# HOTEL ADDITION AND ROAD RE-ALIGNMENT ENVIRONMENTAL NOISE ASSESSMENT DAVIS, CA

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## Introduction

This study evaluates the significance of noise impacts resulting from the proposed closure of a segment of Arboretum Drive to vehicular traffic and the extension of Old Davis Road, and an addition to the Hyatt Place Hotel building. Key issues addressed in this study are the potential increase in traffic noise levels at the Solano Park residential area as a result of the realignment of the roadway closer to these residences, and the short term effect of construction noise. The report presents fundamental concepts of environmental noise, describes the existing noise environment in the area, provides applicable information from the 2003 LRDP EIR, and then presents an analysis of the key noise issues.

## Fundamentals of Environmental Noise

Noise is defined as unwanted sound. Airborne sound is a rapid fluctuation of air pressure above and below atmospheric pressure. Sound levels are usually measured and expressed in decibels (dB) with 0 dB corresponding roughly to the threshold of hearing. Decibels and other technical terms are defined in Table 1.

Most of the sounds we hear in the environment do not consist of a single frequency, but rather a broad band of frequencies, with each frequency differing in sound level. The intensities of each frequency add together to generate a sound. The method commonly used to quantify environmental sounds consists of evaluating all of the frequencies of a sound in accordance with a weighting that reflects the facts that human hearing is less sensitive at low frequencies and extreme high frequencies than in the frequency mid-range. This is called "A" weighting, and the decibel level so measured is called the A-weighted sound level (dBA). In practice, the level of a sound source is conveniently measured using a sound level meter that includes an electrical filter corresponding to the A-weighting curve. Typical A-weighted levels measured in the environment and in industry are shown in Table 2 for different types of noise.

Although the A-weighted noise level may adequately indicate the level of environmental noise at any instant in time, community noise levels vary continuously. Most environmental noise includes a conglomeration of noise from distant sources which create a relatively steady background noise in which no particular source is identifiable. To describe the time-varying character of environmental noise, the statistical noise descriptors, $L_{01}$, $L_{10}$, $L_{50}$, and $L_{90}$, are commonly used. They are the A-weighted noise levels equaled or exceeded during 1%, 10%, 50%, and 90% of a stated time period. A single number descriptor called the $L_{eq}$ is also widely used. The $L_{eq}$ is the average A-weighted noise level during a stated period of time.

In determining the daily level of environmental noise, it is important to account for the difference in response of people to daytime and nighttime noises. During the nighttime, exterior background noises are generally lower than the daytime levels. However, most household noise also decreases at night and exterior noise becomes very noticeable. Further, most people sleep at night and are very sensitive to noise intrusion. To account for human sensitivity to nighttime noise levels, a descriptor, DNL (day/night average sound level), was developed. The DNL

## Table 1: Definitions of Acoustical Terms Used in this Report

| Term | Definitions |
|---|---|
| Decibel, dB | A unit describing, the amplitude of sound, equal to 20 times the logarithm to the base 10 of the ratio of the pressure of the sound measured to the reference pressure. The reference pressure for air is 20. |
| Sound Pressure Level | Sound pressure is the sound force per unit area, usually expressed in micro Pascals (or 20 micro Newtons per square meter), where 1 Pascal is the pressure resulting from a force of 1 Newton exerted over an area of 1 square meter. The sound pressure level is expressed in decibels as 20 times the logarithm to the base 10 of the ratio between the pressures exerted by the sound to a reference sound pressure (e.g., 20 micro Pascals). Sound pressure level is the quantity that is directly measured by a sound level meter. |
| Frequency, Hz | The number of complete pressure fluctuations per second above and below atmospheric pressure. Normal human hearing is between 20 Hz and 20,000 Hz. Infrasonic sound are below 20 Hz and Ultrasonic sounds are above 20,000 Hz. |
| A-Weighted Sound Level, dBA | The sound pressure level in decibels as measured on a sound level meter using the A-weighting filter network. The A-weighting filter de-emphasizes the very low and very high frequency components of the sound in a manner similar to the frequency response of the human ear and correlates well with subjective reactions to noise. |
| Equivalent Noise Level, $L_{eq}$ | The average A-weighted noise level during the measurement period. |
| $L_{max}$, $L_{min}$ | The maximum and minimum A-weighted noise level during the measurement period. |
| $L_{01}$, $L_{10}$, $L_{50}$, $L_{90}$ | The A-weighted noise levels that are exceeded 1%, 10%, 50%, and 90% of the time during the measurement period. |
| Day/Night Noise Level, $L_{dn}$ or DNL | The average A-weighted noise level during a 24-hour day, obtained after addition of 10 decibels to levels measured in the night between 10:00 pm and 7:00 am. |
| Community Noise Equivalent Level, CNEL | The average A-weighted noise level during a 24-hour day, obtained after addition of 5 decibels in the evening from 7:00 pm to 10:00 pm and after addition of 10 decibels to sound levels measured in the night between 10:00 pm and 7:00 am. |
| Ambient Noise Level | The composite of noise from all sources near and far. The normal or existing level of environmental noise at a given location. |
| Intrusive | That noise which intrudes over and above the existing ambient noise at a given location. The relative intrusiveness of a sound depends upon its amplitude, duration, frequency, and time of occurrence and tonal or informational content as well as the prevailing ambient noise level. |

**Table 2: Typical Noise Levels in the Environment**

| Common Outdoor Noise Source | Noise Level (dBA) | Common Indoor Noise Source |
|---|---|---|
| | 120 dBA | |
| Jet fly-over at 1000 feet | | Rock concert |
| | 110 dBA | |
| Pile driver at 100 feet | 100 dBA | |
| | | Night club with live music |
| | 90 dBA | |
| Large truck pass by at 50 feet | | |
| | 80 dBA | Noisy restaurant |
| | | Garbage Disposal |
| Gas lawn mower at 30 feet | 70 dBA | Vacuum cleaner |
| Commercial/Urban area daytime | | Normal speech face to face |
| Suburban expressway at 300 feet | 60 dBA | |
| Suburban daytime | | Active office environment |
| | 50 dBA | |
| Urban area nighttime | | |
| | 40 dBA | Quiet office environment |
| Suburban nighttime | | |
| Quiet rural areas | 30 dBA | Library |
| | | Quiet bedroom at night |
| Wilderness area | 20 dBA | |
| | 10 dBA | Quiet recording studio |
| Threshold of human hearing | 0 dBA | Threshold of human hearing |

divides the 24-hour day into the daytime of 7:00 AM to 10:00 PM and the nighttime of 10:00 PM to 7:00 AM. The nighttime noise level is weighted 10 dB higher than the daytime noise level. The Community Noise Equivalent Level (CNEL) is another 24-hour average which includes both an evening and nighttime weighting.

**Existing Noise Environment**

Sound levels were measured in the project area on April 28-29, 2011. A combination of long-term (24 hour) measurements and short-term attended measurements were made. The noise measurement locations are shown on Figure 1. Measurement location LT-1 was selected to characterize existing ambient noise levels at the Solano Park residential area which would potentially be the most affected sensitive receptors for this project. Measurement location LT-2 was located along Arboretum Drive to establish the existing level of roadway traffic noise and is used as a reference for the traffic noise modeling. Short-term measurement location ST-1 was adjacent to Hyatt Place to characterize ambient noise levels near the hotel. The measurements were made with Larson-Davis Laboratories integrating precision sound level meters fitted with microphones and windscreens. The instrumentation was calibrated before and after the survey. During the survey, skies were clear, winds on Thursday and Friday morning were moderate.

The noise environment at the Solano Park residential area near the proposed roadway realignment results primarily from vehicular traffic on Interstate 80. The sound of intermittent trains passing on the Union Pacific Railroad tracks is also audible at the site. Local vehicular traffic along Arboretum Drive is insignificant at this location, but circulation of vehicles in and around the residential area does contribute to the overall noise environment. The results of the noise measurements survey are summarized on Figure 2. The 24-hour day/night average sound level was 59 dBA CNEL. During the daytime, typical average noise levels ranged from 55-57 dBA $L_{eq}$. The range of noise levels during each measurement interval, characterized by the difference between the $L_{01}$ statistical descriptor and the $L_{90}$ statistical descriptor, was typically between about 50 dBA and 70 dBA during the daytime and about 45 dBA and 65 dBA during the nighttime. Noise measurements at location LT-2 along Arboretum Drive are summarized in Figure 3. The measured 24-hour average noise level was 60 dBA CNEL. This location was located several hundred feet further from Interstate 80 and the railroad tracks, and was adjacent to Arboretum Drive. Traffic on Arboretum Drive was the most significant noise source, but distant traffic and the sound of train horns also contributed to measured noise levels.

Measurement location ST-1 was at the site of the proposed hotel addition. Vehicular traffic on Interstate 80 and railroad trains are the most significant sources of noise at this location. Noise levels from I-80 typically range from about 51-53 dBA. The average noise level measured during the morning measurement was 53 dBA $L_{eq}$. Subsequent to the short-term noise measurement, train passages were observed and monitored near the hotel. An eastbound freight train passed by at about 11:40 AM. The beginning of the train passby was not monitored. At the end of the passby, a freight engine pushing the train generated a maximum instantaneous noise level of 65 dBA. It was noted that the train did not sound its warning horn until it was well passed the hotel. An eastbound three-car Amtrak train passed by at 11:47 AM. The train horn generated a maximum instantaneous noise level of 85 dBA outside the hotel building. It was, again, noted that the train did not sound its warning horn until it was well passed the hotel. Railroad cars generated typical maximum noise levels of about 65-68 dBA.

**Figure 1: Noise Measurement Locations**

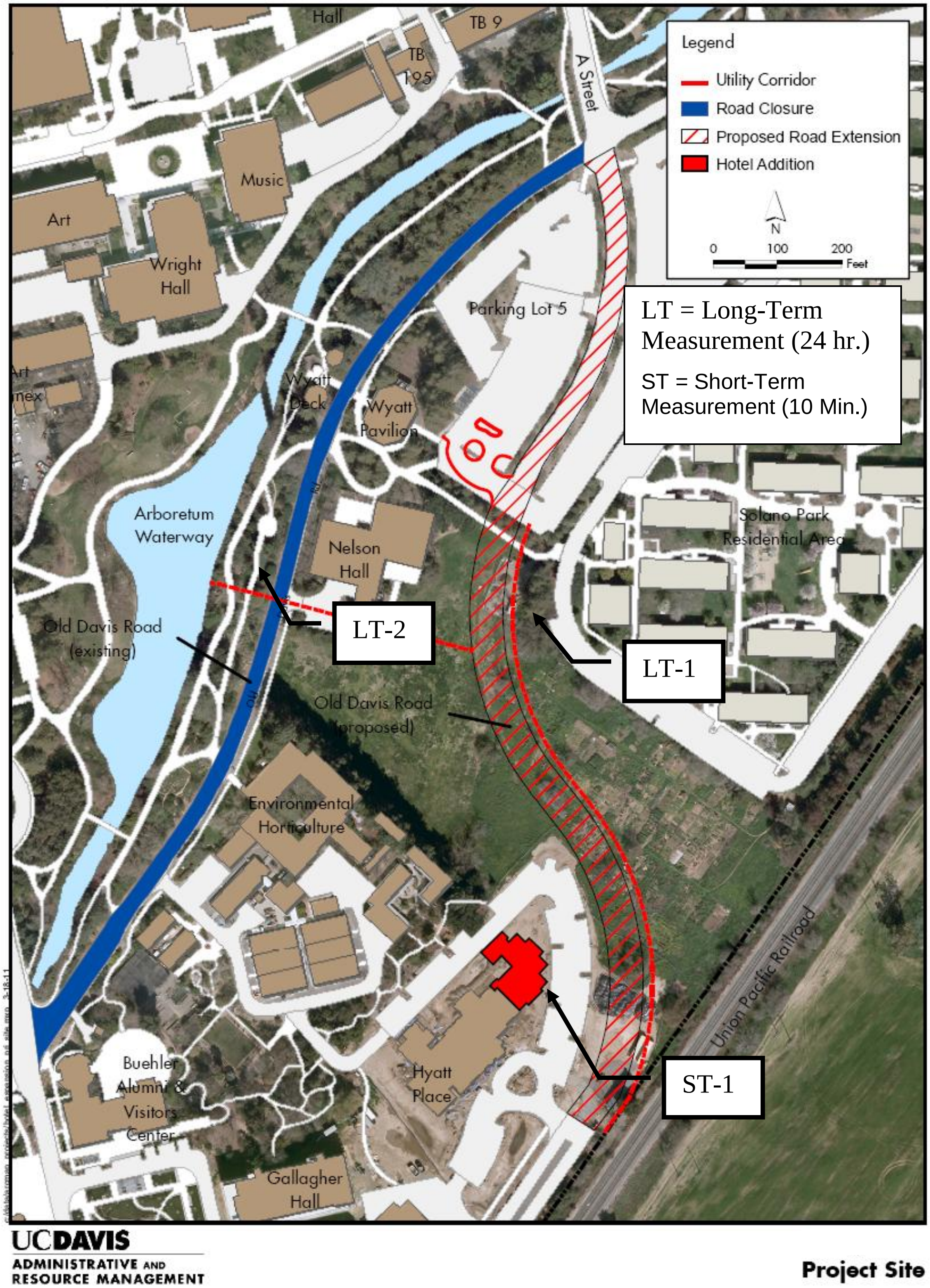


**Figure 2: Noise Levels at LT-1**
**Solano Park Residential Area near Solano Park Circle**
**April 28, 2011 to April 29, 2011**

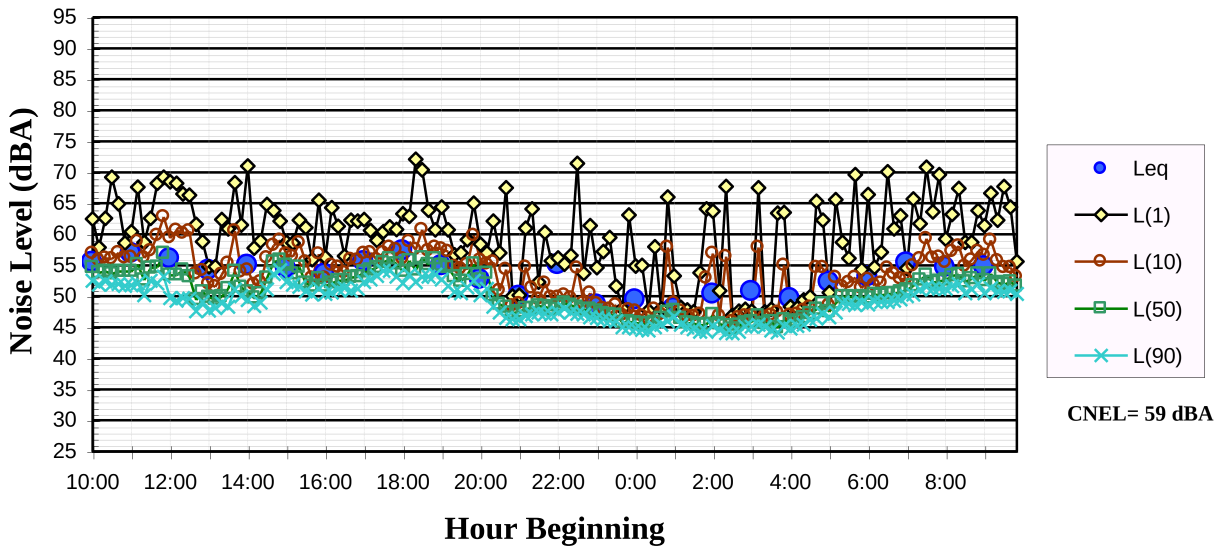
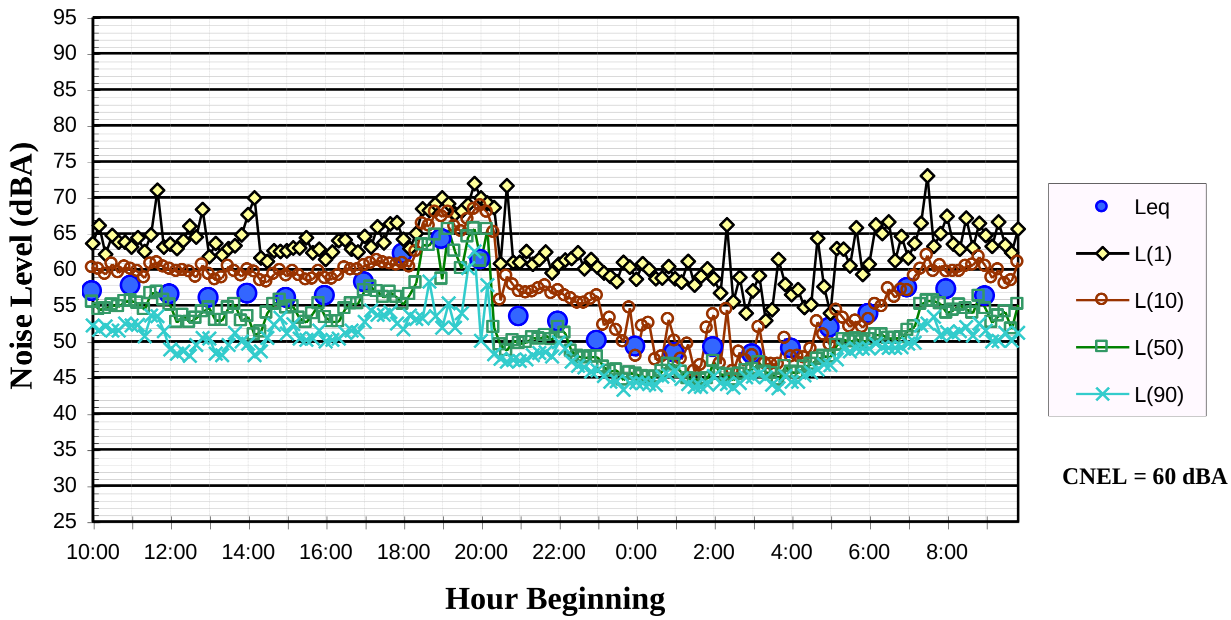



**Figure 3: Noise Levels at LT-2**
**~ 55 feet from the Center of Arboretum Drive**
**April 28, 2011 to April 29, 2011**



## 2003 LRDP EIR Standards of Significance

The 2003 LRDP EIR considers a noise impact significant if growth under the 2003 LRDP would result in the following:

Exposure of persons to or generation of noise levels in excess of levels set forth in Table 4.10-3 of the 2003 LRDP EIR.

**Table 3: Thresholds of Significance for Noise Evaluations**

| **Noise Source[a]** | **Criterion Noise Level[b]** | **Substantial Increase in Noise Level[b]** |
|---|---|---|
| **Road Traffic and Other Long-Term Sources** | **65 dBA CNEL** | **>=3 dBA if CNEL w/project is >= 65 dBA**<br>**>=5 dBA if CNEL w/project is 50–64 dBA**<br>**>=10 dBA if CNEL w/project is < 50 dBA** |
| **Construction (temporary)** | **80 dBA $L_{eq\ (8h)}$[e] daytime**<br><br>**80 dBA $L_{eq\ (8h)}$ evening**<br><br>**70 dBA $L_{eq\ (8h)}$ nighttime** | **Not Applicable** |

**Source: 2003 LRDP EIR**
**[a] The 2003 LRDP would not substantially increase rail activity; therefore, a threshold of significance for rail noise is not included in this table.**
**[b] At noise-sensitive land use unless otherwise noted. Noise-sensitive land uses include residential and institutional land uses.**
**[c] $L_{eq(h)}$ is an average measurement over a one-hour period.**
**[e] $L_{eq(8h)}$ is an average measurement over an eight-hour period.**

Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels.

A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project.

A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project.

For a project within 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, exposure of people residing or working in the project area to excessive noise levels.

## 2003 LRDP EIR Impacts and Mitigation Measures

Impacts of campus growth under the 2003 LRDP through 2015-16 related to noise are evaluated in Section 4.10 of the 2003 LRDP EIR. As analyzed in Section 4 of this Initial Study, the proposed project is within the scope of analysis in the 2003 LRDP EIR. Significant and potentially significant noise impacts identified in the 2003 LRDP EIR that are relevant to the proposed project are presented below with their corresponding levels of significance before and after application of mitigation measures identified in the 2003 LRDP EIR. Mitigation measures are included to reduce the magnitude of project-level impact 4.10-2 and cumulative impact 4.10-3, but these impacts are identified as significant and unavoidable because of the uncertainty regarding mitigation feasibility and effectiveness, and because mitigation falls within other jurisdictions to enforce and monitor and therefore cannot be guaranteed by the University of California.

| **2003 LRDP EIR Impacts**<br>NOISE | | **Level of Significance Prior to Mitigation** | **Level of Significance After Mitigation** |
|---|---|---|---|
| 4.10-1 | Construction of campus facilities pursuant to the 2003 LRDP could expose nearby receptors to excessive groundborne vibration and airborne or groundborne noise. | PS | LS |
| 4.10-2 | Implementation of the 2003 LRDP would result in increased vehicular traffic on the regional road network, which would substantially increase ambient noise levels at some locations. | S | SU |

**Levels of Significance: LS=Less than Significant, S=Significant, PS=Potentially Significant, SU=Significant and Unavoidable**

Mitigation measures in the 2003 LRDP EIR that are applicable to the proposed project are presented below. Since these mitigation measures are already being carried out as part of implementation of the 2003 LRDP, they will not be readopted in this Initial Study or Negative Declaration. The benefits of these mitigation measures will be achieved independently of considering them as specific mitigation measures of this project. Nothing in this Study in any way alters the obligations of the campus to implement 2003 LRDP EIR mitigation measures.

**2003 LRDP EIR Mitigation Measures**
**NOISE**

4.10-1 Prior to initiation of construction, the campus shall approve a construction noise mitigation program including but not limited to the following:

- Construction equipment shall be properly outfitted and maintained with feasible noise-reduction devices to minimize construction-generated noise.
- Stationary noise sources such as generators or pumps shall be located 100 feet away from noise-sensitive land uses as feasible.
- Lay down and construction vehicle staging areas shall be located 100 feet away from noise-sensitive land uses as feasible.
- Whenever possible, academic, administrative, and residential areas that will be subject to construction noise shall be informed a week before the start of each construction project.
- Loud construction activity (i.e., construction activity such as jack hammering, concrete sawing, asphalt removal, and large-scale grading operations) within 100 feet of a residential or academic building shall not be scheduled during finals week.
- Loud construction activity as described above within 100 feet of an academic or residential use shall, to the extent feasible, be scheduled during holidays, Thanksgiving breaks, Christmas break, Spring break, or Summer break.
- Loud construction activity within 100 feet of a residential or academic building shall be restricted to occur between 7:30 AM and 7:30 PM.

**Impact 1: Construction Noise** - *Less than significant*

The construction of the project would generate noise levels that would increase noise levels at noise sensitive receptors in the vicinity of the project site. Noise impacts from construction activities depend on the various pieces of equipment operating, the timing and length of noise generating activities, the distance between the noise generating activities and receptors that would be affected by the noise, and shielding from intervening buildings. Construction activities for individual projects are typically carried out in stages. During each stage of work, there would be a different mix of equipment operating. Construction noise levels would vary by stage and vary within stages based on the amount of equipment in operation and location where the equipment is operating. Typical construction noise levels at a distance of 50 feet are shown in Tables 4 and 5. Table 4 shows the average noise level ranges by construction phase and Table 5 (located on the next page) shows the maximum noise level ranges for different construction equipment. Most noise is in the range of 80 to 90 dBA at a distance of 50 feet from the source.

The highest noise levels would be generated during grading, excavation, and foundation construction. Large pieces of earth-moving equipment, such as graders, scrapers, and bulldozers, generate maximum noise levels of 85 to 90 dBA at a distance of 50 feet. Average noise levels at 100 feet from the typical roadway and building construction activities would range from 70 to 80 dBA $L_{eq}$ during busy construction periods. Noise levels drop off at a rate of about 6 dBA per doubling of distance between the noise source and receptor. The Solano Park Residential Area and Hyatt Place are the nearest sensitive receptors to the road construction activities (about 150 feet away). During construction, exterior noise levels would range from 67 – 77 dBA. These highest noise levels would only occur when construction is occurring on the roadway segments nearest the receivers. Roadway construction noise occurring at the nearest point to Solano Park Housing would be below the Campus threshold of 80 dBA $L_{eq}$, therefore, the impact is less than significant. Construction of the Hyatt Place addition would elevate noise levels at the hotel and surrounding uses. Some disturbance is expected for hotel guests, but it would be short-term in nature and mitigated by use of standard controls and best practices.

**Table 4:**
**Typical Ranges of Energy Equivalent Construction Noise Levels at 50 Ft., $L_{eq}$ in dBA**

| | **Domestic Housing** | | **Office Building, Hotel, Hospital, School, Public Works** | | **Industrial Parking Garage, Religious Amusement & Recreations, Store, Service Station** | | **Public Works Roads & Highways, Sewers, and Trenches** | |
|---|---|---|---|---|---|---|---|---|
| | **I** | **II** | **I** | **II** | **I** | **II** | **I** | **II** |
| Ground Clearing | 83 | 83 | 84 | 84 | 84 | 83 | 84 | 84 |
| Excavation | 88 | 75 | 89 | 79 | 89 | 71 | 88 | 78 |
| Foundations | 81 | 81 | 78 | 78 | 77 | 77 | 88 | 88 |
| Erection | 81 | 65 | 87 | 75 | 84 | 72 | 79 | 78 |
| Finishing | 88 | 72 | 89 | 75 | 89 | 74 | 84 | 84 |

I - All pertinent equipment present at site.

II - Minimum required equipment present at site.

**(Source: U.S.E.P.A., Legal Compilation on Noise, Vol. 1, p. 2-104, 1973.**

**Table 5: Construction Equipment 50-foot Noise Emission Limits**

| Equipment Category | $L_{max}$ Level (dBA)[1,2] | Impact/Continuous |
|---|---|---|
| Arc Welder | 73 | Continuous |
| Auger Drill Rig | 85 | Continuous |
| Backhoe | 80 | Continuous |
| Bar Bender | 80 | Continuous |
| Boring Jack Power Unit | 80 | Continuous |
| Chain Saw | 85 | Continuous |
| Compressor[3] | 70 | Continuous |
| Compressor (other) | 80 | Continuous |
| Concrete Mixer | 85 | Continuous |
| Concrete Pump | 82 | Continuous |
| Concrete Saw | 90 | Continuous |
| Concrete Vibrator | 80 | Continuous |
| Crane | 85 | Continuous |
| Dozer | 85 | Continuous |
| Excavator | 85 | Continuous |
| Front End Loader | 80 | Continuous |
| Generator | 82 | Continuous |
| Generator (25 KVA or less) | 70 | Continuous |
| Gradall | 85 | Continuous |
| Grader | 85 | Continuous |
| Grinder Saw | 85 | Continuous |
| Horizontal Boring Hydro Jack | 80 | Continuous |
| Hydra Break Ram | 90 | Impact |
| Impact Pile Driver | 105 | Impact |
| Insitu Soil Sampling Rig | 84 | Continuous |
| Jackhammer | 85 | Impact |
| Mounted Impact Hammer (hoe ram) | 90 | Impact |
| Paver | 85 | Continuous |
| Pneumatic Tools | 85 | Continuous |
| Pumps | 77 | Continuous |
| Rock Drill | 85 | Continuous |
| Scraper | 85 | Continuous |
| Slurry Trenching Machine | 82 | Continuous |
| Soil Mix Drill Rig | 80 | Continuous |
| Street Sweeper | 80 | Continuous |
| Tractor | 84 | Continuous |
| Truck (dump, delivery) | 84 | Continuous |
| Vacuum Excavator Truck (vac-truck) | 85 | Continuous |
| Vibratory Compactor | 80 | Continuous |
| Vibratory Pile Driver | 95 | Continuous |
| All other equipment with engines larger than 5 HP | 85 | Continuous |

**Notes:**

1 **Measured at 50 feet from the construction equipment, with a "slow" (1 sec.) time constant.**

2 **Noise limits apply to total noise emitted from equipment and associated components operating at full power while engaged in its intended operation.**

3 **Portable Air Compressor rated at 75 cfm or greater and that operates at greater than 50 psi.**

To reduce noise from construction, a series of best practices are provided including implementation measures included in the LRDP.

1. Implement LRDP Mitigation Measure 4.10-1.

2. Construction equipment should be well maintained and used judiciously to be as quiet as practical.

3. Utilize 'quiet' models of air compressors and other stationary noise sources where technology exists;

4. Equip all internal combustion engine-driven equipment with mufflers, which are in good condition and appropriate for the equipment;

5. Prohibit all unnecessary idling of internal combustion engines;

6. Post the schedule of major construction activities and allowable construction hours;

7. Designate a disturbance coordinator, responsible for responding to complaints about construction noise. The name and telephone number of the disturbance coordinator shall be posted at the construction site and made available to businesses, residences or noise-sensitive land uses adjacent to the construction site;

**Impact 2: Traffic Noise -** *Less than significant*

The key noise-related issue for this project is the potential increase in vehicular traffic noise at the Solano Park residential area and in the vicinity of the Hyatt Place Hotel resulting from the re-alignment of Old Davis Road. Pursuant to CEQA Guidelines, and the significance criteria established by the UC Davis Long-Range Development Plan, a significant noise impact will occur if there is a substantial increase in noise at a sensitive receptor location. What constitutes a substantial increase is dependent upon the future CNEL. The existing noise level in the area is 59-60 dBA CNEL. The significance threshold defines a substantial increase to be 5 dBA CNEL for a location where the existing the noise level without the project is projected to range from 50-64 dBA CNEL.

The effect of future roadway traffic on the noise environment was calculated using the Federal Highway Administration's Traffic Noise Model (TNM). The traffic noise model is a three-dimensional model that takes into account the volume and speed of traffic on the roadway, the horizontal and vertical alignment of the roadway, and the horizontal and vertical location of the noise sensitive receptors potentially affected by roadway noise. The proposed project is a two-lane roadway with an expected average speed of 25 mph. Automobile traffic will be the predominant vehicle type. For noise modeling purposes, it was assumed that 1% of the vehicles would generate noise levels comparable to medium trucks and buses and 1% of the vehicles would generate noise levels comparable to heavy trucks, with the balance of the vehicles regular automobile traffic. Traffic data used in the modeling was supplied by Fehr & Peers, the transportation consultant for the project. A stop sign will be located near the residences. The presence or absence of a stop sign will not measurably affect future traffic noise levels in the area. When the roadway is realigned, and the hotel addition is complete, traffic noise levels generated by the roadway are calculated to, independent of other ambient noise sources, cause the noise level to be about 48 dBA CNEL at the closest point of the Solano Park residential area and about 49 dBA CNEL at the Hyatt Place Hotel. When noise from traffic on the proposed roadway is added to existing ambient noise levels, the increase in noise levels would be about 0.3 dBA CNEL. The future CNEL would be in the same range as the existing level, and the significance threshold is an increase of 5 dBA CNEL or greater. The projected increase would be minimal resulting in a less-than-significant environmental impact.

The transportation consultant also provided traffic volumes for cumulative scenarios. Vehicular traffic noise on the new roadway segment is calculated to cause noise levels of about 49-50 dBA $L_{eq}$ at the Solano Park residential area and 51 dBA $L_{eq}$ at the Hyatt Place Hotel. The calculated increase in the CNEL is, again, less than 0.5 dBA CNEL, a less-than-significant impact.