts of the project would therefore be **less than significant**.

c) *For a project located within the vicinity of a private airstrip or an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels?*

Less than significant impact. The closest airport to the proposed project site is Truckee Tahoe Airport, located about 1.2 miles to the southeast. There are no other airports within the project area. Based on the Truckee Tahoe Airport Land Use Compatibility Plan the project site is outside of the 60 dB CNEL noise contour. Therefore, there would be a **less than significant** impact.

8 Summary of Findings

The results of the noise and vibration technical analysis indicate that potential impacts during construction would be **less than significant**. Offsite exterior noise impacts due to operation of the proposed project would be **less than significant**. Offsite exterior noise impacts due to traffic noise would be **less than significant**.

9 References Cited

California Natural Resources Agency. 2024 California Environmental Quality Act (CEQA) Statute and Guidelines. s.l. : Association of Environmental Professionals.

Caltrans (California Department of Transportation). 2013. *Technical Noise Supplement to the Traffic Noise Analysis Protocol*. September.

- Caltrans. 2020. *Transportation and Construction Vibration Guidance Manual*. Division of Environmental Analysis, Environmental Engineering, Hazardous Waste, Air, Noise, Paleontology Office. Sacramento, California. April.
- Town of Truckee. *Development Code, Chapter 18.44* . October 12, 2023
- Town of Truckee. *General Plan: Safety and Noise Element*. May 2023.
- Town of Truckee. 2024. *Town of Truckee 2025 General Plan EIR*.
- DOT (U.S. Department of Transportation). 2006. *FHWA Roadway Construction Noise Model: User's Guide*. Final Report. FHWA-HEP-06-015. DOT-VNTSC-FHWA-06-02. Cambridge, Massachusetts: DOT, Research and Innovative Technology Administration. Final Report. August.
- FHWA. December 8, 2008. *Roadway Construction Noise Model (RCNM), Software Version 1.1*. U.S. Department of Transportation, Research and Innovative Technology Administration, John A. Volpe National Transportation Systems Center, Environmental Measurement and Modeling Division. Washington, D.C.
- FTA (Federal Transit Administration). 2018. *Transit Noise and Vibration Impact Assessment*. FTA Report No. 0123. September.
- Saxelby Acoustics. 2021. *Rocker Memorial Skatepark Project – Environmental Noise Assessment*. Transportation Noise Prediction Model
- International Code Council (ICC). 2019. *2019 California Green Building Standards Code, Title 24, Part 11, Chapter 5*. First Printing. July. <https://codes.iccsafe.org/content/CAGBSC2019/chapter-5-nonresidential->
- International Organization of Standardization (ISO). 1996. *Standard 9613-2 (Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation)*. Geneva.
- NASEM (National Academies of Sciences Engineering and Medicine). 2022. “NCHRP 25–49 [Final].” <https://apps.trb.org/cmsfeed/trbnetprojectdisplay.asp?projectid=3889>. OPR (Governor's Office of Planning and Research). 2017. *State of California General Plan Guidelines*. July 2017.
- State of California. California Code of Regulations, Title 24, Part 2, Volume 1, Chapter 12, Section 1206.4, Allowable Interior Noise Level. ICC Digital Coes. [Online] 2019.

Appendix A

Baseline Noise Measurement Field Data

Field Noise Measurement Data

Record: 1989

Project Name	Truckee Regional Library
Project #	17020
Date	2024-10-17

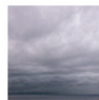
Meteorological Conditions

Upload NOAA Forecast

10:58

5G

Current conditions at
Truckee-Tahoe (KTRK)
Lat: 39.31667°N Lon: 120.13333°W Elev: 5899.0ft.



Overcast
43°F
6°C

Humidity 100%
Wind Speed N 0 MPH
Barometer 29.94 in (1013.89 mb)
Dewpoint 43°F (6°C)
Visibility 10.00 mi
Last update 17 Oct 09:50 AM PDT

[More Local Wx](#) | [3 Day History](#) | [Hourly Weather Forecast](#)

Extended Forecast for
Truckee CA

Today

Tonight

Friday



60%

High: 50 °F

Showers
Likely



30%

Low: 16 °F

Chance
Showers then
Clear



High: 49 °F

Sunny

Detailed Forecast

Today

Showers likely, mainly between 2pm and 5pm. Snow level 8300 feet lowering to 7300 feet. Partly sunny, with a high near 50. Southwest wind 5 to 15 mph becoming west in the afternoon. Chance of

[View in Desktop Mode](#)

forecast.weather.gov

FORMS FIELD DATA REPORT

Temp (F)	43
Humidity % (R.H.)	100
Wind	Calm
Wind Speed (MPH)	0
Wind Direction	North
Sky	Overcast

Instrument and Calibrator Information	
Instrument Name List	(SAC) NL-62
Instrument Name	(SAC) NL-62
Instrument Name Lookup Key	(SAC) NL-62
Manufacturer	Rion
Model	NL-62
Serial Number	350815
Calibration Date	7/16/2018
Calibrator Name	(SAC) Rion NC-74
Calibrator Name	(SAC) Rion NC-74
Calibrator Name Lookup Key	(SAC) Rion NC-74
Calibrator Manufacturer	Rion
Calibrator Model	NC-74
Calibrator Serial #	34167529
Pre-Test (dBA SPL)	94.1
Post-Test (dBA SPL)	94

Windscreen	Yes
Weighting?	A-WTD
Slow/Fast?	Slow

Monitoring	
Record #	1
Site ID	ST1
Site Location Lat/Long	39.328494, -120.179691
Begin (Time)	10:55:00
End (Time)	11:10:00
Leq	58.1
Lmax	70
Lmin	50.2
Other Lx?	L90, L50, L10
L90	50.7
L50	52.1
L10	59.7
Other Lx (Specify Metric)	L
Primary Noise Source	Traffic
Other Noise Sources (Background)	Distant Aircraft
Other Noise Sources Additional Description	One airplane flyover, adjacent road noise, and distant highway noise
Is the same instrument and calibrator being used as previously noted?	Yes

F DUDEK FORMS FIELD DATA REPORT	
Are the meteorological conditions the same as previously noted?	Yes

Description / Photos	
Terrain	Mixed

Site Photos	
Photo	
Comments / Description	Facing SE

Site Photos	
Photo	

F DUDEK FORMS FIELD DATA REPORT	
Comments / Description	Facing SW

Site Photos	
Photo	
Comments / Description	Facing NW

Site Photos	
Photo	

Comments / Description	Facing NE
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Monitoring	
Record #	2
Site ID	ST2
Site Location Lat/Long	39.327510, -120.183686
Begin (Time)	11:19:00
End (Time)	11:34:00
Leq	65.5
Lmax	70.1
Lmin	59.6
Other Lx?	L90, L50, L10
L90	60.4
L50	64.9
L10	68.7
Other Lx (Specify Metric)	L
Primary Noise Source	Traffic
Other Noise Sources (Background)	Distant Industrial, Distant Traffic
Other Noise Sources Additional Description	Railway crossing bell, some construction equipment nearby
Is the same instrument and calibrator being used as previously noted?	Yes
Are the meteorological conditions the same as previously noted?	Yes

Description / Photos

Terrain

Hard

Site Photos

Photo

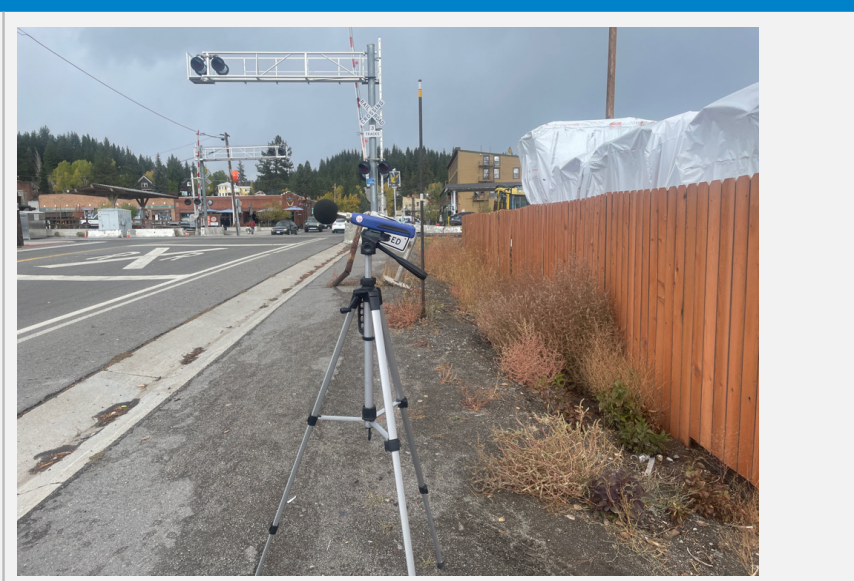


Comments / Description

Facing SW

Site Photos

Photo



FORMS DUDEK FIELD DATA REPORT	
Comments / Description	Facing NW

Site Photos	
Photo	
Comments / Description	Facing NE

Site Photos	
Photo	

Comments / Description	Facing SE
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Monitoring	
Record #	3
Site ID	ST3
Site Location Lat/Long	39.326731, -120.181149
Begin (Time)	12:33:00
End (Time)	12:48:00
Leq	55.6
Lmax	60.1
Lmin	53.1
Other Lx?	L90, L50, L10
L90	53.5
L50	55.2
L10	57.6
Other Lx (Specify Metric)	L
Primary Noise Source	Traffic
Other Noise Sources (Background)	
Other Noise Sources Additional Description	Rain started partway through the measurement
Is the same instrument and calibrator being used as previously noted?	Yes
Are the meteorological conditions the same as previously noted?	Yes

Description / Photos

Upload Google Maps Data



Terrain

Mixed

Site Photos

Photo



Comments / Description

Facing NW

Site Photos

Photo



Comments / Description

Facing NE

Site Photos

Photo



Comments / Description

Facing SE

Site Photos	
Photo	
Comments / Description	Facing SW

Monitoring	
Record #	4
Site ID	ST4
Site Location Lat/Long	39.326280, -120.180322
Begin (Time)	13:09:00
End (Time)	13:24:00
Leq	73.2
Lmax	78.1
Lmin	61.5
Other Lx?	L90, L50, L10

L90	65.8
L50	71.6
L10	76.7
Other Lx (Specify Metric)	L
Primary Noise Source	Traffic
Is the same instrument and calibrator being used as previously noted?	Yes
Are the meteorological conditions the same as previously noted?	Yes

Description / Photos	
Terrain	Mixed

Site Photos	
Photo	
Comments / Description	Facing N

Site Photos



Comments / Description

Facing E

Site Photos



F DUDEK RMS FIELD DATA REPORT	
Comments / Description	Facing S

Site Photos	
Photo	
Comments / Description	Facing W

Monitoring	
Record #	5
Site ID	ST5
Site Location Lat/Long	39.324852, -120.177053
Begin (Time)	13:38:00
End (Time)	13:53:00
Leq	66.2
Lmax	73.4

FORMS FIELD DATA REPORT

Lmin	52.8
Other Lx?	L90, L50, L10
L90	53.1
L50	59.7
L10	70.9
Other Lx (Specify Metric)	L
Primary Noise Source	Traffic
Other Noise Sources (Background)	Distant Traffic
Other Noise Sources Additional Description	Adjacent road and distant highway
Is the same instrument and calibrator being used as previously noted?	Yes
Are the meteorological conditions the same as previously noted?	Yes

Description / Photos

Terrain	Mixed
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Site Photos

Photo



FORMS DUDEK FIELD DATA REPORT	
Comments / Description	Facing N

Site Photos	
Photo	
Comments / Description	Facing E

Site Photos	
Photo	

FORMS DUDEK FIELD DATA REPORT	
Comments / Description	Facing S

Site Photos	
Photo	
Comments / Description	Facing W

Monitoring	
Record #	6
Site ID	ST6
Site Location Lat/Long	39.326655, -120.169994
Begin (Time)	14:02:00
End (Time)	14:17:00
Leq	54.2
Lmax	59.2

Lmin	48.6
Other Lx?	L90, L50, L10
L90	48.9
L50	53.3
L10	56.9
Other Lx (Specify Metric)	L
Primary Noise Source	Traffic
Is the same instrument and calibrator being used as previously noted?	Yes
Are the meteorological conditions the same as previously noted?	Yes

Description / Photos

Terrain	Mixed
---------	-------

Site Photos
Photo


FORMS DUDEK FIELD DATA REPORT	
Comments / Description	Facing SW

Site Photos	
Photo	
Comments / Description	Facing NW

Site Photos	
Photo	

FORMS FIELD DATA REPORT	
Comments / Description	Facing NE

Site Photos	
Photo	
Comments / Description	Facing SE

Appendix B

Construction Noise Modeling Input and Output

Source to barrier distance		5000	noise level limit for construction phase at residential land use, per County guidance = 80										80														
Receiver to barrier distance		170	allowable hours over which Leq is to be averaged = 8										8														
Receiver height		5	0 = temporary barrier (TB) of input height inserted between source and receptor																								
Construction Activity	Equipment	Total Equipment Qty	Reference Level (L) 50 ft. from FHWA RCNM 2 Table	Client Equipment Description, Data Source and/or Notes	Source to NSR Distance (ft.)	Temporary Barrier Insertion Loss (dB)	Additional Noise Reduction	Distance-Adjusted Leq	Allowable Operation Time (hours)	Allowable Operation Time (minutes)	Predicted 8-hour Leq	Source Elevation (ft.)	Receiver Elevation (ft.)	Barrier Height (ft.)	Source to Barr. ("A") Horiz. (ft.)	Revr. to Barr. ("B") Horiz. (ft.)	Source to Revr. ("C") Horiz. (ft.)	"A" (ft.)	"B" (ft.)	"C" (ft.)	Path Length Diff. "B"- "C" (ft.)	Abarr (dB)	Leff (with barrier)	Leff (w/out barrier)	L (with barrier)	L (without barrier)	Lbarr (dB)
Site Preparation	Grader (passby)	1	78.5		430	0.1		55.0	8	480	55	6.0	5	0	5000	170	5170	5000.0	170.1	5170.0	0.00	0.1	5.5	5.5	0.7	0.7	0.1
	Backhoe	1	75.8		430	0.1		52.3	8	480	52	4.5	5	0	5000	170	5170	5000.0	170.1	5170.0	0.00	0.1	4.8	4.8	0.7	0.7	0.1
Total for Site Preparation Phase:											56.9																
Grading	Grader (passby)	1	78.5		430	0.1		55.0	8	480	55	6.0	5	0	5000	170	5170	5000.0	170.1	5170.0	0.00	0.1	5.5	5.5	0.7	0.7	0.1
	Dozer	1	80.0		430	0.1		56.4	8	480	56	5.3	5	0	5000	170	5170	5000.0	170.1	5170.0	0.00	0.1	5.2	5.2	0.7	0.7	0.1
	Backhoe	1	75.8		430	0.1		52.3	8	480	52	4.5	5	0	5000	170	5170	5000.0	170.1	5170.0	0.00	0.1	4.8	4.8	0.7	0.7	0.1
Total for Grading Phase:											59.7																
Building Construction	Crane	1	74.2		430	0.1		50.8	8	480	51	7.7	5	0	5000	170	5170	5000.0	170.1	5170.0	0.00	0.1	6.4	6.4	0.6	0.6	0.1
	Telescopic Handler (Forklift)	2	88.3		430	0.1		64.7	8	480	68	3.0	5	0	5000	170	5170	5000.0	170.1	5170.0	0.00	0.1	4.0	4.0	0.7	0.7	0.1
	Backhoe	2	75.8		430	0.1		52.3	8	480	55	4.5	5	0	5000	170	5170	5000.0	170.1	5170.0	0.00	0.1	4.8	4.8	0.7	0.7	0.1
Total for Building Construction Phase:											68.0																
Paving	Backhoe	1	75.8		430	0.1		52.3	8	480	52	4.5	5	0	5000	170	5170	5000.0	170.1	5170.0	0.00	0.1	4.8	4.8	0.7	0.7	0.1
	Drum Mixer	4	65.8		430	0.1		42.1	8	480	48	3.0	5	0	5000	170	5170	5000.0	170.1	5170.0	0.00	0.1	4.0	4.0	0.7	0.7	0.1
	Placing - Concrete (triple roller)	1	85.1		430	0.1		61.5	8	480	62	5.0	5	0	5000	170	5170	5000.0	170.1	5170.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1
	Compactor (Roller)	1	82.4		430	0.1		58.8	8	480	59	4.4	5	0	5000	170	5170	5000.0	170.1	5170.0	0.00	0.1	4.7	4.7	0.7	0.7	0.1
Total for Paving Phase:											63.8																

Source to barrier distance		5000	noise level limit for construction phase at residential land use, per County guidance =										80														
Receiver to barrier distance		170	allowable hours over which Leq is to be averaged =										8														
Receiver height		5	0 = temporary barrier (TB) of input height inserted between source and receptor																								
Construction Activity	Equipment	Total Equipment Qty	Reference Level (d) 50 ft. from FHWA RCNM 2 Table	Client Equipment Description, Data Source and/or Notes	Source to NSR Distance (ft.)	Temporary Barrier Insertion Loss (dB)	Additional Noise Reduction	Distance-Adjusted Leq	Allowable Operation Time (hours)	Allowable Operation Time (minutes)	Predicted 8-hour Leq	Source Elevation (ft.)	Receiver Elevation (ft.)	Barrier Height (ft.)	Source to Barr. ("A") Horiz. (ft.)	Revr. to Barr. ("B") Horiz. (ft.)	Source to Revr. ("C") Horiz. (ft.)	"A" (ft.)	"B" (ft.)	"C" (ft.)	Path Length Diff. "B"- "C" (ft.)	Abarr (dB)	Leff (with barrier)	Leff (w/out barrier)	Q (with barrier)	Q (without barrier)	Lebarr (dB)
Site Preparation	Grader (passby)	1	78.5		180			63.7	8	480	64	6.0	5	0	5000	170	5170	5000.0	170.1	5170.0	0.00	0.1	5.5	5.5	0.7	0.7	0.1
	Backhoe	1	75.8		180	0.1		60.8	8	480	61	4.5	5	0	5000	170	5170	5000.0	170.1	5170.0	0.00	0.1	4.8	4.8	0.7	0.7	0.1
	Total for Site Preparation Phase:											65.5															
Grading	Grader (passby)	1	78.5		180	0.1		63.7	8	480	64	6.0	5	0	5000	170	5170	5000.0	170.1	5170.0	0.00	0.1	5.5	5.5	0.7	0.7	0.1
	Dozer	1	80.0		180			65.1	8	480	65	5.3	5	0	5000	170	5170	5000.0	170.1	5170.0	0.00	0.1	5.2	5.2	0.7	0.7	0.1
	Backhoe	1	75.8		180	0.1		60.8	8	480	61	4.5	5	0	5000	170	5170	5000.0	170.1	5170.0	0.00	0.1	4.8	4.8	0.7	0.7	0.1
Total for Grading Phase:											68.3																
Building Construction	Crane	1	74.2		330	0.1		53.4	8	480	53	7.7	5	0	5000	170	5170	5000.0	170.1	5170.0	0.00	0.1	6.4	6.4	0.6	0.6	0.1
	Telescopic Handler (Forklift)	2	88.3		330	0.1		67.2	8	480	70	3.0	5	0	5000	170	5170	5000.0	170.1	5170.0	0.00	0.1	4.0	4.0	0.7	0.7	0.1
	Backhoe	2	75.8		330	0.1		54.8	8	480	58	4.5	5	0	5000	170	5170	5000.0	170.1	5170.0	0.00	0.1	4.8	4.8	0.7	0.7	0.1
Total for Building Construction Phase:											70.5																
Paving	Backhoe	1	75.8		180	0.1		60.8	8	480	61	4.5	5	0	5000	170	5170	5000.0	170.1	5170.0	0.00	0.1	4.8	4.8	0.7	0.7	0.1
	Drum Mixer	4	65.8		180	0.1		50.6	8	480	57	3.0	5	0	5000	170	5170	5000.0	170.1	5170.0	0.00	0.1	4.0	4.0	0.7	0.7	0.1
	Placing * Concrete (triple roller)	1	85.1		180	0.1		70.1	8	480	70	5.0	5	0	5000	170	5170	5000.0	170.1	5170.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1
	Compactor (Roller)	1	82.4		180	0.1		67.4	8	480	67	4.4	5	0	5000	170	5170	5000.0	170.1	5170.0	0.00	0.1	4.7	4.7	0.7	0.7	0.1
Total for Paving Phase:											72.4																

Appendix C

Project Sound Source Calculation Data

AHUs (plenum-type return fan only, no condenser units [see separate worksheet]):
Building Minimum Ventilation
Library

Data from AQ data request reply from Ted Felix

*from Loren Cook's "Engineering Cookbook", 1999 edition, p. 41

assumed average occupied square footage per dwelling unit (DU): 500
percent GSF actually occupied (and need ventilation): 80

A-weighting adjustments

average of values for the two fan diameter ranges, per Guyer (Table 12)	plug	40	40	38	34	29	23	19	16
average of values for the two fan diameter ranges, per Guyer (Table 12)	tube	47	44	46	47	44	45	38	35
per Guyer (Table 12, presumed based on Bies & Hansen ENC)	prop	46	48	55	53	52	48	43	38
per Guyer (Table 12, presumed based on Bies & Hansen ENC)	none	0	0	0	0	0	0	0	0

fan or AHU cabinet liner/interior attenuation (excludes inlet/outlet PWL split, already in calcs above):

		non-residential space					residential space							A-weighted PWL (for CadnaA inputs)														
Phase	Land Use	GSF	Avail. SF (ft2)	Height (ft)	comparable facility function	Avg. minutes to change air*	Volume (ft3)	DU	DU SF (ft2)	DU Height (ft)	DU function	DU avg. min to change air*	DU volume (ft3)	Total CFM	m²	Pressure (inwg)	Pressure (Pa)	Q (m³/s)	fan type = plug, tube, or prop	63	125	250	500	1000	2000	4000	8000	OA dB
return air fans in building rooftop AHUs:																												
	Library	20000	16000	10	shops (general)	6.5	160000		0	8	residence	3.5	0	24615	1487	2	500	12	plug	59	71	72	73	70	63	57	52	78

bldg_AC

		dBA	ft
reference low speed car at indicated distance		50	30
	at 1 m	69.2	3.28
car qty	50	86.21	
minutes per hour idling	6	76.21	
hemisphere conversion of SPL to PWL	8	84.2	

use a muffled internal combustion engine from CadnaA's list of pre-set sources, change the kW so that the resulting PWL matches the above overall bold value.

		dB(A)
reference low speed car at indicated distance	50	
	at 1 m	#DIV/0!
car qty	50	#DIV/0!
minutes per hour idling	6	#DIV/0!
hemisphere conversion of SPL to PWL	8	#DIV/0!

Hayne 2006 paper, Table 2

Table 2. Equivalent sound levels of speakers at a distance of 1m from the speaker's mouth for indicated vocal efforts

Voice Effort	Average Speech Level (dB(A))
Whispering	36
Soft Speaking	42
Relaxed Speaking	48
Relaxed Normal Speaking	54
Raised Normal Speaking	60
Raised Speaking	66
Loud Speaking	72
Very Loud Speaking	78
Shouting	84
Maximal Shout	90
Maximal Shout (Individuals)	96

Source: (Lazarus (1986))

Hayne 2006 paper, Figure 5

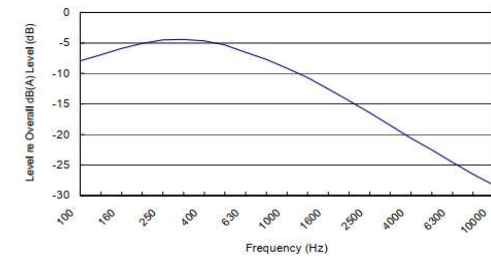


Figure 5: Long-term average speech spectrum (Source: van Heusden, Plomp and Pols (1979))

72	= SPL at 1m (dB(A)) for selected vocal effort	Hz	25	31.5	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000	6300	8000
	plot per Hayne 2006, Figure 5 (spectrum)		-14	-13	-12	-11	-10	-9	-8	-7	-6	-5.5	-5	-4.5	-4.5	-5	-6	-7	-8	-10	-12	-14	-16	-18	-20	-22	-24	-26
	A-wtd. PWL for CadnaA input		66	67	68	69	70	71	72	73	74	74.5	75	75.5	75.5	75	74	73	72	70	68	66	64	62	60	58	56	54
2	= number of speakers																											
30	= time (minutes) per hour each person is talking																											
0.0	= value to apply as "Attenuation" on the area source that references the above individual vocal effort PWL to account for above two input parameters																											

ID	Level Lr		Limit. Value		Land Use		Noise Type	Height (ft)	Coordinates		
	Day (dBA)	Night (dBA)	Day (dBA)	Night (dBA)	Type	Auto			X (ft)	Y (ft)	Z (ft)
rcvr_2	32.5	32.5	0	0	0	x	Total	13.12 r	544.33	2292.86	13.12
rcvr_3	26	26	0	0	0	x	Total	13.12 r	246.94	1956.36	13.12
rcvr_1	26.1	26.1	0	0	0	x	Total	13.12 r	786.4	2727.4	13.12