Appendix 3.12-1

# Noise and Vibration Technical Report

# Berkeley Space Center at NASA Research Park

# Noise and Vibration Technical Report

**Prepared for:**

University of California, Berkeley

National Aeronautics and Space Administration
Ames Research Center

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# Contents

# Tables

# Figures

*All figures can be found at the end of their respective chapter.*

# Acronyms and Abbreviations

| Acronym | Definition |
|---|---|
| µPa | microPascals |
| Active Uses | complementary accessory uses that would be publicly accessible |
| ARC | Ames Research Center |
| Caltrans | California Department of Transportation |
| CEQA | California Environmental Quality Act |
| CNEL | Community Noise Equivalent Level |
| dB | decibel |
| dBA | A-weighted decibel |
| Development Guidelines | Berkeley Space Center Development Guidelines |
| FTA | Federal Transit Administration |
| General Plan | Noise Compatibility Standards for Land Use in Santa Clara County |
| Hz | Hertz |
| in/s | inch per second |
| joint EIR/EIS | joint environmental impact report/environmental impact statement |
| kHz | kilohertz |
| kW | kilowatt |
| $L_{dn}$ | day-night sound level |
| $L_{eq}$ | equivalent sound level |
| $L_{max}$ | maximum sound level |
| $L_{min}$ | minimum sound level |
| $L_V$ | vibration velocity level |
| $L_{xx}$ | percentile-exceeded sound level |
| Master Plan | Berkeley Space Center Master Plan |
| NASA ARC | National Aeronautics and Space Administration's Ames Research Center |
| NEPA | National Environmental Policy Act |
| NRP | NASA Research Park |
| PPV | peak particle velocity |
| proposed project/ proposed action | Berkeley Space Center at NASA Research Park |
| R&D | research-and-development |
| rms | root-mean-square |
| SEL | sound equivalent level |
| Short-Term Lodging | short-term lodging, including associated amenities |
| sound pressure level | SPL |
| Student/Faculty Housing | student/faculty housing, including associated amenities |
| traffic noise model | TNM |
| UC Regents | The Regents of the University of California |

# Glossary

**Ambient Noise Level** – The pre-project background noise level, which is often used interchangeably with "existing noise." The ambient noise level is the all-encompassing composite of noise (from all sources near and far) associated with a given environment.

**A-Weighted Decibel (dBA)** – An overall frequency-weighted sound level in decibels that approximates the frequency response of the human ear. The dBA scale is the most widely used scale for environmental noise assessment.

**Community Noise Equivalent Level (CNEL)** – The energy average of the A-weighted sound levels occurring during a 24-hour period, with 5 dB added to the sound levels occurring during the period from 7:00 p.m. to 10:00 p.m. and 10 dB added to the sound levels occurring during the period from 10:00 p.m. to 7:00 a.m. $L_{dn}$ and CNEL are typically within 1 dB of each other and interchangeable for the purposes of an environmental impact report (EIR).

**Day-Night Average Sound Level ($L_{dn}$ or LDN)** – The energy average of the A-weighted sound levels occurring during a 24-hour period, with a 10 dB penalty added to sound levels between 10:00 p.m. and 7:00 a.m.

**Decibel (dB)** – A measure of sound on a logarithmic scale that indicates the squared ratio of sound pressure amplitude to a reference sound pressure amplitude. The reference pressure is 20 micropascals.

**Equivalent Sound Level ($L_{eq}$)** – The equivalent steady-state sound level containing the same total acoustical energy as a time-varying signal over a given sample period. $L_{eq}$ is typically computed over 1-, 8-, and 24-hour sample periods. The 1-hour A-weighted equivalent sound level (1-hour $LA_{eq}$) is the energy average of A-weighted sound levels occurring during a 1-hour period.

**Frequency (Hz)** – The frequency of a sound is equivalent to its pitch in musical terms. The units of frequency are expressed in Hertz (Hz), which represents the number of cycles (vibrations) per second.

**Maximum Sound Level ($L_{max}$)** – The maximum sound level measured during a given measurement period.

**Minimum Sound Level ($L_{min}$)** – The minimum sound level measured during a given measurement period.

**Noise** – Sound that is loud, unpleasant, unexpected, or otherwise undesirable.

**Noise-Sensitive Receptors** – Locations that may potentially be adversely affected by the addition of a new source of noise (typically including residential dwellings, educational and religious facilities, and, in some cases, certain commercial land uses)

**Peak Particle Velocity (PPV)** – PPV is defined the maximum instantaneous positive or negative peak amplitude of vibration velocity. The unit of measurement for PPV is inches per second (in/sec). Unlike many quantities used in the study of environmental acoustics, PPV is typically presented with use of linear values, not a dB scale.

**Point Source** – A source that radiates sound as if from a single point.

**Receiver, or Noise-Sensitive Receiver** – A stationary position at which noise or vibration levels are specified, typically representative of one or more noise- or vibration-sensitive land uses such as a home, school, hotel, etc.

**Root Mean Square (RMS)** – Groundborne vibration can be quantified by the root-mean-square velocity amplitude. The root-mean-square amplitude is expressed in terms of the vibration decibel level, a metric that is typically used to assess human annoyance.

**Sound Exposure Level (SEL)** – The level of sound accumulated over a given time interval or event. Technically, the sound exposure level is the level of the time-integrated, mean-square A-weighted sound for a stated time interval or event, with a reference time of 1 second.

**Sound Level Meter (SLM)** – An instrument used for the measurement of sound level, with a standard frequency-weighting and standard exponentially weighted time averaging.

**Sound Pressure Level (SPL)** – A physical measure of the magnitude of a sound related to the sound's energy. The terms *sound pressure level* and *sound level* are often used interchangeably. It is measured in decibels.

**Sound Transmission Class (STC)** – A single-number rating used to compare the sound insulation properties of walls, floors, ceilings, windows, or doors. This rating is designed to correlate with subjective impressions of the ability of building elements to reduce the overall loudness of speech, radio and television sound, and similar noise sources in offices and buildings.

**Sound** – A vibratory disturbance transmitted by pressure waves through a medium such as air or water that is capable of being detected by a receiving mechanism, such as the human ear or a microphone.

**Vibration Velocity Level (or Vibration Decibel Level, VdB)** – The root-mean-square velocity amplitude for measured ground motion, expressed in decibels.

# Executive Summary

Moffett Partners, LLC (Project Proponent), a joint venture of The Regents of the University of California (UC Regents) and SKSP NRP, LLC, is proposing a master-planned mixed-use academic and research project, referred to as the Berkeley Space Center at the National Aeronautics and Space Administration (NASA) Research Park (NRP) (proposed project/proposed action).[1] The Project Proponent will require the UC Regents' authorization under the California Environmental Quality Act (CEQA) to proceed with the proposed project and NASA's approval to proceed following analysis consistent with the National Environmental Policy Act (NEPA). NASA is the NEPA Lead Agency for the proposed action and, as the Authority Having Jurisdiction, NASA would issue building permits and oversee mitigation monitoring related to development and operation of the proposed project. The UC Regents is the CEQA Lead Agency for the proposed project and would provide authorization before the proposed action is submitted for NASA's approval.[2]

The proposed project is located at NASA's Ames Research Center (NASA ARC) on an approximately 39-acre site (Project Site), along with approximately 6 acres of off-site areas (Off-Site Areas) where utility improvements and building demolition would take place. Together, the Project Site and Off-Site Areas comprise the approximate 45-acre limits of work (Limits of Work).

The University of California, Berkeley (UC Berkeley) (on behalf of UC Regents) and NASA are preparing a joint environmental impact report/environmental impact statement (joint EIR/EIS) for the proposed project that evaluates the following:[3]

- CEQA Proposed Project (NEPA Build Alternative 1)
- CEQA Reduced Density Alternative (NEPA Build Alternative 2)
- CEQA Reduced Height Alternative
- CEQA No-Project/Existing Conditions Alternative
- NEPA No-Action Alternative

The Project Proponent has identified one variant/sub-alternative that includes certain project features that are different from those of the CEQA Proposed Project and CEQA Reduced Density Alternative: the No Student/Faculty Housing Variant/Sub-Alternative (Variant).[4] In addition, the CEQA Proposed Project could also include a Water Reuse Facility (WRF) Option or a Central Utility Plant (CUP) Option.[5]

This technical report evaluates the potential short- and long-term noise and vibration effects associated with construction and operation of the proposed project. The report documents the assumptions, methodologies, and findings used to support the impact analysis.

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1 Throughout this report, *proposed project* refers to both the proposed project (under the California Environmental Quality Act) and the proposed action (under the National Environmental Policy Act).

2 UC Regents is a legal entity that includes all of the University of California campuses.

3 Throughout this report, the discussion of the CEQA Proposed Project and the CEQA Reduced Density Alternative also applies to the corresponding Build Alternative under NEPA.

4 Throughout this report, *Variant* refers to both the Variant (under CEQA) and the Sub-Alternative (under NEPA).

5 Under the Water Reuse Facility Option, portions of the non-potable supply would be provided on-site rather than by Mountain View. The Central Utility Plant Option would provide a centralized heating and cooling system for all buildings instead of building-by-building heating, ventilation, and air-conditioning (HVAC) systems.

# Construction Noise

Project noise modeling demonstrated that construction of the CEQA Proposed Project and the CEQA Reduced Density Alternative would result in noise levels in excess of thresholds during daytime hours and nighttime hours. Because the construction equipment proposed for use and overall footprint of construction would be the same under the CEQA Proposed Project (with either utility option and with the Variant) and the CEQA Reduced Density Alternative (with or without the Variant), the modeled construction noise levels would be the same regardless of whether the CEQA Proposed Project (with or without the WRF and CUP) or the CEQA Reduced Density Alternative is developed. Mitigation Measures NOI-1 and NOI-2 have been identified to reduce construction noise levels. However, it may not be possible to reduce all daytime and nighttime construction noise to a level below the significance thresholds used in this assessment, even with implementation of all feasible mitigation measures.

With respect to heavy and haul truck noise, traffic from construction truck activity for the CEQA Proposed Project and the CEQA Reduced Density Alternative, including utility options and the Variant, would result in a less than a 3-decibel (dB) increase in noise levels along all segments that comprise the project truck route (noting that a change of 3 dB is considered barely perceptible) according to the noise modeling results. Note that there are also no noise-sensitive receptors along the roadway segments that comprise the haul route north of U.S. 101. For this reason, and because the maximum modeled noise increase resulting from construction truck activity would be less than the 3 dB increase threshold established for the project, noise effects related to construction truck activity would not be considered substantial.

# Operations

The makes and models for project mechanical equipment (including heating, cooling, and ventilation equipment and equipment associated with battery energy storage systems [BESS]) have not been finalized and the quantities of each type of equipment have not been determined. Therefore, the analysis included in this technical report is based on reasonable assumptions regarding the types and locations of equipment proposed for each project building, as provided by the Project Proponent, and readily available noise data for example/similar equipment. The example equipment analysis completed for the project indicated that mechanical equipment noise under the CEQA Proposed Project and the CEQA Reduced Density Alternative would have the potential to exceed the applicable noise standards at the nearest noise-sensitive receptors without mitigation. In addition, the mechanical equipment analysis for the CUP Option and WRF Option demonstrated that the equipment associated with these uses may also result in noise levels in excess of the thresholds without mitigation (although estimated noise levels from the equipment were lower than the estimated noise levels from the aforementioned rooftop mechanical equipment). Therefore, mechanical equipment noise effects under these options would be the same as the levels identified for the CEQA Proposed Project. Given the uncertainty over the final equipment selections and locations, the potential exists for actual noise levels to be higher or lower than those presented in this analysis. For the reasons described above, Mitigation Measure NOI-3 has been identified to reduce noise levels from mechanical equipment and ensure that applicable noise exposure limits are not exceeded.

In general, twelve 500-kilowatt (kW) diesel generators with Tier 4 Final engines would be installed at the Project Site to provide emergency power, providing a total of 6 megawatts of backup generation capacity. If either the CUP Option or the WRF Option is implemented as part of the CEQA Proposed Project, 13 generators would be installed at the Project Site. The makes and models of the project's emergency generators have not been finalized. Although generator testing would be temporary (lasting 2 to 4 hours) and intermittent (occurring once per month), modeling conducted with example data for a single 500 kW generator indicates that noise from emergency generator testing would exceed the applied daytime noise standards at nearby residential land uses. Mitigation Measure NOI-4 has been identified to reduce noise levels such that applicable noise exposure limits are not exceeded during generator testing. With implementation of this mitigation measure, noise levels from emergency generator testing would be reduced to below significance thresholds.

With respect to noise from delivery trucks and loading activity, the delivery of goods (e.g., food and parcel deliveries, etc.) is a common occurrence in cities and urban environments. The Project Site is in an urban area, and background ambient noise levels are elevated by both the nearby U.S. 101 and Moffett Federal Airfield. Measured existing noise levels at the Project Site and at nearby sensitive uses were in the range of 63 to 75 dBA $L_{dn}$. Usage at each project loading dock or loading zone would be short term, sporadic, and low intensity. The vast majority of daily deliveries would be completed with medium-sized trucks and/or United Parcel Service- (UPS-) style delivery vans; only one delivery per day with a large truck (i.e., greater than 40 feet) is expected per building. None of the proposed project land uses are substantial truck-trip generators such as warehousing or distribution centers. All project loading docks that are internal to buildings would not be anticipated to generate substantial noise outside the project buildings. While some project buildings would have external loading zones, all of these buildings would also have internal loading docks. As a result, external loading at these buildings would still be limited. In addition, exterior loading zones would not accommodate deliveries by large trucks (i.e., greater than 40 feet in length); all such deliveries would take place at interior project loading docks. Further, loading would typically occur during daytime hours when ambient noise levels are higher and when people are less sensitive to noise. For the reasons described above, the project would not be expected to result in substantial increases in noise in the project area from delivery trucks and loading or unloading activities.

With regards to traffic noise, none of the analyzed roadway segments under CEQA Proposed Project and the CEQA Reduced Density Alternative are estimated to experience a project-related 3 dB or greater increase in noise at sensitive land uses when comparing existing (measured) noise levels to existing-plus-project noise levels (with consideration given to existing measured noise). Therefore, traffic noise increases associated with the project would not be considered substantial. Note that project traffic volumes would decrease with implementation of Mitigation Measure TRAN-1 Mitigated TDM Plan that Further Reduces VMT, in Section 3.16, *Transportation*, of the joint EIR/EIS; this would further reduce project-related traffic noise to levels below those presented in this analysis.

Estimated parking garage noise levels would be well below the existing (measured) average daytime noise levels (i.e., for the CEQA Proposed Project, 15 to 28 dB lower; for the CEQA Reduced Density Alternative, 17 to 31 dB lower) at nearby noise-sensitive receptors (i.e., the Wescoat Village residences), based on the modeling results. The resulting overall increases in ambient noise levels would be negligible (0.2 dB or less) and would not be considered substantial.

Estimates of potential noise levels resulting from amplified music or speech at programming or events under the CEQA Proposed Project and the CEQA Reduced Density Alternative were based on previous measurements of events with amplified music and speech. Estimated noise levels from such events at the nearest sensitive uses were well below the existing average daytime noise levels at the nearest noise-sensitive receptors. In addition, events, including outdoor events with amplified sound at the project's Central Green, would be infrequent (approximately 12 per year).

Potential noise levels resulting from amplified music or speech at programming or events under the CEQA Proposed Project and the CEQA Reduced Density Alternative were estimated based on previous measurements of events with amplified music and speech. Estimated noise levels from such events at the nearest sensitive uses were well below the existing average daytime noise levels at the nearest noise-sensitive receptors. In addition, events, including outdoor events with amplified sound at the project's Central Green, would be infrequent (approximately 12 per year).

# Construction Vibration

Vibration-induced damage effects could occur under the CEQA Proposed Project and the CEQA Reduced Density Alternative if a vibratory roller for in-street utility work is used within 22 feet of off-site vibration-sensitive structures (i.e., structures that are similar to the "historic and some old buildings" California Department of Transportation [Caltrans] structure type, with an applicable peak particle velocity [PPV] vibration criterion of 0.25 inch per second).[6] Note that Buildings 6, 16, and 510 are considered to be vibration-sensitive structures due to their age and location within approximately 22 feet of the Limits of Work. Residential structures west of the Project Site are most likely similar to the "new residential structures" type because they were constructed around 2005; modeling results demonstrated that vibration-related damage effects would not be expected to occur at these structures. The equipment proposed for use under the project, besides a vibratory roller, would not be expected to result in vibration levels in excess of applicable damage criteria for any adjacent structures. Implementation of Mitigation Measure NOI-5 would be required if a vibratory roller is proposed for use within 22 feet of vibration-sensitive structures. This measure would reduce construction-related vibration effects by ensuring that specific buffer distances between vibration-sensitive structures would be maintained and, when it is not possible to maintain said buffer distances, by mitigating potential building damage through pre- and post-construction surveys and building repairs, if necessary. Implementation of this mitigation measure would avoid or reduce vibration-related damage effects (e.g., by returning damaged structures to pre-construction conditions).

With respect to vibration-related annoyance for residences or places where people sleep, nighttime on-site concrete pours and off-site in-street utility work would both be expected to result in vibration levels below the "strongly perceptible" annoyance threshold (used to assess the potential for sleep disturbance) at nearby residential land uses under CEQA Proposed Project and the CEQA Reduced Density Alternative. In addition, work in a given area would be short term. Vibration-related annoyance effects are generally greater when individuals are exposed to vibration for longer durations.

Finally, an analysis was also conducted to determine if vibration from project construction activities would have the potential to interfere with the use of vibration-sensitive equipment at nearby off-site research or laboratory buildings that have vibration-sensitive equipment (e.g., the U.S. Geological

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6 For purposes of this analysis, the structures most similar to the "historic and some old buildings" Caltrans structure type are called "vibration-sensitive structures" in the vibration-related damage discussion.

Survey [USGS] Building 800, which is north of the Project Site and north of Westcoat Road). The analysis demonstrated that vibration generated by project construction equipment may exceed applied thresholds at nearby sensitive research equipment and may disrupt the use of such equipment during project construction. Mitigation Measure NOI-6 has been identified to reduce effects on vibration-sensitive equipment. Even with implementation of all feasible mitigation, it may not be possible to fully reduce interference effects on nearby vibration-sensitive laboratory or research equipment.

# Chapter 1
# **Introduction**

Moffett Partners, LLC (Project Proponent), a joint venture of The Regents of the University of California (UC Regents) and SKSP NRP, LLC, is proposing a master-planned mixed-use academic and research project, referred to as the Berkeley Space Center at the National Aeronautics and Space Administration (NASA) Research Park (NRP) (proposed project/proposed action).[7] The Project Proponent will require authorization from the UC Regents to proceed with the proposed project under the California Environmental Quality Act (CEQA), and NASA's approval to proceed following analysis consistent with the National Environmental Policy Act (NEPA). NASA is the NEPA Lead Agency for the proposed action and, as the Authority Having Jurisdiction, NASA would issue building permits and monitor applicable mitigation measures related to development and operation of the proposed project. The UC Regents is the CEQA Lead Agency for the proposed project and would provide authorization before the proposed action is submitted for NASA's approval.[8]

The University of California, Berkeley (UC Berkeley) (on behalf of UC Regents) and NASA are preparing a joint environmental impact report/environmental impact statement (joint EIR/EIS) for the proposed project that evaluates the following:[9]

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The Project Proponent has identified one variant/sub-alternative that includes certain project features that are different from those of the CEQA Proposed Project and CEQA Reduced Density Alternative: the No Student/Faculty Housing Variant/Sub-Alternative (Variant).[10] In addition, the CEQA Proposed Project could also include a Water Reuse Facility (WRF) Option or a Central Utility Plant (CUP) Option.[11]

This technical report has been prepared to support UC Berkeley's and NASA's environmental review process and provide information regarding the potential noise and vibration impacts associated with the proposed project. This report characterizes existing conditions and evaluates the potential for short- and long-term noise and vibration effects associated with construction and operation of the proposed project. In addition, this report documents the assumptions, methodologies, and findings used to support the impact analysis. Furthermore, where applicable, this report identifies mitigation measures that would avoid or minimize specific effects on noise and vibration.

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9 Throughout this report, the discussion of the CEQA Proposed Project and the CEQA Reduced Density Alternative also applies to the corresponding Build Alternative under NEPA.

10 Throughout this report, *Variant* refers to both the Variant (under CEQA) and the Sub-Alternative (under NEPA).

11 Under the Water Reuse Facility Option, portions of the non-potable supply would be provided on-site rather than by Mountain View. The Central Utility Plant Option would provide a centralized heating and cooling system for all buildings instead of building-by-building heating, ventilation, and air-conditioning (HVAC) systems.

# 1.1 Organization of This Technical Report

The report comprises the following chapters:

- Glossary
- Executive Summary
- Chapter 1, Introduction
- Chapter 2, Project Description, describes the proposed project.
- Chapter 3, Affected Environment/Existing Setting, provides background information on noise and vibration fundamentals, and describes the existing environmental setting with respect to noise and vibration.
- Chapter 4, Regulatory Setting, introduces federal, state, regional and local laws, regulations, and policies considered in the analysis of noise and vibration.
- Chapter 5, Impact Analysis, describes the methods for evaluating effects, the thresholds of significance, and assesses the potential for noise and vibration effects to result from construction and operation of the project.
- Chapter 6, References, provides complete reference information for the published, online, agency, institutional, and individual sources consulted in preparation of this report.
- Chapter 7, Preparers, identifies the authors of this report.

  In addition, supporting information is provided in the following appendix:

  - Appendix A, Noise and Vibration Appendix

# Chapter 2
# Project Description

## 2.1 Project Location

The proposed project is located at NASA's Ames Research Center (NASA ARC), as depicted on Figure 2-1, on an approximately 39-acre project site (Project Site), along with approximately 6 acres of off-site areas (Off-Site Areas) where utility improvements and building demolition would take place. Together, the Project Site and Off-Site Areas comprise the approximate 45-acre limits of work (Limits of Work), as depicted on Figure 2-2 and as more fully described below.

The Limits of Work are located primarily on federal land within NASA ARC, an approximately 2,000-acre facility located in unincorporated Santa Clara County, California between U.S. 101 and the southwestern edge of San Francisco Bay. A small portion of the Off-Site Areas is on federal land owned by the United States Army (Army). The city of Mountain View borders NASA ARC to the north and southwest, and the city of Sunnyvale borders NASA ARC to the southeast and east. NASA ARC is approximately 33 miles south of the city of San Francisco and 8 miles north of the city of San José.

The Project Site is within the city of Mountain View Sphere of Influence but outside of any city's jurisdictional limits. The Off-Site Areas are also within the city of Mountain View Sphere of Influence; most of the Off-Site Areas are outside of any city's jurisdictional limits, with the exception of the northern portion and the southwestern portion, which are within the city of Mountain View. The Project Site is bounded by Wescoat Road to the north and Cody Road to the east.[12] The southern boundary of the Project Site is between Edquiba Road and Girard Road. The western boundary of the Project Site is within an empty lot immediately west of Bailey Road. The Project Site is a portion of Santa Clara County Assessor's Parcel Number 116-18-012.

The Limits of Work is currently developed with 18 one- to three-story buildings that total approximately 185,600 square feet, along with surface parking lots, roadways, and utility infrastructure. The existing buildings are mostly vacant; many were formerly used as ancillary buildings that supported Navy operations (e.g., offices, food service, a gas station, pool, recreation center, and lodging). The other existing buildings within the Limits of Work comprise industrial, storage, and utility facilities. As of mid-2024, approximately 42 people were employed within the Limits of Work; no full time residents or short term occupants (e.g., summer interns) lived within the Limits of Work.

The Project Site is relatively flat, with existing grades gradually sloping from south to north. The Project Site is currently covered with a substantial amount of impervious hardscape. This includes roads, surface parking lots, streets, and paths, which, in total, cover approximately 70 percent of the site. Existing landscaping includes approximately 245 trees located throughout the Project Site.

Soil and groundwater at the Project Site have been affected by contamination associated with the Middlefield-Ellis-Whisman (MEW) Superfund site and the U.S. Navy's operations at Naval Air Station Moffett Field, which is no longer in operation. The MEW extraction and treatment system is directly adjacent to and within the Project Site. Within the Project Site there are several recovery wells and

[12] Cody Road would be realigned to the east as part of the proposed project and would be the eastern boundary of the Project Site.

underground piping for the treatment system. No potable water supplies are fed or contaminated by NASA ARC groundwater; all potable water is purchased from the San Francisco Public Utilities Commission, which contains some portion of off-site groundwater sources.

## 2.2 Proposed Berkeley Space Center Master Plan and Proposed Berkeley Space Center Development Guidelines

The proposed project will include the proposed Berkeley Space Center Master Plan (Master Plan), which establishes the overall project vision, conceptual plans, and illustrative renderings, and the proposed Berkeley Space Center Development Guidelines (Development Guidelines), which provide Maximum and Minimum Development Parameters and Standards for the proposed project buildings and open space. The Maximum and Minimum Development Parameters are a conceptual layout depicting the horizontal and vertical dimensions of the project. Standards are mandatory requirements that would be required to be implemented for the project. Together, the Master Plan and the Development Guidelines will be included as part of the project application submitted by the Project Proponent to NASA. The analysis of the environmental impacts of the proposed project is based on the proposed Maximum and Minimum Development Parameters and the Standards established in the Development Guidelines.

## 2.3 Project Characteristics

The proposed project under consideration by NASA (i.e., the proposed action) would include academic and research facilities, consisting of offices, laboratories, research-and-development (R&D) uses, and related amenities (collectively, "Research and Office Uses"); conference center and related amenities ("Conference Uses"); ground-floor retail, food and beverage, maker spaces (i.e., collaborative work spaces for using various tools and materials), and other complementary accessory uses that would be publicly accessible (collectively, "Active Uses"); student/faculty housing, including associated amenities ("Student/Faculty Housing"); short-term lodging, including associated amenities ("Short-Term Lodging"); transportation networks; and open spaces, as well as landscaped spaces, to create a state-of-the-art research and education hub that shapes the future of technology and innovation and advance the UC Regents educational, scientific research, charitable, and other exempt purposes (within the meaning of Section 501(c)(3) of the United States Internal Revenue Code). Figure 2-3 shows the conceptual land use plan for the proposed project.[13] Implementation of the proposed project would include demolition of all existing buildings on the Project Site. In addition, as discussed above, the proposed project also includes Off-Site Areas consisting of utility improvements and building demolition. Together, the Project Site and the Off-Site Areas comprise the Limits of Work.

Pursuant to NEPA, the joint EIR/EIS evaluates the following alternatives at an equal level of detail:

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[13] Both the parcel boundary and the Project Site boundary are shown in the conceptual plans. The parcel boundary includes the leased premises; it is provided for informational purposes only. The Project Site boundary includes the area that would be redeveloped as part of the proposed project.

- **CEQA Proposed Project (NEPA Build Alternative 1)**, which would create approximately 2.3 million square feet of Research and Office Uses, Conference Uses, Active Uses, Student/Faculty Housing, and Short-Term Lodging for visitors and conference attendees. The CEQA Proposed Project would include approximately 2 million square feet for Research and Office Uses, 25,000 square feet for Conference Uses, 90,000 square feet for Active Uses, 130,000 square feet for Student/Faculty Housing, and 75,000 square feet for Short-Term Lodging. Only the CEQA Proposed Project includes the Water Reuse Facility (WRF) Option and the Central Utility Plant (CUP) Option.[14]
- **CEQA Reduced Density Alternative (NEPA Build Alternative 2)**, which would create approximately 1.4 million square feet of Research and Office Uses, Conference Uses, Active Uses, Student/Faculty Housing, and Short-Term Lodging for visitors and conference attendees. Compared to the CEQA Proposed Project, the CEQA Reduced Density Alternative would provide less space for Research and Office Uses. The CEQA Reduced Density Alternative would include approximately 1.1 million square feet for Research and Office Uses, 25,000 square feet for Conference Uses, 90,000 square feet for Active Uses, 130,000 square feet for Student/Faculty Housing, and 75,000 square feet for Short-Term Lodging.
- **NEPA No-Action Alternative**, under which the proposed action would not be constructed and operated at the Project Site. The buildings within the Limits of Work that are currently operational would continue to be operational. The buildings within the Limits of Work that are currently vacant could be reoccupied consistent with the prior uses of the buildings (e.g., ancillary buildings that supported Navy operations as well as industrial, storage, and utility facilities); reoccupying the vacant buildings would not require construction activity. The NASA Ames Development Plan (NADP), which established NASA's vision for long-term development of NASA ARC, also allows other types of uses at the Project Site. The NEPA No-Action Alternative could result in retaining the approximately 185,600 square feet of existing mixed uses, resulting in approximately 668 employees.[15] The NEPA No-Action Alternative would not result in the reoccupation of any buildings formerly used for lodging; thus, the NEPA No-Action Alternative would not generate any new full-time residents or short term occupants (e.g., summer interns) within the Limits of Work.

Consistent with the guidance in State CEQA Guidelines Sections 15126.6(d) and 15126.6(e), the joint EIR/EIS evaluates the following alternatives in comparison to the CEQA Proposed Project with or without the No Student/Faculty Housing Variant/Sub-Alternative described below. The following alternatives are evaluated qualitatively in the joint EIR/EIS and no detailed analysis is provided in this report.

- **CEQA Reduced Height Alternative,** which would create approximately 2 million square feet of Research and Office Uses, Conference Uses, Active Uses, Student/Faculty Housing, and Short-Term Lodging for visitors and conference attendees. Compared to the CEQA Proposed Project, the CEQA Reduced Height Alternative would achieve lower maximum building height and a greater step-down depth for the Subareas along Wescoat Road. In addition, the CEQA Reduced Height Alternative would provide less space for Research and Office Uses and less space for Student/Faculty Housing compared to the CEQA Proposed Project. The CEQA Reduced Height

14 Under the Water Reuse Facility Option, portions of the non-potable supply would be provided on-site rather than by Mountain View. The Central Utility Plant Option would provide a centralized heating and cooling system for all buildings instead of building-by-building heating, ventilation, and air-conditioning (HVAC) systems.

15 This is based on a generation rate of 3.6 employees per 1,000 square feet.

Alternative would include approximately 1.66 million square feet for Research and Office uses, 25,000 square feet for Conference Uses, 90,000 square feet for Active Uses, 100,000 square feet for Student/Faculty Housing, and 75,000 square feet for Short-Term Lodging.

- **CEQA No-Project/Existing Conditions Alternative**, under which the Project Proponent would not construct and operate the CEQA Proposed Project at the Project Site. The buildings within the Limits of Work that are currently operational would continue to be operational and the buildings within the Limits of Work that are currently vacant would remain vacant.[16]

Table 2-1 summarizes the similarities and differences between the CEQA Proposed Project and the CEQA Reduced Density Alternative.

### 2.3.1 No Student/Faculty Housing Variant/Sub-Alternative

The Project Proponent has identified one variant/sub-alternative that includes certain project features that are different from those of the CEQA Proposed Project and CEQA Reduced Density Alternative: the No Student/Faculty Housing Variant/Sub-Alternative (Variant).[17] Both the CEQA Proposed Project and the CEQA Reduced Density Alternative include the Variant. The Variant would replace the 130,000 square feet of Student/Faculty Housing in Subarea 6 with 130,000 square feet of Research and Office Uses under both the CEQA Proposed Project and CEQA Reduced Density Alternative. Specifically, the Variant would include 90,000 square feet of laboratory and R&D uses, 25,000 square feet of office uses, and 15,000 square feet of academic uses. The Variant would have the same type of land uses; the same general site plan; the same maximum building height; the same amount of Conference Uses, Active Uses, Short-Term Lodging, and open space; the same number of guests; the same roadway infrastructure; the same utility infrastructure; the same parking ratio; and the same construction activities proposed and evaluated under the CEQA Proposed Project and CEQA Reduced Density Alternative. Because the amount of Research and Office Uses and the number of Student/Faculty Housing units would be different under the Variant, the number of bicycle parking spaces, and the number of residents, employees, and students would likewise change. This potential difference in proposed land use is identified as a variant because it may or may not be included as part of the project during implementation. Figure 2-4 shows the conceptual land use plan for the Variant.

**Table 2-1. Summary of Similarities and Differences between the CEQA Proposed Project and the CEQA Reduced Density Alternative**

| Characteristic | CEQA Proposed Project (NEPA Build Alternative 1) | CEQA Reduced Density Alternative (NEPA Build Alternative 2) |
|---|---|---|
| ***Similarities*** | | |
| Types of Land Uses | Same | |
| Location of Land Uses | Same (see Figure 2-3) | |
| Site Plan | Same (see Figure 2-3) | |

[16] This provides a conservative analysis under CEQA for the purposes of comparison.

[17] Throughout this report, *Variant* refers to both the Variant (under CEQA) and the Sub-Alternative (under NEPA).

| Characteristic | CEQA Proposed Project (NEPA Build Alternative 1) | CEQA Reduced Density Alternative (NEPA Build Alternative 2) |
|---|---|---|
| Limits of Work (i.e., Project Footprint) | Same (45 acres, including 39-acre Project Site and 6 acres of Off-Site Areas) | |
| Maximum Building Height[a] | Same (Approximately 80 feet, with an exceedance of up to 25 feet for mechanical equipment and screens) | |
| Amount of Conference Uses, Active Uses, Student/Faculty Housing, Short-Term Lodging, and Open Space | Same (25,000-square-feet of Conference Uses, 90,000 square feet of Active Uses, 145 Student/Faculty Housing units, 100 Short-Term Lodging units, and a minimum of 10 acres of open space) | |
| Number of Residents and Guests | Same (200 guests and 363 residents) | |
| Utility Infrastructure and Roadways[b] | Same | |
| Parking Ratio | Same | |
| Construction Start and End Dates | Same (begin in 2027 and end in 2040) | |
| No Student/Faculty Housing Variant/Sub-Alternative | Same (Variant included) | |
| ***Differences*** | | |
| Number of Internal Floors[a] | Greater to accommodate increased square footage and building height restriction | Less given reduced overall square footage |
| Internal Floor-to-Floor Heights[a] | Lower to accommodate increased square footage and building height restriction | Higher given reduced overall square footage |
| Amount of Square Footage for Research and Office Uses | Greater (2,000,000 square feet) | Less (1,080,000 square feet) |
| Number of Employees and Students[c] | Greater (5,997 employees and 177 students) | Less (3,331 employees and 95 students) |
| Number of Parking Spaces[c] | Greater | Less |
| WRF Option and CUP Option[d] | Yes | No |

Source: Proposed Berkeley Space Center Development Guidelines.

Notes:

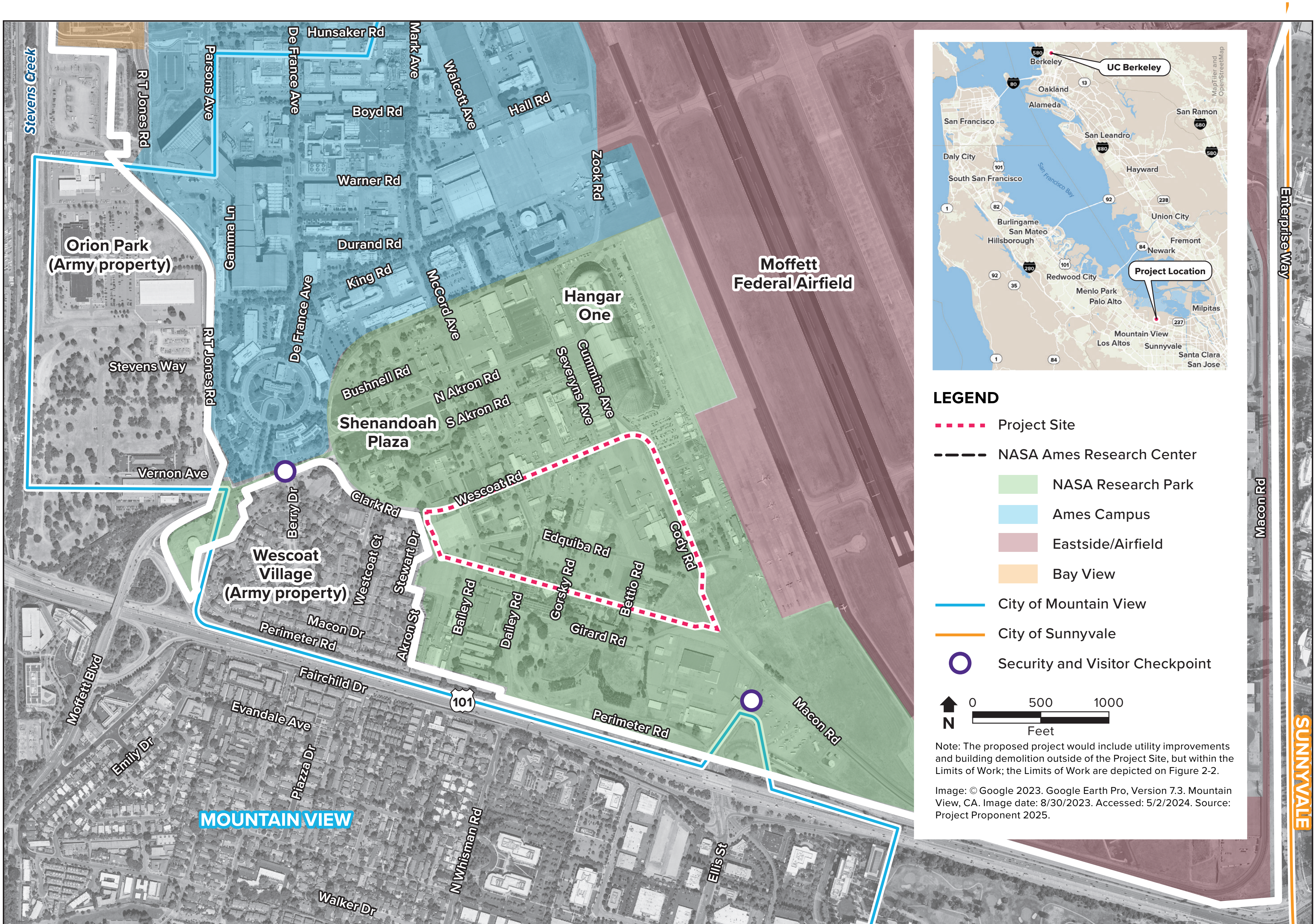
WRF = Water Reuse Facility; CUP = Central Utility Plant

a. The internal floor-to-floor heights could be lower under the CEQA Proposed Project to accommodate more square footage in each building, whereas the internal floor-to-floor heights under the CEQA Reduced Density Alternative could be higher because less square footage would need to be accommodated in each building.

b. Only the CEQA Proposed Project includes the WRF Option and the CUP Option; see footnote "d" for more information regarding these options. The proposed roadways would be the same.

c. The difference in the number of employees, students, and parking is due to the greater amount of Research and Office Uses that would be included in the CEQA Proposed Project.

d Under the WRF Option, portions of the non-potable demand would be met using on-site reuse supply rather than recycled water from Mountain View. The non-potable demand that cannot be met by the WRF Option would require the use of potable water. The CUP Option would provide a centralized heating and cooling system for all buildings instead of building-by-building heating, ventilation, and air-conditioning (HVAC) systems.




Graphics ... 104894 (9-10-2025)

ICF

**Figure 2-1**
**Project Location**
Berkeley Space Center at NASA Research Park

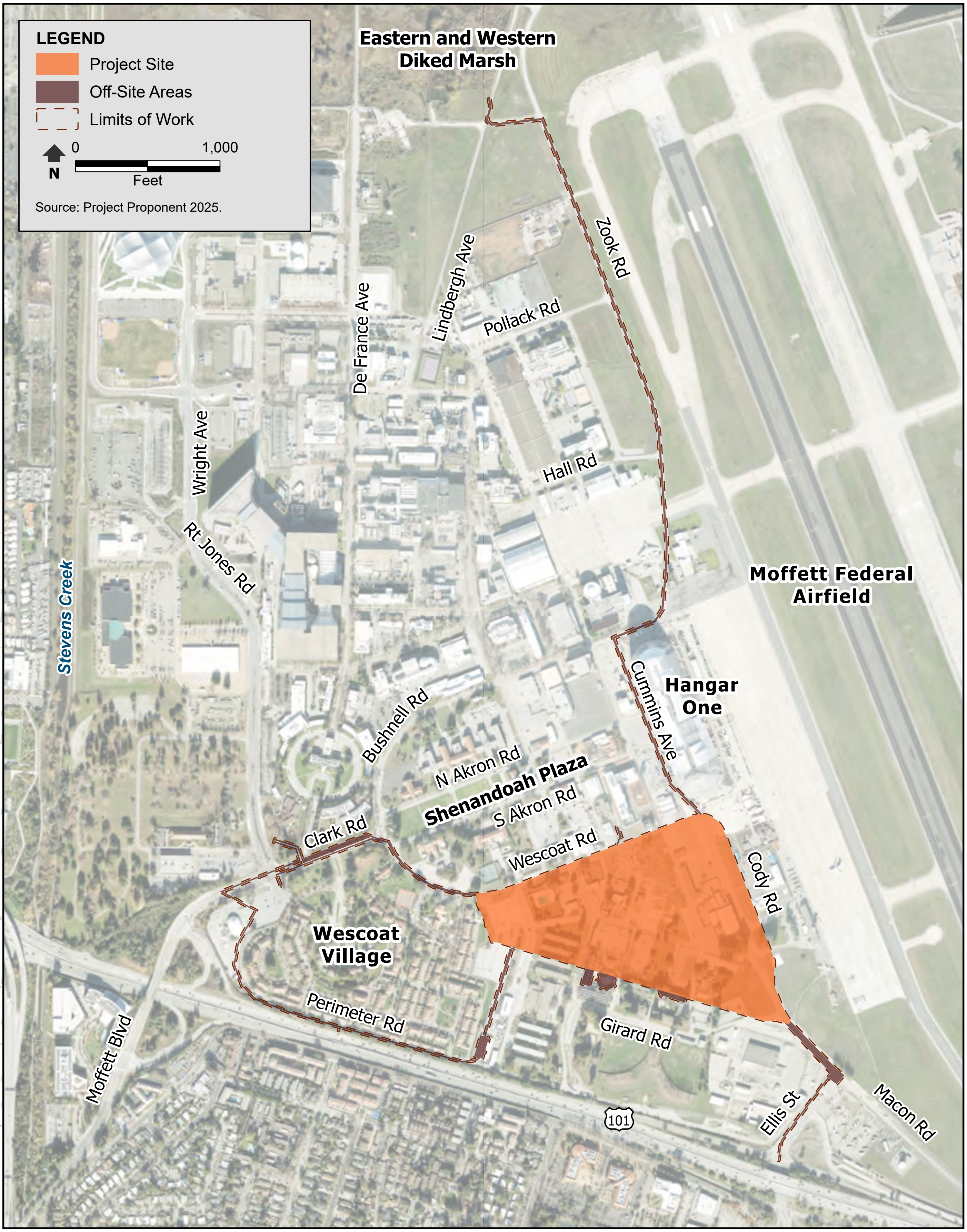




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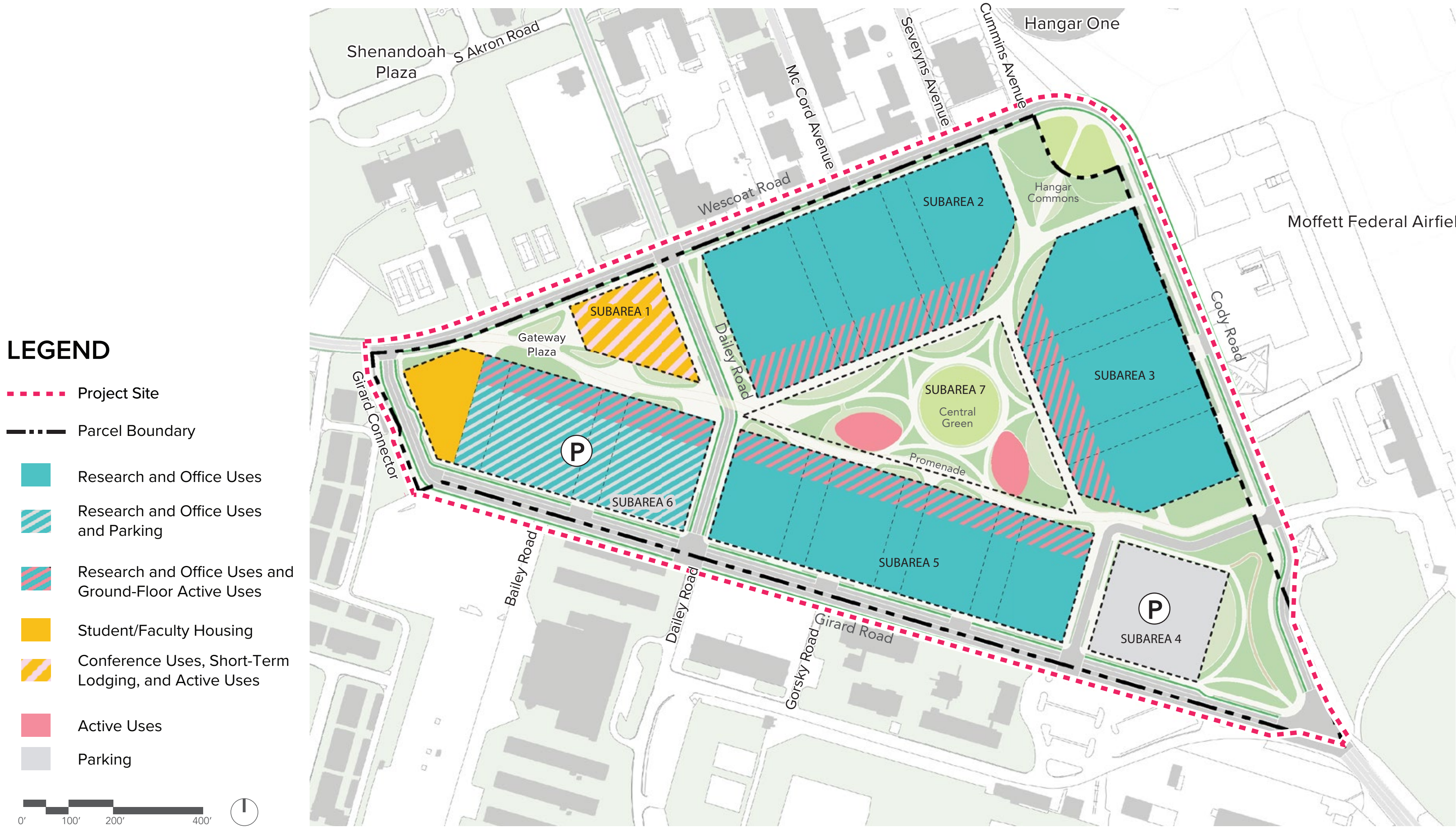
**Figure 2-2**
**Limits of Work**
Berkeley Space Center at NASA Research Park



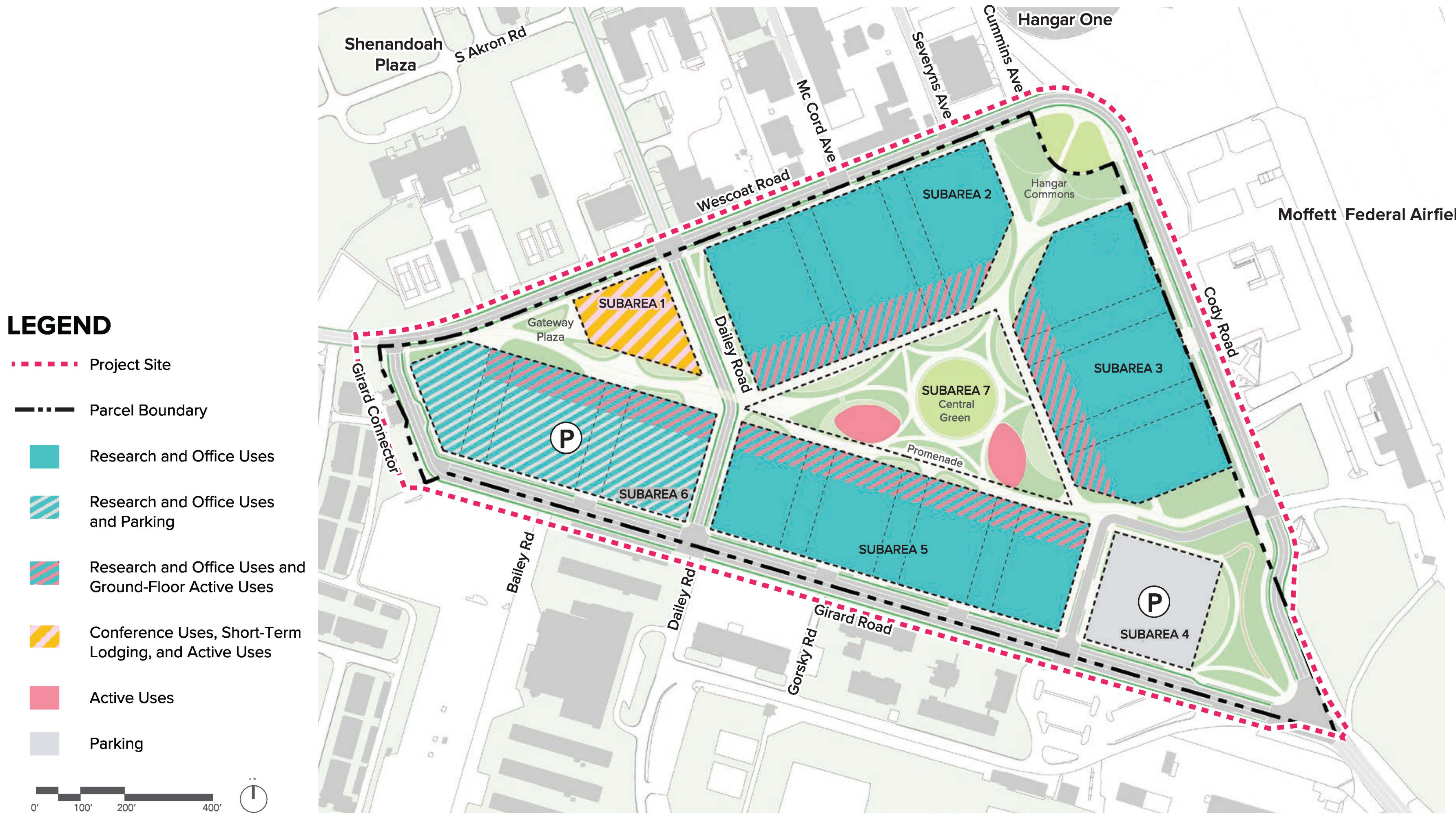

Note: Images are conceptual until after project approval. The proposed project would include utility improvements and building demolition outside of the Project Site, but within the Limits of Work; the Limits of Work are depicted on Figure 2-2. The parcel boundary includes the leased premises; it is provided for informational purposes only.

Source: Project Proponent 2024.

Graphics ... 104894 (9-9-2025) tg

ICF

**Figure 2-3**
**Conceptual Land Use Plan for the CEQA Proposed Project and CEQA Reduced Density Alternative**
Berkeley Space Center at NASA Research Park




Note: Images are conceptual until after project approval. The proposed project would include utility improvements and building demolition outside of the Project Site, but within the Limits of Work; the Limits of Work are depicted on Figure 2-2. The parcel boundary includes the leased premises; it is provided for informational purposes only.

Source: Project Proponent 2025.

Graphics … 104894 (9-10-2025) TG

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**Figure 2-4**

**Conceptual Land Use Plan (No Student/Faculty Housing Variant)**

Berkeley Space Center at NASA Research Park

Chapter 3
# Affected Environment/Environmental Setting

## 3.1 Noise Fundamentals

Sound can be described as the mechanical energy of a vibrating object transmitted by pressure waves through a liquid or gaseous medium (e.g., air) to a hearing organ, such as a human ear. Noise is often defined as sound that is objectionable because it is unwanted, disturbing, or annoying.

In the science of acoustics, the fundamental model consists of a sound (or noise) source, a receptor, and the propagation path between the two. The loudness of the noise source and the obstructions or atmospheric factors, which affect the propagation path to the receptor, determine the sound level and the characteristics of the noise perceived by the receptor.

The sections that follow provide an explanation of key concepts and the acoustical terms used in the analysis of environmental and community noise.

### 3.1.1 Frequency, Amplitude, and Decibels

Continuous sound can be described by its *frequency* (pitch) and *amplitude* (loudness). A low-frequency sound is perceived as low in pitch; a high-frequency sound is perceived as high-pitched. Frequency is expressed in terms of cycles per second, or Hertz (Hz) (e.g., a frequency of 250 cycles per second is referred to as 250 Hz). High frequencies are sometimes more conveniently expressed in kilohertz (kHz), or thousands of Hz. The audible frequency range for humans is generally between 20 Hz and 20,000 Hz.

The amplitude of pressure waves generated by a sound source correlates with the loudness of that source. The amplitude of a sound is typically described in terms of sound pressure level (SPL), also referred to simply as the sound level. The SPL refers to the root-mean-square (rms)[18] pressure of a sound wave and is measured in units called micropascals (μPa). One μPa is approximately one hundred-billionth (0.00000000001) of normal atmospheric pressure. Sound pressure amplitudes for different kinds of noise environments can range from less than 100 to more than 100,000,000 μPa. Because of this large range of values, sound is rarely expressed in terms of μPa. Instead, a logarithmic scale is used to describe the SPL in terms of decibels, abbreviated dB. The decibel is a logarithmic unit that describes the ratio of the actual sound pressure to a reference pressure (20 μPa is the standard reference pressure level for acoustical measurements in air). Specifically, an SPL, in dB, is calculated as follows:

$$SPL = 20 \times \log_{10}\left(\frac{X}{20\mu Pa}\right)$$

where $X$ is the actual sound pressure and 20 μPa is the reference pressure. The threshold of hearing for young people is about 0 dB, which corresponds to 20 μPa.

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[18] Root mean square (rms) is defined as the square root of the mean (average) value of the squared amplitude of the noise signal.

#### 3.1.1.1 Decibel Calculations

Because decibels represent noise levels on a logarithmic scale, SPLs cannot be added, subtracted, or averaged through ordinary arithmetic. On the dB scale, a doubling of sound energy corresponds to a 3 dB increase. In other words, when two identical sources produce sound of the same loudness, their combined sound level at a given distance is 3 dB higher than that of one source under the same conditions. For example, if one bulldozer produces an SPL of 80 dB, two bulldozers would not produce a combined sound level of 160 dB. Rather, they would combine to produce 83 dB. The cumulative sound level of any number of sources, such as excavators, can be determined using decibel addition. The same decibel addition is used for A-weighted decibels, as described below.

The arithmetic mean (average) of a series of noise levels does not accurately represent the overall average noise level. Instead, the values must be averaged using a linear scale before converting the result back into a logarithmic (dB) noise level. This method is typically referred to as calculating the "energy average" of the noise levels. Table 3-1 demonstrates the general results of adding noise from multiple sources. Note that the examples summarized in this table are rounded to the nearest whole number.

**Table 3-1. Rules for Combining Sound Levels by Decibel Addition**

| When two decibel values differ by… | …add the following amount to the higher decibel value | Example |
|---|---|---|
| 0 to 1 dB | 3 dB | 60 dB + 61 dB = 64 dB |
| 2 to 3 dB | 2 dB | 60 dB + 63 dB = 65 dB |
| 4 to 9 dB | 1 dB | 60 dB + 69 dB = 70 dB |
| 10 dB or more | 0 dB | 60 dB + 75 dB = 75 dB |

Source: California Department of Transportation. 2013. *Technical Noise Supplement to the Traffic Noise Analysis Protocol.* September. Available: *https://dot.ca.gov/-/media/dot-media/programs/environmental-analysis/documents/env/tens-sep2013-a11y.pdf*. Accessed: July 9, 2025.

#### 3.1.1.2 A-Weighting

The dB scale alone does not adequately characterize how humans perceive noise. The dominant frequencies of a sound have a substantial effect on human response to that sound. Although the intensity (i.e., 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 in the range of audible frequencies as well as in the way it perceives the SPL in that range. In general, people are most sensitive to the frequency range of 1,000 to 5,000 Hz and perceive sounds within that range better than sounds of the same amplitude at higher or lower frequencies. To approximate the response of the human ear, sound levels of individual frequency bands are weighted (i.e., adjusted), depending on human sensitivity to those frequencies. The resulting SPL is expressed in A-weighted decibels, or dBA.

The A-weighting scale approximates the frequency response of the average young ear when listening to most ordinary sounds. When people make judgments regarding the relative loudness or annoyance of a sound, their judgments correlate well with the A-weighted sound levels of those sounds. Table 3-2 describes typical A-weighted sound levels for various noise sources.

**Table 3-2. Typical A-Weighted Sound Levels**

| Common Outdoor Noise Source | Sound Level (dBA) | Common Indoor Noise Source |
|---|---|---|
| | — 110 — | Rock band |
| Jet flying at 1,000 feet | | |
| | — 100 — | |
| Gas lawn mower at 3 feet | | |
| | — 90 — | |
| Diesel truck at 50 feet at 50 mph | | Food blender at 3 feet |
| | — 80 — | Garbage disposal at 3 feet |
| Noisy urban area, daytime | | |
| Gas lawn mower at 100 feet | — 70 — | Vacuum cleaner at 10 feet |
| Commercial area | | Normal speech at 3 feet |
| Heavy traffic at 300 feet | — 60 — | |
| | | Large business office |
| Quiet urban daytime | — 50 — | Dishwasher in next room |
| Quiet urban nighttime | — 40 — | Theater, large conference room (background) |
| Quiet suburban nighttime | | |
| | — 30 — | Library |
| Quiet rural nighttime | | Bedroom at night |
| | — 20 — | |
| | | Broadcast/recording studio |
| | — 10 — | |
| Lowest threshold of human hearing | — 0 — | Lowest threshold of human hearing |

Source: California Department of Transportation. 2013. *Technical Noise Supplement to the Traffic Noise Analysis Protocol.* September. Available: *https://dot.ca.gov/-/media/dot-media/programs/environmental-analysis/documents/env/tens-sep2013-a11y.pdf*. Accessed: July 9, 2025.

## 3.1.2 Noise Descriptors

Because sound levels can vary markedly over a short period of time, various descriptors or noise “metrics” have been developed to quantify environmental and community noise. These metrics generally describe either the average character of the noise or the statistical behavior of the variations in the noise level. Some of the most common metrics used to describe environmental noise, including those used in this report, are described below.

- **Equivalent Sound Level ($L_{eq}$)** is the most common metric used to describe short-term average noise levels. Many noise sources produce levels that fluctuate over time; examples include mechanical equipment that cycles on and off or construction work, which can vary sporadically. The $L_{eq}$ describes the average acoustical energy content of noise for an identified period of time, commonly 1 hour. Thus, the $L_{eq}$ of a time-varying noise and that of a steady noise are the same if they deliver the same acoustical energy over the duration of the exposure. For many noise sources, the $L_{eq}$ will vary, depending on the time of day. A prime example is traffic noise, which rises and falls, depending on the amount of traffic on a given street or freeway.

- **Maximum Sound Level ($L_{max}$)** and **Minimum Sound Level ($L_{min}$)** refer to the maximum and minimum sound levels, respectively, that occur during the noise measurement period. More specifically, they describe the rms sound levels that correspond to the loudest and quietest 1-second intervals occurring during the measurement.
- **Percentile-Exceeded Sound Level ($L_{xx}$)** describes the sound level exceeded for a given percentage of a specified period. For example, $L_{50}$ is the sound level exceeded 50 percent of the time (e.g., 30 minutes per hour) and $L_{25}$ is the sound level exceeded 25 percent of the time (e.g., 15 minutes per hour).
- **Community Noise Equivalent Level (CNEL)** is a measure of the 24-hour average, A-weighted noise level, which is also time-weighted to "penalize" noise that occurs during evening and nighttime hours when noise is generally recognized to be more disturbing (because people are trying to rest, relax, or sleep). Specifically, 5 dBA is added to the $L_{eq}$ during the evening hours of 7:00 p.m. to 10:00 p.m., 10 dBA is added to the $L_{eq}$ during the nighttime hours of 10:00 p.m. to 7:00 a.m., and the energy average is then taken for the whole 24-hour day.
- **Day-Night Sound Level ($L_{dn}$)** is very similar to the CNEL described above. $L_{dn}$ is also a time-weighted average of the 24-hour A-weighted noise level. The only difference is that no "penalty" is applied to the evening hours of 7:00 p.m. to 10:00 p.m. However, 10 dBA is added to the $L_{eq}$ during the nighttime hours of 10:00 p.m. to 7:00 a.m.; the energy average is then taken for the whole 24-hour day. The abbreviation "$L_{dn}$" is used throughout this chapter; however, some agencies use the alternative abbreviation of "DNL."

Various federal, state, and local agencies have adopted CNEL or $L_{dn}$ as the measure of community noise. Although not identical, CNEL and $L_{dn}$ are normally within 1 dBA of each other when measured in typical community environments, and many noise standards/regulations use the two interchangeably.

## 3.1.3 Sound Propagation

When sound propagates over a distance, it changes in both level and frequency content. The manner in which noise attenuates (decreases) with distance depends on the factors described below. In general, noise attenuates with distance. Roadway noise sources tend to be arranged linearly. Therefore, noise from roadway vehicular traffic attenuates at a rate of approximately 3.0 to 4.5 dB per doubling of distance from the source, depending on the intervening surface (paved or vegetated, respectively).[19] Point sources of noise, such as stationary equipment or construction equipment, typically attenuate at a rate of approximately 6.0 to 7.5 dB per doubling of distance from the source.[20] For example, a sound level of 80 dBA at 50 feet from the noise source will be reduced to 74 dBA at 100 feet, 68 dBA at 200 feet, and so on. Noise levels can also be attenuated by shielding the noise source or providing a barrier between the source and the receptor.

- **Geometric Spreading.** Sound from a single source (i.e., a "point" source) radiates uniformly outward as it travels away from the source in a spherical pattern. The sound level attenuates at a general rate of 6 dBA for each doubling of distance. Highway noise is not a single stationary point source of sound. The movement of vehicles on a highway makes the source of the sound appear to

[19] Ibid.

[20] The 1.5 dB variation in the attenuation rate (6 dB versus 7.5 dB) can result from ground-absorption effects, which occur as sound travels over soft surfaces such as earth or vegetation (with a 7.5 dB attenuation rate) versus hard surfaces such as pavement or hard-packed earth (with a 6 dB rate).

emanate from a line (i.e., a "line" source) rather than from a point. This results in cylindrical spreading rather than the spherical spreading resulting from a point source. The change in sound level (i.e., attenuation) from a line source is generally 3 dBA per doubling of distance.

- **Ground Absorption.** The noise path between the source and the observer is usually close to the ground. The excess noise attenuation from ground absorption occurs due to acoustic energy losses on sound wave reflection. For acoustically "hard" sites (i.e., sites with a reflective surface, such as a parking lot or a smooth body of water, between the source and the receptor), no excess ground attenuation is assumed because the sound wave is reflected without energy losses. For acoustically absorptive or "soft" sites (i.e., sites with an absorptive ground surface, such as soft dirt, grass, or scattered bushes and trees), an excess ground attenuation value of 1.5 dBA per doubling of distance is normally assumed. When added to the geometric spreading, the excess ground attenuation results in an overall drop-off rate of 4.5 dBA per doubling of distance for a line source and 7.5 dBA per doubling of distance for a point source.
- **Atmospheric Effects.** Research by the California Department of Transportation (Caltrans) and others has shown that atmospheric conditions can have a major effect on noise levels. Factors include wind, air temperature (including vertical temperature gradients), humidity, and turbulence. Receptors downwind from a source can be exposed to increased noise levels relative to calm conditions, whereas receptors upwind can have lower noise levels. Increased sound levels can also occur over relatively large distances because of temperature inversion conditions (i.e., increasing temperature with elevation).
- **Shielding by Natural or Human-Made Features.** A large object or barrier in the path between a noise source and a receptor can substantially attenuate noise levels at the receptor. The amount of attenuation provided by this shielding depends on the size of the object, proximity to the noise source and receptor, surface weight, solidity, and the frequency content of the noise source. Natural terrain features (such as hills and dense woods) and human-made features (such as buildings and walls) can substantially reduce noise levels. Walls are often constructed between a source and a receptor with the specific purpose of reducing noise. In addition to the noise that diffracts over the top of a barrier, noise will also diffract around the ends of the barrier, leading to "flanking" noise that can reduce the overall efficacy of the barrier. Assuming it is long enough to minimize the effects of flanking noise, a barrier that breaks the line of sight between a source and a receptor will typically result in at least 5 dB of noise reduction. A higher barrier may provide as much as 20 dB of noise reduction.

## 3.1.4 Human Response to Noise

Noise can have a range of effects on people, including hearing damage, sleep interference, speech interference, performance interference, physiological responses, and annoyance. Each of these is briefly described below.

- **Hearing Damage.** A person exposed to high noise levels can suffer either gradual or traumatic hearing damage. Gradual hearing loss occurs with repeated exposure to excessive noise levels and is most commonly associated with occupational noise exposures in heavy industry or other very noisy work environments. Traumatic hearing loss is caused by sudden exposure to an extremely high noise level, such as a gunshot or explosion at very close range. The potential for noise-induced hearing loss is not generally a concern in typical community noise environments. Noise levels in neighborhoods, even in very noisy airport environs, are not loud enough to cause hearing loss.

- **Sleep Interference.** Exposure to excessive noise levels at night has been shown to cause sleep disturbance. Sleep disturbance refers not only to awakening from sleep but also to effects on the quality of sleep, such as altered sleep patterns and stages. World Health Organization guidelines recommend noise limits of 30 dBA $L_{eq}$ (8-hour average) for continuous noise and 45 dBA $L_{max}$ for single sound events inside bedrooms at night to minimize sleep disturbance (World Health Organization 1999).
- **Speech Interference.** Speech interference can be a problem in any situation where clear communication is desired but is often of particular concern in learning environments (such as schools) or situations where poor communication could jeopardize safety. Normal conversational speech inside homes is typically in the range of 50 to 65 dBA (U.S. Environmental Protection Agency [EPA] 1977); any noise in this range or louder may interfere with speech. As background noise levels rise, the intelligibility of speech decreases, and the listener will fail to recognize an increasing percentage of the words spoken. A speaker may raise his or her voice in an attempt to compensate for higher background noise levels, but this, in turn, can lead to vocal fatigue for the speaker.
- **Performance Interference.** Excessive noise has been found to have various detrimental effects on human performance, including information processing, concentration, accuracy, reaction times, and academic performance. Intrusive noise from individual events can also cause distraction. These effects are of obvious concern for learning and work environments.
- **Physiological Responses.** Acute noise has been shown to cause measurable physiological responses in humans, including changes in stress hormone levels, the pulse rate, and blood pressure. The extent to which these responses cause harm or are signs of harm is not clearly defined, but it has been postulated that they could contribute to stress-related diseases, such as hypertension, anxiety, and heart disease. However, research indicates that the links between environmental noise and permanent health effects are generally weak and inconsistent. Statistically significant health risks have been found from extended exposure to very high noise levels, such as the exposure associated with workers in an industrial setting for 5 to 30 years (World Health Organization 1999).
- **Annoyance.** The subjective effects of annoyance, nuisance, and dissatisfaction are possibly the most difficult to quantify, and no accurate method exists to measure these effects. This difficulty arises primarily from differences in individual sensitivity and habituation to sound, which can vary widely from person to person. What one person considers tolerable can be unbearable to another of equal hearing acuity. An important method in estimating the likelihood of annoyance due to a new sound is comparing it to the existing baseline or "ambient" environment to which that person has adapted. In general, the more the level or tonal (frequency) variations of a sound exceed the previously existing ambient sound level or tonal quality, the less acceptable the new sound will be.

In most cases, effects from sounds typically found in the natural environment would be limited to annoyance or interference. Physiological effects and hearing loss would be more commonly associated with long term human-made noise, such as in an industrial or occupational setting.

Studies have shown that, under controlled conditions in an acoustics laboratory, a healthy human ear is able to discern changes in sound levels of 1 dBA. In the normal environment, the healthy human ear can detect changes of about 2 dBA; however, it is widely accepted that a doubling of sound energy, which results in a change of 3 dBA in the normal environment, is considered just noticeable to most people. A change of 5 dBA is readily perceptible, and a change of 10 dBA is perceived as being twice as loud. Accordingly, a doubling of sound energy (e.g., doubling the volume of traffic on a highway) resulting in a 3 dBA increase in sound would generally be barely detectable.

### 3.1.5 Noise-Sensitive Land Uses

Noise-sensitive land uses are the locations most likely to be adversely affected by excessive noise levels, along with places where quiet is an essential element of their intended purpose. What constitutes a noise-sensitive land use can vary by jurisdiction; however, such uses typically include residential areas, educational and religious facilities, and, in some cases, certain commercial land uses. Noise-sensitive land uses located near the Project Site include the existing Wescoat Village residences west of the Project Site, school uses (i.e., Carnegie Mellon University Silicon Valley and the Ames Child Care Center), and a church (i.e., the Moffet Field Chapel).

## 3.2 Groundborne Vibration Fundamentals

This section describes basic concepts related to groundborne vibration. Groundborne vibration is a small, rapidly fluctuating motion transmitted through the ground. The effects of groundborne vibrations are typically limited to nuisance or annoyance for people; however, at extreme vibration levels, damage to buildings may also occur.

In contrast to airborne sound, groundborne vibration is not a phenomenon that most people experience every day. The ambient groundborne vibration level in residential areas is usually much lower than the threshold of human perception. Most perceptible indoor vibration is caused by sources within buildings, such as mechanical equipment while in operation, people moving, or doors slamming. Typical outdoor sources of perceptible groundborne vibration are heavy construction activity (such as blasting, pile driving, or earthmoving), steel-wheeled trains, and traffic on rough roads. If a roadway is smooth, the groundborne vibration from traffic is rarely perceptible, even in locations close to major roads. The strength of groundborne vibration from typical environmental sources diminishes (or attenuates) fairly rapidly over distance.

For the prediction of groundborne vibration, the fundamental model consists of a vibration source, a receptor, and the propagation path between the two. The power of the vibration source and the characteristics and geology of the intervening ground, which affect the propagation path to the receptor, determine the groundborne vibration level and the characteristics of the vibration perceived by the receptor.

The sections that follow provide an explanation of key concepts and terms used in the analysis of environmental groundborne vibration.

### 3.2.1 Displacement, Velocity, and Acceleration

When a vibration source (e.g., blasting, construction equipment, train) impacts the ground, it imparts energy to the ground, creating vibration waves that propagate away from the source along the surface and downward into the ground. As vibration waves travel outward from a source, they excite the particles of rock and soil through which they pass and cause them to oscillate. The distance that these particles move is referred to as the *displacement* and is typically very small, usually only a few ten-thousandths to a few thousandths of an inch. *Velocity* describes the instantaneous speed of the motion, and *acceleration* is the instantaneous rate of change of the speed. Each of these measures can be further described in terms of *frequency* and *amplitude*, as discussed below.

Although displacement is generally easier to understand than velocity or acceleration, it is rarely used to describe groundborne vibration because most transducers used to measure vibration directly measure velocity or acceleration, not displacement.

## 3.2.2 Frequency and Amplitude

The frequency of a vibrating object describes how rapidly it is oscillating. The unit of measurement for the frequency of vibration is Hz (the same as used in the measurement of noise), which describes the number of cycles per second.

The amplitude of displacement describes the distance that a particle moves from its resting (or equilibrium) position as it oscillates and can be measured in inches. The amplitude of vibration velocity (the speed of the movement) can be measured in inches per second (in/sec). The amplitude of vibration acceleration (the rate of change in speed) can be measured in in/sec per second.

## 3.2.3 Vibration Descriptors

As noted above, there are various ways to quantify groundborne vibration, based on its fundamental characteristics. Because vibration can vary markedly over a short period of time, various descriptors have been developed to quantify vibration. The two most common descriptors used in the analysis of groundborne vibration are vibration velocity level (Lv) and peak particle velocity (PPV), each of which is described below.

**PPV** is defined as the maximum instantaneous positive or negative peak amplitude of vibration velocity. The unit of measurement for PPV is in/sec. Unlike many quantities used in the study of environmental acoustics, PPV is typically presented with use of linear values, not a dB scale. Because it is related to the stresses that are experienced by buildings, PPV is generally accepted as the most appropriate descriptor for evaluating the potential for building damage (both Federal Transit Administration and Caltrans guidelines recommend using PPV for this purpose). It is also used in many instances to evaluate the human response to groundborne vibration (Caltrans guidelines recommend using PPV for this purpose). The PPV level can be calculated using methods provided in Caltrans' guidance manual (Caltrans 2020) and the following equation from the guidance manual:

$$PPV_{rec} = PPV_{ref} \times (25/D)^n$$

where $PPV_{rec}$ is the PPV at a receptor; $PPV_{ref}$ is the reference PPV at 25 feet from the equipment; D is the distance from the equipment to the receptor, in feet; and n is a value related to the vibration attenuation rate through ground (the default recommended value for n is 1.1).

**$L_V$** describes the rms vibration velocity. Due to the typically small amplitudes of groundborne vibrations, vibration velocity is often expressed in decibels, calculated as follows:

$$L_V = 20 \times \log_{10}\left(\frac{V}{V_{ref}}\right)$$

where *V* is the actual rms velocity amplitude and $V_{ref}$ is the reference velocity amplitude. It is important to note that there is no universally accepted value for $V_{ref}$, but the accepted reference quantity for vibration velocity in the U.S. is 1 micro-inch per second ($1\times10^{-6}$ in/s). The abbreviation VdB is commonly used for vibration decibels to distinguish from noise level decibels. $L_V$ is often used to evaluate human response to vibration levels (Federal Transit Administration guidelines recommend using $L_V$ for this purpose).

### 3.2.4 Vibration Propagation

Vibration energy spreads out as it travels through the ground, causing the vibration level to diminish with distance away from the source. High-frequency vibrations attenuate much more rapidly than low frequencies; therefore, low frequencies tend to dominate the spectrum at large distances from the source. The propagation of groundborne vibration is not as simple to model as airborne noise. This is because noise in the air travels through a relatively uniform medium, while groundborne vibrations travel through the ground, which may contain significant geological differences. Geological factors that influence the propagation of groundborne vibration include the following:

- **Soil conditions.** The type of soil is known to have a strong influence on the levels of groundborne vibration. Among the most important factors are the stiffness and internal damping of the soil. Hard, dense, and compacted soil; stiff clay soil; and hard rock transmit vibration more efficiently than loose, soft soils; sand; or gravel.
- **Depth to bedrock.** Shallow depth to bedrock has been linked to efficient propagation of groundborne vibration. One possibility is that shallow bedrock acts to concentrate the vibration energy near the surface, reflecting vibration waves back toward the surface that would otherwise continue to propagate farther down into the ground.
- **Soil strata.** Discontinuities in the soil strata (i.e., soil layering) can also cause diffractions or channeling effects that affect the propagation of vibration over long distances.
- **Frost conditions.** Vibration waves typically propagate more efficiently in frozen soils than in unfrozen soils. Propagation also varies, depending on the depth of the frost.
- **Water conditions.** The amount of water in the soil can affect vibration propagation. The depth of the water table in the path of the propagation also appears to have substantial effects on groundborne vibration levels.

Specific conditions at the source and receptor locations can also affect the vibration levels. For instance, how the source is connected to the ground (e.g., direct contact, through rails, or as part of a structure) will affect the amount of energy transmitted into the ground. There are also notable differences when the source is underground (such as in a tunnel) versus on the surface. At the receptor, vibration levels can be affected by variables such as the foundation type, building construction, and acoustical absorption inside the rooms where people are located. When vibration encounters a building, a ground-to-foundation coupling loss will usually reduce the overall vibration level. However, under certain circumstances, the ground-to-foundation coupling may also amplify the vibration level due to structural resonances of the floors and walls.

## 3.2.5 Effects of Groundborne Vibration

Vibration can result in effects that range from annoyance to structural damage. Annoyance or disturbance of people may occur at vibration levels substantially below those that would pose a risk of damage to buildings. Each of these effects is discussed below.

### 3.2.5.1 Potential Building Damage

When groundborne vibration encounters a building, vibrational energy is transmitted to the structure, causing it to vibrate. If the vibration levels are high enough, damage to the building may occur. Depending on the type of building and the vibration levels, this damage could range from cosmetic architectural damage (e.g., cracked plaster, stucco, or tile) to more severe structural damage (e.g., cracking of floor slabs, foundations, columns, beams, or wells). Buildings can typically withstand higher levels of vibration from transient sources than from continuous or frequent intermittent sources. Transient sources are those that create a single isolated vibration event, such as blasting or drop balls. Continuous/frequent intermittent sources include impact pile drivers (impact or vibratory), crack-and-seat equipment, and vibratory compaction equipment. Older fragile buildings (which may include important historic buildings) are of particular concern. Modern commercial and industrial buildings can generally withstand much higher vibration levels before potential damage occurs.

### 3.2.5.2 Human Disturbance or Annoyance

Groundborne vibration can be annoying to people and cause serious concern for nearby neighbors of vibration sources, even when vibration is well below levels that could cause physical damage to structures. Groundborne vibration is almost exclusively a concern inside buildings. It is rarely perceived as a problem outdoors where the motion may be discernible but with a less adverse reaction in the absence of the effects associated with the shaking of a building. The normal frequency range of most groundborne vibration that can be felt generally starts at a low frequency of less than 1 Hz and extends to a high of about 200 Hz.

When groundborne vibration waves encounter a building, vibrational energy is transmitted to the building foundation. It then propagates throughout the remainder of the structure, causing building surfaces (walls, floors, and ceilings) to vibrate. This movement may be felt directly by building occupants; it may also generate a low-frequency rumbling noise as sound waves are radiated by the vibrating surfaces. At higher frequencies, building vibration can cause other audible effects, such as rattling among windows, building fixtures, or items on shelves or hanging on walls. These audible effects due to groundborne vibration are referred to as groundborne noise. Groundborne vibration levels that result in groundborne noise are often experienced as a combination of perceptible vibration and low-frequency noise. However, sources that have the potential to generate groundborne noise are likely to produce airborne noise impacts that mask the radiated groundborne noise. Any perceptible effect (vibration or groundborne noise) can lead to annoyance. The degree to which a person is annoyed depends on the activity in which they are participating at the time of the disturbance. For example, someone sleeping or reading will be more sensitive than someone who is engaged in any type of physical activity. Reoccurring vibration effects often lead people to believe that the vibration is damaging their home, even though the vibration levels are well below minimum thresholds for damage potential (Caltrans 2020).

Numerous studies have been conducted to characterize the human response to vibration. Over the years, numerous vibration criteria and standards have been suggested by researchers, organizations, and governmental agencies. These studies suggest that the thresholds for perception and annoyance vary, according to duration, frequency, and amplitude of vibration. For continuous or frequent intermittent vibration sources (such as construction activity, including the use of pile drivers or vibratory compaction equipment), the human response to vibration varies from barely perceptible at a PPV of 0.01 in/sec to distinctly perceptible at a PPV of 0.04 in/sec, strongly perceptible at a PPV of 0.1 in/sec, and severe at a PPV of 0.4 in/sec (Caltrans 2020). With respect to vibration-sensitive equipment, vibration-sensitive instruments or machinery, such as those used in research laboratories or in hospitals, can be disrupted at much lower levels than would typically affect other uses. The Federal Transit Administration (FTA) has developed guidelines for evaluating potential effects on such equipment, as described in more detail in the Regulatory Setting section of this document.

### 3.2.6 Vibration-Sensitive Land Uses

As noted above, the potential effects of groundborne vibration can generally be divided into three categories: building damage, potential human annoyance, and potential disruption to vibration-sensitive equipment. Because building damage would be considered a permanent negative effect at any building, regardless of land use, any type of building would typically be considered sensitive to this type of impact. Fragile structures, which often include historic buildings, are most susceptible to damage and are of particular concern.

Regarding the potential effects of groundborne vibration and noise for people, except for long-term occupational exposure, vibration levels rarely affect human health. Instead, most people consider vibration to be an annoyance that can affect concentration or disturb sleep. People may tolerate infrequent, short-duration vibration levels, but human annoyance to vibration becomes more pronounced if the vibration is continuous or occurs frequently. Human annoyance effects from groundborne vibration are typically considered only inside occupied buildings and not in outside areas such as residential yards, parks, or open space.

Buildings that would be considered sensitive to human annoyance caused by vibration are generally the same as those that would be sensitive to noise (e.g., residential land uses). The primary vibration-sensitive receptors in the project area are structures near the Project Site, which could be susceptible to damage, and residents of nearby residential structures, which could be susceptible to vibration-related annoyance, especially during nighttime hours. In addition, one nearby building is comprised of U.S. Geological Survey (USGS) laboratories. Microscopes and other vibration-sensitive equipment are located within several of these laboratories; the operation of such laboratory equipment can be affected by construction vibration. Other buildings with sensitive research equipment could also be located in the vicinity of project construction.

## 3.3 Existing Noise Environment

The existing noise environment in the project vicinity generally comprises transportation-, industrial-, and residential-related noise sources. Traffic along U.S. 101 heavily influences the ambient noise levels in this area, along with aircraft noise from Moffett Federal Airfield. Industrial noise sources (e.g., exhaust fans and other mechanical equipment) are also present within NASA ARC. Lastly, residential sources, such as air conditioners and lawn maintenance equipment, were noticed in the project vicinity during the project noise survey.

To quantify existing ambient noise levels near the Project Site, long-term (24-hour) and short-term (15-minute) ambient noise measurements were conducted between April 22 and April 24, 2025. On these days, weather conditions ranged from clear to overcast, with no precipitation. Winds were light, with wind speeds averaging approximately 1 to 2 miles per hour.

Long- and short-term monitoring locations were selected to capture existing ambient noise levels throughout the day and night near the Project Site as well as in areas that were representative of nearby noise-sensitive receptors (including residential, educational, and child-care facilities). Noise monitoring locations were also selected to capture existing ambient noise levels at nearby office uses to the south and industrial land uses to the north. The long-term measurements were conducted using a Piccolo Type 2 sound-level meter (SLM). Each SLM measured 1-minute $L_{eq}$ for a period of approximately 24 hours. The recorded 1-minute $L_{eq}$ noise levels were converted into 1-hour $L_{eq}$ noise levels and used to generate 24-hour average $L_{dn}$, 24-hour CNEL, and average noise levels for the daytime and nighttime hours. In addition, the highest and lowest 1-hour $L_{eq}$ noise level during the measurement window were noted.

Seven long-term noise measurement locations were selected near the Project Site. The 24-hour noise levels from the long-term measurements ranged from approximately 63 to 75 dBA $L_{dn}$, with the highest noise levels generally corresponding to areas near U.S. 101. In addition, three short-term (15-minute) noise measurements were conducted near the Project Site using a Larson Davis LxT Type 1 SLM. The measured short-term noise levels ranged from approximately 51 to 54 dBA $L_{eq}$.

The relevant noise data from the noise measurement survey are summarized in Tables 3-3 and 3-4 for the long- and short-term noise measurements, respectively. Figure 3-1 shows the noise measurement locations. Appendix A includes the complete dataset of noise measurement data from the field survey.

**Table 3-3. Measured Existing Noise Levels in the Project Vicinity, Long Term**

| | | | | 12-Hour Noise Metrics (7:00 a.m. to 7:00 p.m.) | | Daytime Noise Metrics (7:00 a.m. to 10:00 p.m.) | | Nighttime Noise Metrics (10:00 p.m. to 7:00 a.m.) | |
|---|---|---|---|---|---|---|---|---|---|
| Site | Site Description | $L_{dn}$ | CNEL | Average $L_{eq}$[a] | Lowest 1-Hour $L_{eq}$[b] | Average $L_{eq}$[c] | Lowest 1-Hour $L_{eq}$[d] | Average $L_{eq}$[e] | Lowest 1-Hour $L_{eq}$[f] |
| LT-1 | Wescoat Road east of Stewart Drive | 63.7 | 63.9 | 56.4 | 53.4 | 56.4 | 53.4 | 57.4 | 52.1 |
| LT-2 | Dailey Road south of Wescoat Road | 67.6 | 67.9 | 61.6 | 58.3 | 61.4 | 58.3 | 61.2 | 53.7 |
| LT-3 | Fairchild Drive west of Whisman Road | 75.3 | 75.7 | 71.1 | 66.5 | 71.0 | 66.5 | 68.4 | 63.1 |
| LT-4 | Parking lot south of Edquiba Road | 66.5 | 67.0 | 62.1 | 59.5 | 62.1 | 59.5 | 59.7 | 49.2 |
| LT-5 | Macon Road and Ellis Street | 69.9 | 70.3 | 65.2 | 61.3 | 65.3 | 61.3 | 63.1 | 56.4 |
| LT-6 | Arnold Avenue north of Clark Road | 63.4 | 63.8 | 59.8 | 57.3 | 59.5 | 57.0 | 55.4 | 50.3 |
| LT-7 | Wescoat Road west of Bailey Road | 66.1 | 66.4 | 59.4 | 55.1 | 59.7 | 55.1 | 59.6 | 55 |

LT = long-term (24-hour) ambient noise measurement.

All noise levels are reported in A-weighted decibels (dBA).

a. The 12-hour average $L_{eq}$ from 7:00 a.m. to 7:00 p.m.

b. The lowest hourly $L_{eq}$ between 7:00 a.m. and 7:00 p.m.

c. The 15-hour daytime average $L_{eq}$ from 7:00 a.m. to 10:00 p.m.

d. The lowest hourly $L_{eq}$ between 7:00 a.m. and 10:00 p.m.

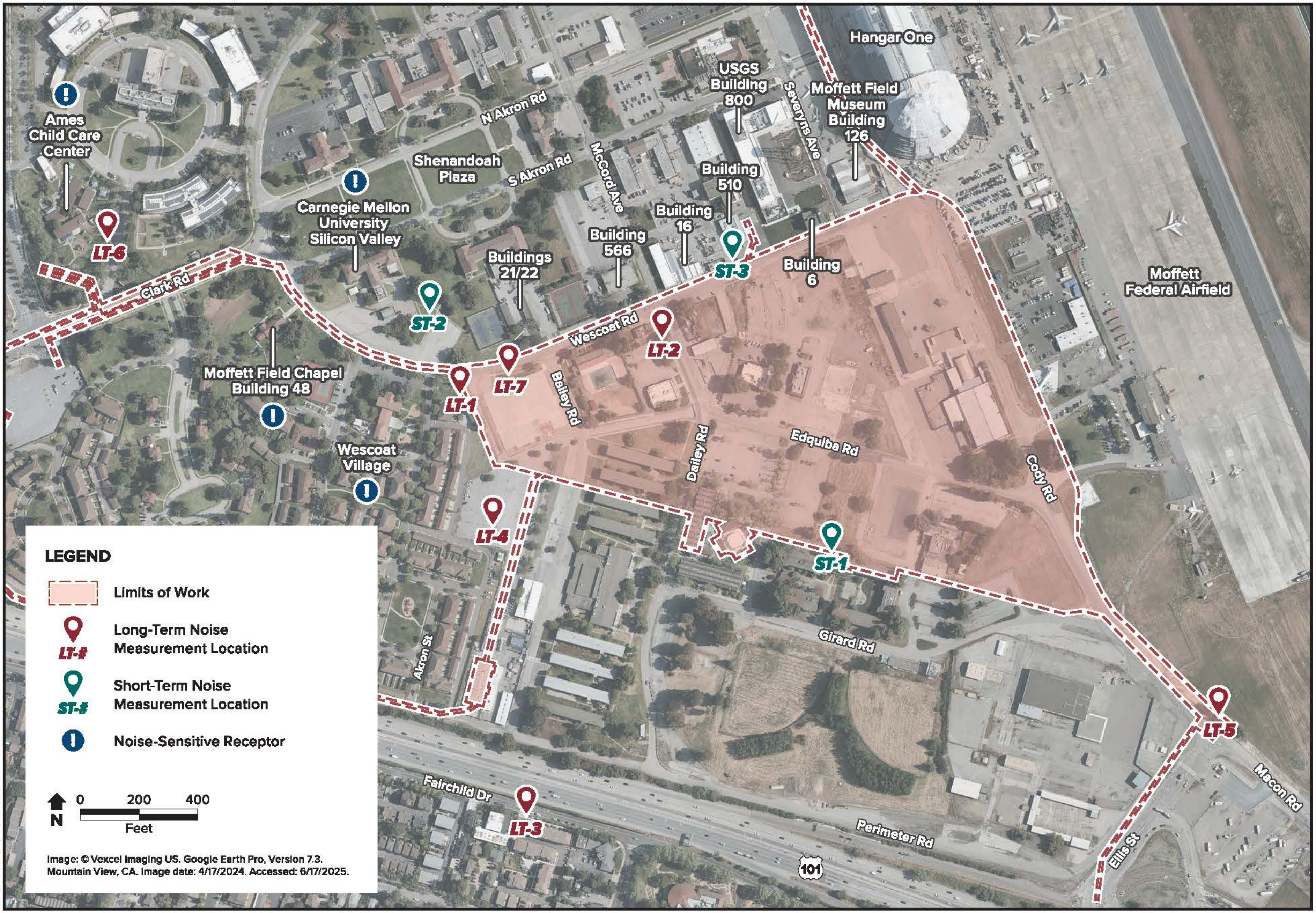
e. The 9-hour nighttime average $L_{eq}$ from 10:00 p.m. to 7:00 a.m.

f. The lowest hourly $L_{eq}$ between 10:00 p.m. and 7:00 a.m.

**Table 3-4. Measured Existing Noise Levels in the Project Vicinity, Short Term**

| Site | Site Description | Measurement Start Time | $L_{eq}$ | $L_{max}$ | $L_{min}$ | Dominant Noise Source(s) |
|---|---|---|---|---|---|---|
| ST-1 | Grassy field west of Kaiser Road | 10:34 a.m. | 51.4 | 64.2 | 45.7 | Traffic, aircraft |
| ST-2 | Southeast of Carnegie Mellon University Silicon Valley | 10:57 a.m. | 52.4 | 60.6 | 49.7 | Traffic, birds |
| ST-3 | Parking lot near Jacobs Technology AFSS | 11:29 a.m. | 53.7 | 67.0 | 48.1 | Traffic, aircraft, HVAC equipment |

ST = short-term (15-minute) ambient noise measurement.
All noise levels are reported in A-weighted decibels (dBA).
AFSS = Ames Facilities Support Services; HVAC = heating, ventilation, air-conditioning




ICF

**Figure 3-1**
**Noise Measurement Locations**
Berkeley Space Center at NASA Research Park

# Chapter 4
# **Regulatory Setting**

UC Berkeley is constitutionally exempt from local governments' regulations, such as city and county general plans, land use policies, and zoning regulations, whenever using property under its control in furtherance of its educational purposes. As such, UC Berkeley will not consider local policies and regulations in its evaluation of the environmental effects of the proposed project unless UC Berkeley expressly decides to use a local policy or regulation as a threshold or standard of significance. For the purposes of CEQA, UC Berkeley has elected to use noise standards from the municipal code of the jurisdiction where the noise-sensitive receptors are located for the analysis of construction and operational noise sources associated with the proposed project. For the proposed project, the nearest noise-sensitive receptors are in NASA ARC, which is located in Santa Clara County. Refer to Figure 3-1 in Chapter 3 of this report, which depicts the locations of the nearest off-site land uses, including noise-sensitive receptors. For purposes of CEQA, UC Berkeley has elected to evaluate construction vibration effects associated with the project per the guidelines and criteria contained in Caltrans' *Transportation and Construction Vibration Guidance Manual* (Caltrans 2020); this guidance includes standards that pertain to construction vibration and are commonly used throughout the state.

NASA ARC, including the area where the proposed action would be built and operated, is an area of exclusive federal jurisdiction. In the absence of an explicit waiver of sovereign immunity by Congress, state and local government regulations (e.g., city and county general plans, land use policies, zoning regulations, and state environmental laws) do not apply to areas of exclusive federal jurisdiction. Therefore, state and local government requirements will not be considered as applicable to the proposed action, when the proposed action and environmental effects are located on ARC jurisdictional property. This includes mitigation measures proposed in accordance with those state and local government regulations that are not applicable in areas of federal jurisdiction; such proposed mitigation measures are optional on the part of NASA. However, NASA may, at its discretion, expressly apply a state or local requirement for purposes of establishing a threshold or standard of significance and may elect to comply with mitigation measures required by state or local governmental agencies. For the purposes of NEPA, NASA has elected to use Federal Transit Administration guidance and thresholds for the analysis of potential construction noise effects associated with the project. For the topic of operational noise, NASA has elected to use FTA General Assessment Methodology construction noise limits to evaluate construction noise effects and local thresholds to evaluate potential operational noise effects. Finally, NASA has elected to evaluate construction vibration effects per the guidelines and criteria contained in Caltrans' *Transportation and Construction Vibration Guidance Manual* (Caltrans 2020).

## 4.1 Federal

### 4.1.1.1 Federal Transit Administration

#### Noise

The FTA has developed general assessment criteria for analyzing construction noise. This assessment is conducted by assuming simultaneous operation of the two loudest pieces of equipment that are expected to operate during a given subphase of construction. Both pieces of equipment are assumed to operate simultaneously at the center of the construction site. The general assessment criteria for construction noise limits are summarized in Table 4-1.

**Table 4-1. FTA General Assessment Criteria for Construction Noise**

| Land Use | 1-hour $L_{eq}$ (dBA) Day | Night |
|---|---|---|
| Residential | 90 | 80 |
| Commercial | 100 | 100 |
| Industrial | 100 | 100 |

Source: Federal Transit Administration. 2018. *Transit Noise and Vibration Impact Assessment.* FTA Report No. 0123. Available: https://www.transit.dot.gov/sites/fta.dot.gov/files/docs/research-innovation/118131/transit-noise-and-vibration-impact-assessment-manual-fta-report-no-0123_0.pdf. Accessed: July 9, 2025.

## Vibration

The FTA's general assessment criteria for evaluating potential construction-generated vibration impacts are included in Table 4.2. This table parses out potential annoyance effects related to interference with interior operations, sleep, and institutional daytime use as a function of the frequency of the vibration event according to three land use categories.

**Table 4-2. FTA General Assessment Criteria for Groundborne Vibration**

| Land Use Category | Impact Levels (VdB; relative to 1 micro-inch/second) Frequent Events[a] | Occasional Events[b] | Infrequent Events[c] |
|---|---|---|---|
| Category 1: Buildings where vibration would interfere with interior operations | 65[d] | 65[d] | 65[d] |
| Category 2: Residences and buildings where people normally sleep | 72 | 75 | 90 |
| Category 3: Institutional land uses with primarily daytime uses | 75 | 78 | 83 |

Source: Federal Transit Administration 2018.
VdB = vibration decibels.

a. "Frequent events" is defined as more than 70 vibration events from the same source per day.
b. "Occasional events" is defined as 30 to 70 vibration events from the same source per day.
c. "Infrequent events" is defined as fewer than 30 vibration events from the same source per day.
d. This criterion limit is based on levels that are acceptable for most moderately sensitive equipment, such as optical microscopes. Vibration-sensitive manufacturing or research would require detailed evaluation to define the acceptable vibration levels.

As described in footnote "d" of Table 4.2, the Criterion for Category 1 land uses is based on levels that are acceptable for most moderately sensitive equipment, such as optical microscopes. Vibration-sensitive manufacturing or research equipment require a detailed evaluation to define the acceptable vibration levels, the criteria for which are included in Table 4.3. As shown in this table, Categories VC-A and above have thresholds that are below the general Category 1 standard of 65 VdB for frequent events (the most sensitive category included in Table 4.2).

Categories VC-B and below have more stringent vibration criteria than the 65 VdB Category 1 standard because these uses typically have more sensitive equipment, such as scanning electron microscopes.

**Table 4-3. FTA Interpretation of Vibration Criteria for Detailed Vibration Analysis**

| Criterion Curve | Max Lv,* VdB | Description of Use |
|---|---|---|
| Workshop (ISO) | 90 | Vibration that is distinctly felt. Appropriate for workshops and similar areas not as sensitive to vibration. |
| Office (ISO) | 84 | Vibration that can be felt. Appropriate for offices and similar areas not as sensitive to vibration. |
| Residential Day (ISO) | 78 | Vibration that is barely felt. Adequate for computer equipment and low-power optical microscopes (up to 20X |
| Residential Night, Operating Rooms (ISO) | 72 | Vibration is not felt, but ground-borne noise may be audible inside quiet rooms. Suitable for medium-power optical microscopes (100X) and other equipment of low sensitivity. |
| VC-A | 66 | Adequate for medium- to high-power optical microscopes (400X), microbalances, optical balances, and similar specialized equipment. |
| VC-B | 60 | Adequate for high-power optical microscopes (1000X) and inspection and lithography equipment to 3-micron line widths. |
| VC-C | 54 | Appropriate for most lithography and inspection equipment to 1-micron detail size. |
| VC-D | 48 | Suitable in most instances for the most demanding equipment, including electron microscopes operating to the limits of their capabilities |
| VC-E | 42 | The most demanding criterion for extremely vibration-sensitive equipment. |

* As measured in 1/3-octave bands of frequency over the frequency range 8 to 80 Hz.

# 4.2 State

### 4.2.1.1 Title 24 of the California Code of Regulations, Noise Insulation

California Code of Regulations Title 24, Part 2, Sound Transmission, establishes minimum noise insulation standards to protect persons within new hotels, motels, dormitories, long-term care facilities, apartment houses, and dwellings other than single-family residences. Under this regulation, interior noise levels attributable to exterior noise sources cannot exceed 45 dBA in any habitable room. The noise metric is either the $L_{dn}$ or the CNEL, consistent with the Santa Clara County (County) General Plan (discussed below). Compliance with Title 24 interior noise standards is assessed during the permit review process. This generally protects a proposed project's users from existing ambient outdoor noise levels. If determined necessary, a detailed acoustical analysis of exterior wall and window assemblies may be required.

#### 4.2.1.2 Governor's Office of Planning and Research

The *State of California General Plan Guidelines* document, published and updated by the Governor's Office of Planning and Research, provides guidance for evaluating the compatibility of various land uses with respect to community noise exposure. These guidelines for general land use planning describe noise acceptability categories for the different types of land uses considered by the State of California (State). California also requires each local government entity to perform noise studies and implement a noise element as part of its general plan. The purpose of the noise element is to limit the exposure of the community to excessive noise levels; the noise element must be used to guide decisions concerning land use.

#### 4.2.1.3 California Department of Transportation

There are no State vibration standards that directly apply to the proposed project. As noted below, there are also no quantitative local standards available to assess project-related vibration. Therefore, although the proposed project would not be subject to Caltrans oversight, guidance published by the agency nonetheless provides groundborne vibration criteria that are useful in establishing thresholds for impact determinations. Caltrans' widely referenced *Transportation and Construction Vibration Guidance Manual* (Caltrans 2020) provides guidance for two types of potential impact: (1) damage to structures and (2) annoyance to people. Guideline criteria for each are provided in Tables 4-4 and 4-5.

**Table 4-4. Caltrans Guideline Vibration Damage Criteria**

| | Maximum PPV (in/sec) | |
|---|---|---|
| **Structure and Condition** | **Transient Sources** | **Continuous/Frequent Intermittent Sources** |
| Extremely fragile historic buildings, ruins, ancient monuments | 0.12 | 0.08 |
| Fragile buildings | 0.2 | 0.1 |
| Historic and some old buildings | 0.5 | 0.25 |
| Older residential structures | 0.5 | 0.3 |
| New residential structures | 1.0 | 0.5 |
| Modern industrial/commercial buildings | 2.0 | 0.5 |

Source: California Department of Transportation. 2020. *Transportation and Construction Vibration Guidance Manual*. April. Available: https://dot.ca.gov/-/media/dot-media/programs/environmental-analysis/documents/env/tcvgm-apr2020-a11y.pdf. Accessed: July 9, 2025.

Note:

Transient sources, such as blasting or drop balls, create a single, isolated vibration event. Continuous/frequent intermittent sources include pile drivers (impact and vibratory), crack-and-seat equipment, and vibratory compaction equipment.

**Table 4-5. Caltrans Guideline Vibration Annoyance Criteria**

| Human Response | Maximum PPV (in/sec) Transient Sources | Maximum PPV (in/sec) Continuous/Frequent Intermittent Sources |
|---|---|---|
| Barely perceptible | 0.04 | 0.01 |
| Distinctly perceptible | 0.25 | 0.04 |
| Strongly perceptible | 0.9 | 0.10 |
| Severe | 2.0 | 0.4 |

Source: California Department of Transportation. 2020. *Transportation and Construction Vibration Guidance Manual*. April. Available: https://dot.ca.gov/-/media/dot-media/programs/environmental-analysis/documents/env/tcvgm-apr2020-a11y.pdf. Accessed: July 9, 2025.

Note: Transient sources, such as blasting or drop balls, create a single, isolated vibration event. Continuous/frequent intermittent sources include pile drivers (impact and vibratory), crack-and-seat equipment, and vibratory compaction equipment.

# 4.3 Regional and Local

Because UC Berkeley and NASA have elected to use several noise standards and thresholds from the municipal code of the jurisdiction where noise-sensitive receptors are located (i.e., Santa Clara County), relevant portions of the County General Plan and County Code are summarized below.

## 4.3.1.1 Santa Clara County General Plan

The Santa Clara County General Plan, in the Health and Safety chapter, establishes land use compatibility standards for the county (Santa Clara County 1994). It also includes strategies and policies related to noise. Relevant components of the Health and Safety chapter, including strategies, policies, and implementation actions, are included below.

***Policy C-HS 24:*** Environments for all residents of Santa Clara County free from noises that jeopardize their health and well-being should be provided through measures that promote noise and land use compatibility.

***Policy C-HS 25:*** Noise impacts from public and private projects should be mitigated.

Implementation recommendations:

- C-HS(i) 23: Project design review should assess noise impacts on surrounding land uses.
- C-HS(i) 24: Where necessary, construct soundwalls or other noise mitigations.
- C-HS(i) 25: Prohibit construction in areas that exceed applicable interior and exterior standards, unless suitable mitigation measures can be implemented.
- C-HS(i) 26: Require project-specific noise studies to assess actual and projected dB noise contours for proposed land uses likely to generate significant noise.
- C-HS(i) 27: Take noise compatibility impacts into account in developing local land use plans

***Policy C-HS 26:*** New development in areas of noise impact (areas subject to sound levels of 55 DNL or greater) should be approved, denied, or conditioned so as to achieve a satisfactory noise level for those who will use or occupy the facility (as defined in the noise compatibility standards for land use and maximum interior noise levels for intermittent noise [see Tables 4-6 and 4-7]).

**Table 4-6. Noise Compatibility Standards for Land Use in Santa Clara County (General Plan)**

| | Exterior Noise Compatibility Standards (Noise Level – $L_{dn}$ Value in Decibels) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 |
| Land Use | | | | | | | | |
| Residential | Satisfactory | Satisfactory | Cautionary | Cautionary | Critical | Critical | Critical | Critical |
| Commercial | | | | | | | | |
| Hotel | Satisfactory | Satisfactory | Cautionary | Cautionary | Cautionary | Critical | Critical | Critical |
| Other | Satisfactory | Satisfactory | Satisfactory | Satisfactory | Cautionary | Cautionary | Critical | Critical |
| Industrial | Satisfactory | Satisfactory | Satisfactory | Satisfactory | Satisfactory | Cautionary | Critical | Critical |
| Public or Semi-public Facilities | | | | | | | | |
| Church, Hospital, and Nursing | Satisfactory | Satisfactory | Satisfactory | Cautionary | Critical | Critical | Critical | Critical |
| Home | Satisfactory | Satisfactory | Satisfactory | Cautionary | Critical | Critical | Critical | Critical |
| Schools and Libraries | Satisfactory | Satisfactory | Satisfactory | Cautionary | Cautionary | Critical | Critical | Critical |
| Civic Buildings and Other | | | | | | | | |
| Open Space* | Satisfactory | Satisfactory | Satisfactory | Satisfactory | Cautionary | Cautionary | Cautionary | Cautionary |
| Agriculture | | | | | | | | |
| Parks, Open Space Reserves, Wildlife Refuges, Etc. | Satisfactory | Satisfactory | Cautionary | Cautionary | Cautionary | Cautionary | Cautionary | Cautionary |
| **Effects on Humans at this Noise Level** | **Maximum noise for undisturbed sleep – EPA** | | **Normal** / **Raised** — **Voice level which permits conversation at 3 meters (10 ft.)** | | | | **Potentially hazardous to health – EPA** | |

Noise Compatibility Evaluation

| Satisfactory | Cautionary | Critical |
|---|---|---|

*For open space use, there are no critical noise levels listed. Homes in agricultural areas are not subject to the "Residential" standards. Public buildings in parks and open space areas shall meet noise standards as listed under "Public or Semi-Public Facilities." For open space use, the maximum level of noise that a new land use may impose on neighboring open space shall be the upper limit of the "satisfactory" noise level.

Satisfactory noise levels are those that pose no serious threat to the proposed land use. The ambient noise level at the site is compatible with the land use category of the proposed project and would not create annoyance and/or activity interference. Standard construction techniques would be adequate.

Cautionary noise levels are those that could pose a threat to the proposed land use. The ambient noise level is great enough to require study on the compatibility of the proposed project. Normal building methods may not be adequate to protect the use.

Critical noise levels are those that probably pose a threat to the proposed land use. The ambient noise level is severe. The situation requires rigorous analysis of the compatibility of the proposed project with the ambient noise level at the site. This analysis should include both exterior and interior impacts. Simple solutions to noise attenuation may not be adequate. Uses should be allowed only if they have been designed for noise reduction by a professional who is competent in sound reduction.

**Table 4-7. Recommended Maximum Interior Noise Levels for Intermittent Noise (Santa Clara County)**

| Land Use Category | Land Use Type | Maximum Interior Noise Level |
|---|---|---|
| Residential | Single-family residential | 45 |
| | Multi-family residential | 45 |
| Commercial | Hotel or motel | 45 |
| | Executive offices, conference rooms | 55 |
| | Staff offices | 60 |
| | Restaurant, market, retail stores | 60 |
| | Sales, secretarial | 65 |
| | Sports arena, bowling alley, etc. | 75 |
| Industrial | Office (same as above) | 55–60 |
| | Laboratory | 60 |
| | Machine shop, assembly, and others | 75 |
| | Mineral extraction | 75 |
| Public or Semi-public Facility | Concert hall and legitimate theater | 30 |
| | Auditorium, movie theater, church | 45 |
| | Hospital, nursing home and firehouse (sleeping quarters) | 45 |
| | School classroom | 50 |
| | Library | 50 |
| | Other public buildings | 55 |

#### 4.3.1.2 Santa Clara County Code

Section B11-150 of the Santa Clara County Code (County Code) includes relevant background information pertaining to noise as well as noise limits and standards for different types of noise sources. Exterior noise limits that apply in the county are contained in Section B11-152 of the code and included as Table 4-8.

**Table 4-8. Maximum Permissible Sound Levels by Receiving Land Use**

| Receiving Land Use[a] | | Time Period | Noise Level Standards (dBA)[b,c] |
|---|---|---|---|
| One- and two-family residential | | 10:00 p.m. to 7:00 a.m. | 45 |
| | | 7:00 a.m. to 10:00 p.m. | 55 |
| Multi-family residential | Multi-family dwelling[d] | 10:00 p.m. to 7:00 a.m. | 50 |
| | Residential public space[d] | 7:00 a.m. to 10:00 p.m. | 55 |
| Commercial | | 10:00 p.m. to 7:00 a.m. | 60 |
| | | 7:00 a.m. to 10:00 p.m. | 65 |
| Light industrial | | Any time | 70 |
| Heavy industrial | | Any time | 75 |
| **Adjustments to Noise Level Standards** | | | |
| **Duration:** | | | |
| $L_{50}$ (30 minutes per hour) | | Standard | |
| $L_{25}$ (15 minutes per hour) | | Standard +5 dB | |
| $L_{8}$ (5 minutes per hour) | | Standard + 10 dB | |
| $L_{2}$ (1 minute per hour) | | Standard + 15 dB | |
| $L_{0}$ (maximum permissible level) | | Standard + 20 dB | |

a. If the noise measurement occurs on a property adjoining a different land use, the noise level limit applicable to the lower land use category, plus 5 dB, will apply.

b. Correction for character of sound. In the event that the alleged offensive noise contains a steady, audible tone, such as a whine, screech, or hum, or contains music or speech conveying informational content, the standard limits set forth above will be reduced by 5 dB.

c. If the measured ambient level exceeds that permissible with any of the first four noise limit categories above, the allowable noise exposure standard will be increased in 5 dB increments in each category as appropriate to encompass or reflect the ambient noise level. In the event the ambient noise level exceeds the fifth noise limit category, the maximum allowable noise under the category will be increased to reflect the maximum ambient noise level.

d. Note that the daytime noise limit that applies to multi-family dwellings in this table is entitled residential public space, while the nighttime noise limit for multi-family dwellings is entitled multi-family dwelling.

Air-handling equipment is specifically discussed in Subsection 12 of Section B11-154, Prohibited Acts, of the County Code. According to this section, "operating or permitting the operation of any air-conditioning or air-handling equipment in a manner so as to exceed any of the following sound levels without a variance [is prohibited]:

- 50 dBA at any point on the neighboring property line
- 45 dBA at the center of a neighboring patio
- 45 dBA outside of the neighboring living areas' window nearest the equipment location

Subsection 6 under Section B11-154, Prohibited Acts, of the County Code further states that construction is generally prohibited between the hours of 7:00 p.m. and 7:00 a.m. on weekdays and Saturdays and at any time on Sundays and holidays, except for emergency work on utilities or by variance. In addition, where technically and economically feasible, maximum noise levels from construction activities at affected properties are not to exceed those listed in Table 4-9 (for shorter-term construction activities lasting less than 10 days) and Table 4-10 (for longer-term construction activities lasting 10 days or more). Due to the expected duration of project construction for the CEQA Proposed Project and the CEQA Reduced Density Alternative (i.e., more than 10 days), the maximum noise levels for long-term construction activities summarized in Table 4-10 would apply.

**Table 4-9. Maximum Noise Levels for Nonscheduled, Intermittent, Short-term Operation (less than 10 days) of Mobile Equipment**

| | Single- and Two-family Dwelling in Residential Area | Multi-family Dwelling in Residential Area | Commercial Area |
|---|---|---|---|
| Daily, except Sundays and legal holidays, 7:00 a.m. to 7:00 p.m. | 75 dBA | 80 dBA | 85 dBA |
| Daily 7:00 p.m. to 7:00 a.m. and all day Sunday and legal holidays | 50 dBA | 55 dBA | 60 dBA |

**Table 4-10. Maximum Noise Levels for Repetitively Scheduled and Relatively Long-term Operation (periods of 10 days or more) of Stationary Equipment**

| | Single- and Two-family Dwelling in Residential Area | Multi-family Dwelling in Residential Area | Commercial Area |
|---|---|---|---|
| Daily, except Sundays and legal holidays, 7:00 a.m. to 7:00 p.m. | 60 dBA | 65 dBA | 70 dBA |
| Daily 7:00 p.m. to 7:00 a.m. and all day Sunday and legal holidays | 50 dBA | 55 dBA | 60 dBA |

Chapter 5
# Impact Analysis

## 5.1 Methods for Analysis

A combination of existing literature and accepted noise and vibration prediction and propagation algorithms was used to predict noise and vibration levels from project construction, along with noise from operational noise sources associated with the project. The specific methodology used for each analysis topic is described below.

### 5.1.1 Construction Noise and Vibration

#### 5.1.1.1 Construction Noise

##### Daytime Hours

Noise from the construction of a given project varies, depending on the type of equipment in use, how many pieces of equipment are operating at any one time, the proximity of the equipment to a noise receptor, and the duration of equipment use. Estimates of combined construction and demolition noise levels for the proposed project were based on reference sound pressure levels from the Federal Highway Administration (FHWA) Roadway Construction Noise Model (RCNM); the FTA general assessment construction noise analysis method, which recommends combining noise levels from the two loudest pieces of equipment expected to operate simultaneously, assuming both pieces of equipment are located at the center of the construction site; and information provided by the Project Proponent (Federal Highway Administration 2006; Federal Transit Administration 2018). Rather than assuming construction equipment is located at the approximate center of the overall Project Site, the construction noise analysis assumes that equipment is operating at the approximate center of a given building footprint or subphase area. For on-site construction, the distance between the approximate center of the nearest project building to the nearest off-site existing receptor (i.e., the existing Wescoat Village to the west) is estimated to be 200 feet. In addition, note that the two loudest pieces of equipment expected to operate simultaneously by subphase varies by subphase.

The FHWA noise source data used in the construction noise model include reference A-weighted $L_{max}$ noise levels, given at a distance of 50 feet from the construction equipment, and utilization factors for each piece of equipment. The utilization factor is the percentage of time each piece of equipment is typically operated at full power over a specified time period. It is used to estimate $L_{eq}$ values from $L_{max}$ values. For example, the $L_{eq}$ value for a piece of equipment that operates at full power for 50 percent of the time is 3 dB less than the $L_{max}$ value (Federal Highway Administration 2008). The general assessment construction noise analysis method, which is used in this analysis, recommends using a utilization factor of 1 (equivalent to 100 percent) to ensure a conservative analysis. For example, for the Buildings – Grading subphase, the two loudest pieces of equipment proposed for use are two crawler tractors. Modeling for the subphase assumes that these two tractors are operating simultaneously 100 percent of the time during a given hour and located close to one another near the approximate center of a future project building footprint. Refer to Table 5-1 for the source noise levels of various pieces of equipment that may be used during construction of the proposed project and included in the project construction noise analysis.

**Table 5-1. Source Noise Levels for Equipment Proposed for Project Construction ($L_{eq}$)**

| Equipment Type | Noise at 50 Feet ($L_{eq}$)[a] |
|---|---|
| Backhoe[b] | 78 |
| Compactor (ground) | 83 |
| Compressor (air) | 78 |
| Concrete mixer truck | 79 |
| Concrete pump truck | 81 |
| Concrete saw | 90 |
| Crane | 81 |
| Dozer | 82 |
| Excavator | 81 |
| Front-end loader[c] | 79 |
| Generator | 81 |
| Grader | 85 |
| Man lift[d] | 75 |
| Paver | 77 |
| Roller | 80 |
| Tractor | 84 |
| Welder/torch | 74 |

Source: Federal Highway Administration. 2006. *FHWA Roadway Construction Noise Model User's Guide*. FHWA-HEP-05-054. January. Available: https://www.fhwa.dot.gov/ENVIRonment/noise/construction_ noise/rcnm/rcnm.pdf. Accessed: July 9, 2025.

a. $L_{eq}$ source levels by equipment type at a distance of 50 feet are based on the $L_{max}$ source levels from the FHWA RCNM, with a utilization factor of 1 per the FTA general assessment methodology.

b. Representative of a bobcat (crawler)

c. Representative of a forklift.

d. Representative of an aerial lift, scissor lift, and man lift.

Modeled construction noise levels were compared to applicable construction noise standards for daytime hours. For purposes of this CEQA analysis, the local thresholds from the Santa Clara County Municipal Code (which covers the area where the nearest noise-sensitive receptors are located) are used to evaluate construction noise; for purposes of NEPA analysis, construction noise is evaluated to determine compliance with generally accepted federal standards for construction noise (i.e., the FTA thresholds for construction noise).

## Nighttime Hours

Construction activities proposed for nighttime hours (i.e., activities taking place outside of the specified daytime hours for construction identified in the County Code) would be limited to on-site concrete pours and off-site/in-street utility work, as needed. As identified by the Project Proponent, there would be approximately five instances of nighttime construction per building for concrete foundation pours. In addition, construction in roadways for utility installations may also occur outside of normal business hours and on weekends, per NASA requirements. In general, in-street nighttime construction activities would include approximately 10 days of nighttime construction per utility system (e.g., sewer, stormwater, recycled water, power, telecom systems). Equipment proposed for concrete pours and in-street utility work includes concrete mixer trucks, concrete pump trucks, excavators, crawler tractors, concrete saws, and a diesel generator for lights.

As was the case for the daytime construction evaluation, described above, nighttime construction noise was assessed by modeling combined construction noise levels, based on reference noise levels from the FHWA RCNM, the FTA general assessment construction noise analysis method, and information provided by the Project Proponent. Combined construction noise levels from activities occurring outside of daytime hours were compared to the maximum permissible sound level for surrounding noise-sensitive receptors, per the County Code (for the CEQA evaluation) and per the FTA guidelines (for the NEPA evaluation).

### Construction Noise from Haul Trucks and Heavy Trucks

The County Code does not include specific thresholds pertaining to construction noise from haul trucks and heavy trucks. To evaluate the potential noise effects during construction, average daily traffic (ADT) volumes and vehicle classification percentages were used to model existing traffic noise along roadway segments in the vicinity of the Project Site. In addition, traffic noise modeling was completed for an existing-plus-construction-truck condition by adding the worst-case daily heavy truck volumes from project construction to existing daily traffic volumes along roadway segments where project-related heavy truck traffic would occur. Traffic noise levels were predicted at a reference distance of 50 feet from the roadway centerline, using a spreadsheet based on the FHWA Traffic Noise Model, version 2.5. Anticipated worst-case daily haul truck noise was assessed to determine if a 3 dB increase over modeled existing traffic noise levels would occur as a result of hauling activity (a 3 dB change in noise level is considered to be "barely perceptible") along roadway segments with adjacent noise-sensitive receptors.

## 5.1.1.2 Construction Vibration

Vibration effects related to building damage and human annoyance resulting from construction of the proposed project were analyzed using data and modeling methodologies provided by *Caltrans' Transportation and Construction Vibration Guidance Manual* (California Department of Transportation 2020). This guidance manual provides typical vibration source levels for various types of construction equipment as well as methods for estimating the propagation of groundborne vibration over distance. Estimates of vibration levels from project construction activities were based on reference vibration levels from this guidance manual and project-specific construction information provided by the Project Proponent. The following equation from the guidance manual was used to estimate the PPV at the closest vibration-sensitive receptors, based on an estimated worst-case (i.e., closest) distance between sources and receptors:

$$PPV_{rec} = PPV_{ref} \times (25/D)^n$$

where $PPV_{rec}$ is the PPV at a receptor; $PPV_{ref}$ is the reference PPV at 25 feet from the equipment; D is the distance from the equipment to the receptor, in feet; and n is a value related to the vibration attenuation rate through ground. The default recommended value for n by Caltrans is 1.1.

All of the analyzed equipment is classified as continuous/frequent intermittent vibration sources. The most vibration-intensive piece of construction equipment expected to be used for the project is a vibratory roller; note that no pile driving is proposed. A vibratory roller could be used throughout the Project Site, including near the perimeter of the Project Site for roadway compaction and on streets near the Project Site for utility work. Estimated vibration levels from project-specific equipment operating on the Project Site or on nearby roadways (for the in-street/off-site utility work) were compared to Caltrans' vibration-related damage thresholds, presented previously in Table 4-4. The most stringent threshold expected to apply to structures near the Project Site is the Caltrans "historic and some old buildings" category (Rusch pers. comm. [2025]).

With respect to vibration-sensitive equipment, modeling methodologies and guidance from FTA's *Transit Noise and Vibration Impact Assessment Manual* (Federal Transit Administration 2018) were used to estimate VdB vibration levels from project construction equipment at nearby laboratory buildings, including USGS Building 800, which comprises several research laboratories. Although it is known that vibration-sensitive equipment is located within this building, the exact sensitivities of each piece of equipment are not known with certainty. Therefore, estimated vibration levels by construction equipment type were calculated, and screening distances for potential effects between construction equipment and various categories of sensitive laboratory equipment (per the FTA vibration criteria for detailed vibration analysis, as shown in Table 4-3) were generated. Potential effects on sensitive laboratory equipment could occur if project construction equipment is estimated to result in vibration levels greater than the applicable criteria for sensitive laboratory equipment.

## 5.1.2 Operational Noise

Noise associated with project operations was evaluated for individual operational noise sources, as described below. Primary sources of operational noise associated with the project include heating, cooling, and ventilation equipment; emergency generators (during testing); loading docks and loading zones; parking garages; amplified music and speech; and traffic from operations associated with the project.

### 5.1.2.1 Mechanical Equipment

#### Heating, Ventilation, and Cooling Equipment

The makes and models of the heating, cooling, and ventilation equipment proposed for the project have not been finalized, but information about the types and the number of pieces of equipment proposed for use at each building was provided by the Project Proponent. Estimates of the combined noise levels from a representative selection of mechanical equipment were based on noise levels from equipment similar to that proposed for the project. The focus of the mechanical equipment noise evaluation was the portion of the Project Site that would have mechanical equipment installed close to off-site sensitive uses (i.e., the southern and western portions of the Project Site). Noise levels for each equipment type were estimated from readily available data sources (e.g., FHWA and Hoover and Keith manuals) and used to model estimated combined equipment noise (Federal Highway Administration 2006; Hoover and Keith 2000).

Mechanical equipment could operate during both daytime and nighttime hours, with the nighttime noise limits being more stringent. Therefore, estimated noise levels are compared to the more stringent County noise exposure limit for nighttime hours (10:00 p.m. to 7:00 a.m.) to ensure a conservative analysis. The County noise exposure limits, listed by receiving land use type, are contained in Table 4-8, presented previously. According to this table, if measured ambient noise levels are higher than the standards, the allowable noise exposure standard is increased in 5 dB increments, as needed, to encompass or reflect the ambient noise level. The existing residential receptors at Wescoat Village are conservatively represented by LT-1. At this measurement location, the lowest nighttime noise level (1 hour) was measured to be 52.1 dBA $L_{eq}$. This ambient noise level is greater than the nighttime noise level standard outlined in Table 4-8 for multi-family dwellings of 50 dBA $L_{eq}$. Consequently, the noise standard used to assess mechanical equipment noise at this location is increased by 5 dB to encompass or reflect the ambient noise level; therefore, the applicable noise limit at this location would be 55 dBA $L_{eq}$ during nighttime hours.

### BESS Equipment

Battery energy storage systems (BESS) would be installed at multiple project parcels. Preliminary plans indicate that individual BESS systems would range in size (storage capacity) from approximately 6 kilowatt hours (kWh) to 940 kWh. Specific makes and models for the proposed BESS units have not been identified. A review of BESS models rated for storage of 1 megawatt hour (MWh) or less (i.e., 1,000 kWh or less) indicates that the units are likely to consist of battery packs that would be housed in stand-alone containers of various sizes. The primary noise source associated with the containers would be the climate control system, which would regulate the temperature of the batteries to optimize BESS performance. For purposes of analysis, it has been assumed that the noise level from each BESS unit would be comparable to the noise level from an industrial air conditioner. The example used in the noise calculations was a Marvair ComPac air conditioner, Model AYPA72AC, which is a wall-mounted industrial air conditioner used primarily to cool electronic and communication equipment in shelters. This model has been identified during prior noise studies as a unit that would be compatible with a modular BESS enclosure. The Marvair ComPac AYPA72AC has a manufacturer's tested noise level of 55 dBA at 50 feet (Marvair 2011). Because it is assumed that BESS equipment could operate during both daytime and nighttime hours, BESS equipment noise levels are compared to the more stringent applicable nighttime noise exposure limit for nearby noise-sensitive receptors.

As described for the assessment of mechanical heating and cooling equipment, Section B11-152 152 of the County Code establishes noise exposure criteria for non-transportation noise sources (i.e., stationary sources) at noise-sensitive receptors (see Table 4-8). According to this table, if measured ambient noise levels are higher than the standards, the allowable noise exposure standard is increased in 5 dB increments, as needed, to encompass or reflect the ambient noise level. Per the discussion presented previously, the lowest nighttime noise level (1 hour) was measured to be 52.1 dBA $L_{eq}$ at Wescoat Village, which is greater than the nighttime noise level standard outlined in Table 4-8 for multi-family dwellings. The noise standard used to assess BESS noise at this location was increased by 5 dB to 55 dBA $L_{eq}$ during nighttime hours.

## 5.1.2.2 Emergency Generator Testing

The project would incorporate diesel generators, which would be used during power disruptions. Although use of the generators would be limited primarily to emergency circumstances, periodic testing would be required. Note that noise from the operation of generators during an emergency is generally exempt from local noise ordinances. However, the testing of emergency generators is required to comply with applicable local noise limits for operational equipment.

Noise from emergency generator testing at various distances was estimated using conceptual site plans, equipment specification data, and equipment layout information provided by the Project Proponent, along with the general point-source attenuation equation of 6 dB per doubling of distance. The County Code establishes daytime (i.e., 7:00 a.m. to 10:00 p.m.) and nighttime (i.e., 10:00 p.m. to 7:00 a.m.) noise limits for receiving land uses. These can be applied to noise generated by stationary equipment in the county (as presented in Table 4-8). Note that the daytime noise limit in Table 4-8 that applies to multi-family dwellings is labeled *residential public space*, while the nighttime noise limit for multi-family dwellings is labeled *multi-family dwelling*. If measured ambient noise levels are higher than the standards, the allowable noise exposure standard is increased in 5 dB increments, as needed, to encompass or reflect the ambient noise level. All generator testing would take place during daytime hours (7:00 a.m. to 10:00 p.m.); therefore, the daytime noise level limits from Table 4-8 (residential public space) are applied in this analysis. The nearest existing noise-sensitive receptors are the multi-family homes west of the Project Site, which had measured average daytime $L_{eq}$ noise levels of 56.4 dBA. Because this measured noise level exceeds the standard in Table 4-8, the standard is raised by 5 dB from 55 dBA to 60 dBA.

### 5.1.2.3 Loading Noise

The potential for loading noise to result in substantial noise increases in the project area was analyzed qualitatively to determine the potential for a substantial temporary increase in noise at nearby sensitive land uses to occur. A quantitative analysis of loading noise was not considered necessary, given the absence of loading-intensive uses, such as a distribution center.

### 5.1.2.4 Traffic Noise

Traffic noise increases along nearby roadway segments resulting from project development were quantitatively modeled using traffic volumes and existing vehicle-mix assumptions (i.e., the proportion of automobiles, trucks, buses, and other vehicles) provided by the project traffic engineer (Fehr & Peers). Project-specific traffic data for on-campus roadways that service the Project Site were not provided by Fehr & Peers because existing traffic counts were not available for segments within the campus. For purposes of this analysis, on-campus roadway segments were conservatively assumed to host the full ADT volumes of their nearest neighboring off-campus roadway. For example, all vehicles that travel through the Clark Road guard station were assumed to continue onto the campus and travel along Wescoat Road between Clark Road and the Project Site. Based on the provided speed limit of 25 miles per hour along Ellis Street (between Manila Avenue and NASA ARC driveway) and the available roadway speed limit of 25 miles per hour identified for R T Jones Road, located adjacent to the campus, it was assumed that all on-campus segments had a 25-mile-per-hour speed limit. ADT volumes were provided for existing, existing-plus-project (CEQA Proposed Project), existing-plus-project (CEQA Reduced Density Alternative), cumulative-no-project, cumulative-plus-project (CEQA Proposed Project), and cumulative-plus-project (CEQA Reduced Density Alternative) conditions. Modeling of traffic noise from the project was conducted with use of a spreadsheet that was based on the FHWA Traffic Noise Model, version 2.5, for all of these conditions. The spreadsheet calculates the traffic noise level at a fixed distance from the centerline of a roadway, according to the traffic volume, roadway speed, and vehicle mix predicted to occur under each condition.

The evaluation of potential direct traffic noise increases compares traffic noise modeling results for the existing and the existing-plus-project traffic scenarios. Potential noise increases at existing noise-sensitive receptors along evaluated roadways were also assessed. In addition, a comparison of existing traffic noise to cumulative-plus-project traffic noise was conducted to determine if cumulative traffic noise increases would be expected to occur. If cumulative traffic noise increases were expected, the project contribution to these increases would be assessed by comparing traffic noise from the future no-project scenario to the future with-project scenario. The thresholds applied to assess traffic noise increases are:

- A 3 dB increase in noise in areas where existing and resulting noise levels are above the "satisfactory" range for that land use (as defined in the County general plan [55 dBA $L_{dn}$ for residential land uses, 65 dBA $L_{dn}$ for commercial land uses])
- A 5 dB increase in noise in areas where existing and resulting noise levels are below the "satisfactory" range for that land use.

The initial screening traffic noise evaluation is based on modeled traffic noise levels only (i.e., without consideration given to other noise sources making up the ambient noise level in a given area) at a fixed distance of 50 feet. If the screening evaluation showed a potential 3 dB increase,[21] the land uses along the segment were examined to determine if any would be considered noise sensitive; if land uses along a given segment were not considered to be noise sensitive, a potential 3 dB or greater increase in noise was not considered to be substantial, and no further analysis was conducted for that segment. If the screening analysis showed a potential 3 dB increase along segments with sensitive uses (e.g., residential or school land uses), the increase was flagged, and a more detailed assessment was conducted to determine the actual noise increase as a result of the project.

Note that, in some cases, modeled traffic noise levels do not fully characterize the existing noise environment along a given roadway segment; for example, traffic noise from a nearby larger-capacity roadway segment or overhead aircraft may dominate the overall noise environment in some areas. Therefore, along roadway segments where overall noise levels are influenced by traffic on other roadway segments (e.g., U.S. 101) or aircraft traffic, field-measured noise levels (when available) can also be considered in the analysis of potential traffic noise effects, as appropriate. The detailed traffic noise evaluation takes into consideration actual distances to nearby sensitive uses from the roadway centerline (compared to the 50-foot fixed distance used in the screening analysis) and existing measured noise levels, which were available for all segments flagged in the screening analysis.

To conduct the detailed assessment, project-only ADT volumes (i.e., existing-plus-project minus existing volumes) for the segments where a potentially substantial increase was identified were used to calculate project-only traffic noise levels at actual distances between the roadway centerline and the nearest sensitive land use along a given segment. Project-only traffic noise levels were then combined with existing measured ambient noise levels to create a composite ambient-plus-project traffic condition. These composite noise levels were then compared to nearby measured ambient (existing) noise levels to determine if a 3 dB increase from the existing measured noise level would be anticipated to occur as a result of project implementation.

[21] Table 5-9 shows that modeled traffic noise levels from the existing-plus-project scenario were between 62.3 and 70.1 dBA $L_{dn}$. These modeled noise levels all exceed the "satisfactory" range for sensitive uses (up to 55 dBA $L_{dn}$ for residential). Consequently, project-related traffic noise increases that exceed 3 dB are considered substantial for purposes of this analysis.

#### 5.1.2.5 Parking Garage Noise

Although parking area noise is difficult to predict because of the many variables (e.g., parking structure design, the number of vehicles moving through the structure at any given time), noise from parking areas is temporary and periodic. According to FTA's *Transit Noise and Vibration Impact Assessment Manual* (Federal Transit Administration 2018), 1,000 cars in a peak activity hour generate a sound equivalent level (SEL) of 92 dBA at 50 feet, which can be converted to an hourly $L_{eq}$ (average) noise level of 56.4 dBA $L_{eq}$ at 50 feet. Note that this noise level is based on vehicles operating in an open area and does not account for noise attenuation from solid walls associated with a parking garage.

For the purpose of this analysis, parking garage noise was estimated in accordance with the FTA methodology described above at the acoustical average distance from a given parking garage to the nearest off-site residential property. The acoustical average distance is often used to represent noise sources that are mobile or distributed over an area (such as the analyzed parking garage area). It is calculated by multiplying the shortest distance between the receptor and the noise source area (the closest edge of the parking garage) by the farthest distance (the farthest corner of the parking garage) and taking the square root of the product.

#### 5.1.2.6 Amplified Music or Speech from Programming or Events

According to the Project Proponent, the project's Central Green may be used for corporate gatherings that could at times employ amplified sound from a single speaker or background music from a small live band. Events are anticipated to occur monthly, with approximately 12 events per year. To estimate noise levels associated with the programming or events, previous measurements of events with amplified music or speech were used. Specifically, ICF's previously recorded noise levels from human speech being amplified by a single loudspeaker and a small live band, which included a guitar and vocalists with a single amplifier, were used to approximate noise levels from potential events associated with the project. The noise measurements of an individual speaking were taken at a wedding in Lakeside, California, on February 25, 2019. The noise measurements of a small live band were taken at a restaurant patio in Santee, California, on June 21, 2019. Estimated noise levels from such events at the nearest sensitive land uses were compared to existing measured noise levels for these uses. Note that the presented noise levels for amplified sound conservatively do not include attenuation from intervening project buildings, which would likely reduce noise levels experienced at the nearest receptors from amplified music or speech in the Central Green.

### Potential for Noise from New Stationary Sources to Combine

The evaluation of project operational noise is based on the potential for noise from the individual sources or activities described above to exceed the applicable noise ordinance limits or criteria for each respective source. Although it is possible for noise levels from multiple stationary sources to combine and result in greater noise levels, overall, noise levels are generally dominated by the loudest and closest source of noise. In order to ensure a reasonably conservative analysis, the analysis of each source includes realistic worst-case assumptions for noise sources at the closest reasonable distance from the nearest receptors. For these reasons, the analysis of stationary operational noise effects evaluates potential noise levels from individual pieces of equipment or noise sources associated with the project rather than scenarios with multiple types of stationary noise sources (e.g., emergency generators or events with amplified music) operating at the same time.

# 5.2 Thresholds of Significance

In accordance with Appendix G of the CEQA Guidelines, and to evaluate the project's potential effects under NEPA, the proposed project would be considered to have a significant impact or substantial adverse effect if it would result in any of the conditions listed below.

a) Generate 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 (CEQA/NEPA).

b) Generate excessive groundborne vibration or groundborne noise levels (CEQA/NEPA).

c) For a project in 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, expose people residing or working in the project area to excessive noise levels (CEQA/NEPA).

d) In combination with past, present, and reasonably foreseeable probable future projects, result in a cumulatively considerable significant impact with respect to noise or vibration (CEQA).

## 5.2.1 Short-Term Construction Noise Criteria

### 5.2.1.1 CEQA

Regarding the CEQA evaluation, as described above, UC Berkeley elected to use noise standards from the municipal code of the jurisdiction where noise-sensitive receptors are located for this project. Because the nearest noise-sensitive land uses are in an unincorporated area of Santa Clara County, the CEQA analysis evaluates construction noise in the context of the hourly restrictions and quantitative noise limits pertaining to construction in this jurisdiction. For the purposes of this analysis, construction noise will be evaluated to determine if the following were to occur:

- Construction noise levels at any noise-sensitive land use would exceed the limits listed in Table 4-10, presented previously (construction phases would have durations of 10 days or more).
- For multi-family dwellings (i.e., the nearest noise-sensitive receptors to the Project Site), the daytime (7:00 a.m. to 7:00 p.m.) threshold is 65 dBA; nighttime (7:00 p.m. to 7:00 a.m.) is 55 dBA.

Construction noise would be evaluated to determine if a substantial temporary increase in noise would be expected to occur, as follows:

- An increase in noise of 10 dB or more above the existing ambient noise level at any off-site noise-sensitive receptor during project construction

The County Code does not contain numerical noise standards for construction traffic noise. For the purposes of this analysis, traffic noise increases associated with heavy trucks and haul trucks will be evaluated to determine if the following were to occur:

- A 3 dB increase in noise in areas where existing and resulting noise levels are above the "satisfactory" range for that land use (as defined in the County general plan [55 dBA $L_{dn}$ for residential land uses])
- A 5 dB increase in noise in areas where existing and resulting noise levels are below the "satisfactory" range for that land use.

#### 5.2.1.2 NEPA

The NEPA analysis evaluates construction noise using the general assessment methodologies and thresholds from the FTA *Transit Noise and Vibration Impact Assessment Manual*, which include construction noise thresholds for commercial, industrial, and residential uses (Federal Transit Administration 2018) for both daytime and nighttime hours. The general assessment criteria for daytime and nighttime construction noise limits are summarized in Table 4-1, presented previously.

### 5.2.2 Long-Term Operational Noise Criteria

#### 5.2.2.1 CEQA

Estimated noise levels from on-site project operations are assessed relative to County noise exposure limits. Specifically, predicted noise levels were estimated to determine if they would exceed the County noise limits (presented previously in Table 4-8) at any off-site noise-sensitive receptor. Mechanical equipment could operate during both daytime and nighttime hours, with the nighttime noise limits being more stringent. Therefore, estimated noise levels are compared to the (more stringent) County noise exposure limit for nighttime hours (10:00 p.m. to 7:00 a.m.) to ensure a conservative analysis. According to Table 4-8, if measured ambient noise levels are higher than the standards, the allowable noise exposure standard is increased in 5 dB increments, as needed, to encompass or reflect the ambient noise level. The measured existing noise level at the residential receptors at Wescoat Village was 52.1 dBA $L_{eq}$. This ambient noise level is greater than the nighttime noise level standard outlined in Table 4-8 for multi-family dwellings of 50 dBA $L_{eq}$. Consequently, the noise standard used to assess mechanical equipment noise at this location is increased by 5 dB to encompass or reflect the ambient noise level. The applicable noise limit at this location is therefore 55 dBA $L_{eq}$ during nighttime hours.

With respect to traffic noise, the County does not establish specific thresholds to assess the potential for a substantial traffic noise increase to occur. Based on commonly used CEQA thresholds throughout the state, a traffic noise increase is considered substantial for this analysis if the following were to occur:

- A project-generated increase of 5 dBA in traffic noise at a noise-sensitive receptor when the resulting (i.e., existing-plus-project) traffic noise level at that sensitive use remains below the “satisfactory” range for that land use (as defined in the County general plan [55 dBA $L_{dn}$ for residential land uses])
- A project-generated 3 dBA or greater increase in traffic noise when the resulting (i.e., existing-plus-project) traffic noise level at that sensitive use is above the “satisfactory” range for that land use (as defined in the County general plan [55 dBA $L_{dn}$ for residential land uses])

#### 5.2.2.2 NEPA

The NEPA analysis considers the same standards used for the CEQA analysis of long-term operational noise sources.

### 5.2.3 Groundborne Vibration Criteria

#### 5.2.3.1 CEQA

Evaluation of the potential for project construction to result in vibration-related damage and annoyance effects is based on vibration-related damage and annoyance criteria from the Caltrans *Transportation and Construction Vibration Guidance Manual* (California Department of Transportation. 2020). The Caltrans thresholds for potential damage and annoyance were presented previously in Tables 4-4 and 4-5. Specifically, estimated vibration levels are evaluated to determine if the following would occur:

- Groundborne vibration levels would exceed the applicable Caltrans criteria for potential damage to structures at any off-site building at any time (Table 4-4).
- Groundborne vibration levels would exceed the Caltrans criterion for strongly perceptible vibration, which is defined as a PPV of 0.1 in/sec at any off-site residential use during the nighttime hours of 10:00 p.m. to 7:00 a.m.
- Groundborne vibration levels would exceed the applicable FTA vibration criteria for detailed vibration analysis (Table 4-3) at nearby structures containing sensitive research equipment (e.g., USGS Building 800).

#### 5.2.3.2 NEPA

There are no federal regulations that pertain specifically to groundborne vibration from construction activities associated with the proposed project. The NEPA analysis therefore considers the same standards used for the CEQA analysis of vibration-related damage and annoyance effects, including effects to nearby sensitive laboratory equipment.

## 5.3 Impacts

Throughout this technical report, the discussion of the CEQA Proposed Project and each CEQA alternative also applies to the corresponding Build Alternative under NEPA.

### 5.3.1 CEQA No-Project/Existing Conditions Alternative and NEPA No-Action Alternative

Under the CEQA No-Project/Existing Conditions Alternative, the CEQA Proposed Project and the CEQA Reduced Density Alternative would not be constructed. The on-site buildings that are currently operational would continue to be operational. Therefore, the CEQA No-Project/Existing Conditions Alternative would not result in effects on noise or vibration.

Under the NEPA No-Action Alternative, the proposed action would not be constructed and operated at the Project Site. However, the on-site buildings that are currently operational would continue to be operational, and the on-site buildings that are currently vacant would be reoccupied. An impact would occur if the NEPA No-Action Alternative would result in effects such as temporary disturbances generated by construction-related activities. This analysis assumes that reoccupying the existing buildings would not require any construction activity. Therefore, the NEPA No-Action Alternative would not result in construction noise or vibration effects. Similarly, no new sources of operational noise would be introduced on the Project Site and no increases in existing traffic noise levels in the project vicinity would be expected to occur.

## 5.3.2 CEQA Proposed Project (NEPA Build Alternative 1)

This section includes modeling results for each sub-topic, followed by the CEQA analysis and then the NEPA analysis for each sub-topic.

### 5.3.2.1 Project-Level Impacts

#### Construction Noise

Construction for the proposed project has the potential to generate noise that could exceed applicable CEQA and NEPA noise thresholds at nearby sensitive receptors. The proposed project would be constructed in four main phases (with more than 100 subphases) from 2027 to 2040. Construction would consist of both on-site and off-site work. On-site construction activities would generally take place no closer than 100 feet from the nearest existing residences. However, as described previously, the FTA general assessment construction noise analysis method recommends combining noise levels from the two loudest pieces of equipment expected to operate simultaneously, assuming both pieces of equipment are located at the center of the construction site. Rather than assuming construction equipment is located at the approximate center of the overall Project Site, the construction noise analysis assumes that equipment is operating at the approximate center of a given building footprint or subphase area. For on-site construction, the distance between the approximate center of the nearest project building is an estimated 200 feet from the nearest off-site existing residences (i.e., the existing Wescoat Village to the west). In addition, note that the two loudest pieces of equipment expected to operate simultaneously varies by subphase.

Off-site work, which would be limited to utility and in-road work, would occur within the street along the perimeter of the Project Site and on portions of Wescoat Road, Clark Road, Moffett Boulevard, Perimeter Road, Cody Road, Girard Road, and Ellis Street. Off-site work would generally take place no closer than 50 feet from the nearest sensitive receptors (i.e., the existing residences at Wescoat Village); the distance between the approximate center of the nearest in-street construction area is an estimated 55 feet from the nearest off-site existing residences (i.e., the existing Wescoat Village to the west).

**Daytime Construction Noise**

Except as discussed under *Nighttime Construction*, all proposed project construction would be limited to the daytime construction hours, defined by the County as 7:00 a.m. to 7:00 p.m. Monday through Saturday (excluding legal holidays), noting that construction would not occur on Saturdays. Initial modeling was conducted to estimate combined construction noise levels at a reference distance of 50 feet for each subphase type under the CEQA Proposed Project using the analysis approach described in Section 5.1, *Methods for Analysis,* of this report. Specifically, this assessment assumes simultaneous operation of the two loudest pieces of equipment expected to operate during a given subphase of construction (noting that the equipment modeled varies by subphase). Both pieces of equipment are assumed to operate simultaneously at the center of a given construction site (i.e., a given future building footprint), which is as close as approximately 200 feet from the nearest off-site receptor for on-campus buildings.

The results of the analysis are summarized in Table 5-2. Note that, although proposed project construction would include more than 100 subphases, each subphase type (e.g., Buildings – Site Preparation) would use the same equipment. Therefore, although detailed modeling results for all subphases are included in Appendix A, the summary below presents noise levels for each subphase type rather than all 100 subphases.

**Table 5-2. Combined Project Construction Noise Levels at 50 Feet by Subphase Type**

| Subphase Type/Construction Activity[a] | Combined Noise Level at 50 Feet (dBA, $L_{eq}$) |
|---|---|
| Buildings – Site Preparation | 87 |
| Buildings – Grading | 87 |
| Buildings – Demolition | 93 |
| Buildings – Vertical Construction, Foundations | 83 |
| Buildings – Vertical Construction, Trenching | 86 |
| Buildings – Vertical Construction, Core and Shell | 84 |
| Buildings – Architectural Coating | 81 |
| Utilities/roads – Grubbing and Land Clearing | 88 |
| Utilities/roads – Excavation | 91 |
| Utilities/roads – Drainage and Subgrade | 91 |
| Utilities/roads – Paving | 88 |
| Surface parking – Grading | 88 |
| Surface parking – Site Preparation | 88 |
| Surface parking – Paving | 88 |
| Parking Structure – Grading | 87 |
| Parking Structure – Site Preparation | 87 |
| Parking Structure – Building Construction | 84 |
| Parking Structure – Building Coatings | 78 |
| Parking Structure – Paving | 83 |

Source: Federal Highway Administration. 2006. *FHWA Roadway Construction Noise Model User's Guide*. FHWA–HEP–05–054. January. Available: https://www.fhwa.dot.gov/ENVIRonment/noise/construction_noise/rcnm/rcnm.pdf. Accessed: June 18, 2025.

[a] Although proposed project construction would include more than 100 subphases, each subphase type (e.g., Buildings – Site Preparation) would use the same equipment. Detailed modeling results for all subphases are included in Appendix A.

The summary that follows presents noise levels for each subphase type rather than all 100 subphases.

Table 5-2 demonstrates that combined noise levels at a reference distance of 50 feet during all project construction subphase types would be between 78 and 93 dBA $L_{eq}$. This initial modeling demonstrated that the worst-case, or loudest, on-site subphase of construction would be the Buildings – Demolition subphase, which would generate an estimated noise level of 93 dBA $L_{eq}$ at a reference distance of 50 feet. This subphase would involve potentially concurrent operation of multiple concrete saws. Table 5-3 presents the FTA general assessment modeling results for combined noise levels from the worst-case, or loudest, on-site subphase of construction (i.e., Buildings – Demolition) at various distances from the Project Site.

**Table 5-3. Worst-case On-site Construction Noise Phase, Buildings – Demolition**

| **Source Data:** | | **Maximum Sound Level (dBA)** | **Utilization Factor** | **$L_{eq}$ Sound Level (dBA)** |
|---|---|---|---|---|
| Source 1: Concrete Saw – Sound level (dBA) at 50 feet = | | 90 | 100% | 90 |
| Source 2: Concrete Saw – Sound level (dBA) at 50 feet = | | 90 | 100% | 90 |
| Calculated Data: | | | | |
| All sources combined – $L_{max}$ sound level (dBA) at 50 feet = | | — | — | 93 |
| All sources combined – $L_{eq}$ sound level (dBA) at 50 feet = | | — | — | 93 |
| **Receptor** | **Distance between Source and Receptor (feet)[a]** | **Attenuation Due to Distance (dB)** | **Calculated $L_{max}$ Sound Level (dBA)** | **Calculated $L_{eq}$ Sound Level (dBA)[b]** |
| **Existing residential (Wescoat Village)** | **200** | **-12** | **81** | **81** |
| Office/warehouse north of building[c] | 210 | -12 | 81 | 81 |
| Moffett Field Museum[c] | 270 | -15 | 78 | 78 |
| Jacobs Technology AFSS[c] | 270 | -15 | 78 | 78 |
| EMC (software company)[c] | 420 | -18 | 75 | 75 |
| Hangar One[c] | 480 | -20 | 73 | 73 |
| Carnegie Mellon University Silicon Valley | 530 | -21 | 73 | 73 |
| Moffett Field Chapel | 790 | -24 | 69 | 69 |
| Ames Child Care Center | 1,530 | -30 | 63 | 63 |

a. FTA guidance for a general assessment typically recommends measuring from the analyzed receptor to the middle of the Project Site. However, distances were conservatively measured from the analyzed receptor to the approximate center of the nearest proposed project building footprint (i.e., 200 feet for the nearest off-site existing residences).

b. FTA guidance for a general assessment recommends using a utilization factor of 1 for all construction equipment, resulting in $L_{eq}$ values that are equal to $L_{max}$ values.

c. Noise levels are presented at commerical and industrial uses to inform the NEPA assessment.

AFSS = Ames Facilities Support Services

**Bold** text denotes the nearest off-site sensitive land uses (residential)

The nearest sensitive receptors to on-site construction activities would be the existing residences at Wescoat Village west of the Project Site. Existing Wescoat Village receptors are approximately 200 feet from the center of the nearest proposed project building. At that distance, estimated noise levels from on-site construction activities were modeled to be approximately 81 dBA $L_{eq}$, based on the modeling assumptions described in Section 5.1, *Methods for Analysis*. Note that the Buildings – Demolition subphase type is the loudest subphase type for the project and that other construction subphase types would result in lower noise levels at the nearest receptors. Although noise levels are estimated to be lower for some construction subphases, noise levels from all subphases would be in the range of 66 dBA $L_{eq}$ (for building coatings) to 81 dBA $L_{eq}$ (for demolition) at a distance of 200 feet, according to the modeling results; most subphases would result in noise levels greater than 70 dBA $L_{eq}$ at that distance. For example, the Buildings – Site Preparation and Buildings – Grading subphases would both result in an estimated noise level of 75 dBA $L_{eq}$ at a distance of 200 feet. Additional receptors that may be considered sensitive are farther away, including Carnegie Mellon University Silicon Valley, Moffett Field Chapel, and the Ames Child Care Center. At these greater distances, noise levels from on-site construction would be lower than at the nearest sensitive receptors, as shown in Table 5-3.

Commercial and industrial uses are also present in the project vicinity. The nearest such uses include an office/warehouse building north of proposed Building 2 in Subarea 2 and the Moffett Field Museum, located approximately 210 and 270 feet from the Project Site, respectively. At these nearest commercial/industrial uses, estimated noise levels from the loudest on-site subphase of construction (i.e., Buildings – Demolition) were modeled to be 81 and 78 dBA $L_{eq}$, respectively. At commercial and industrial land uses located farther away, noise levels from on-site construction would be lower because of the increased distance between the construction activities and the receiving land use.

With respect to off-site construction, limited in-street work would occur to install utilities throughout the Ames campus and near the Project Site as part of the Utilities/Roads – Excavation and Utilities/Roads – Drainage and Subgrade subphases. The nearest sensitive receptors to proposed off-site construction would be the existing residences at Wescoat Village west of the Project Site, which are approximately 55 feet from the center of the nearest portion of in-street work. The two loudest pieces of equipment included on the construction list for off-site construction subphases would be a grader and a concrete saw. Table 5-4 presents the modeled combined noise levels from these worst-case, off-site subphases of construction at various receptor distances, including at a distance of 55 feet (the distance to the nearest residence from expected locations of in-street/off-site utility work).

At the nearby Wescoat Village receptors, worst-case off-site construction noise levels were modeled to be 90 dBA $L_{eq}$. Additional receptors that may be considered sensitive but located farther away include Carnegie Mellon University Silicon Valley, Moffett Field Chapel, and Ames Child Care Center. At these farther distances, noise levels from off-site construction would be lower than at the nearest sensitive receptors. The nearest commercial and industrial land uses (which are not generally considered to be noise sensitive) would be located 15 feet or more from off-site/in-street construction. At a distance of 15 to 30 feet (i.e., Hangar One and Jacobs Technology AFSS), worst-case construction noise levels from the loudest subphases were modeled to be 96 to 102 dBA $L_{eq}$.

**Table 5-4. Worst-case Off-site/In-street Construction Noise Phase, Utilities/Roads – Excavation and Utilities/Roads – Drainage and Subgrade (same worst-case equipment)**

| Source Data: | Maximum Sound Level (dBA) | Utilization Factor | $L_{eq}$ Sound Level (dBA) |
|---|---|---|---|
| Source 1: grader – Sound level (dBA) at 50 feet = | 85 | 100% | 85 |
| Source 2: concrete saw – Sound level (dBA) at 50 feet = | 90 | 100% | 90 |
| Calculated Data: | | | |
| All sources combined – $L_{max}$ sound level (dBA) at 50 feet = | — | — | 91 |
| All sources combined – $L_{eq}$ sound level (dBA) at 50 feet = | — | — | 91 |

| Receptor | Distance between Source and Receptor (feet)[a] | Attenuation Due to Distance (dB) | Calculated $L_{max}$ Sound Level (dBA) | Calculated $L_{eq}$ Sound Level (dBA)[b] |
|---|---|---|---|---|
| Hangar One[c] | 15 | 10 | 102 | 102 |
| Jacobs Technology AFSS[c] | 30 | 4 | 96 | 96 |
| Office/warehouse north of project Building 2[c] | 40 | 2 | 93 | 93 |
| Moffett Field Museum[c] | 55 | -1 | 90 | 90 |
| **Existing residential (Wescoat Village)** | **55** | **-1** | **90** | **90** |
| Ames Child Care Center | 85 | -5 | 87 | 87 |
| Moffett Field Chapel | 95 | -6 | 86 | 86 |
| Carnegie Mellon University Silicon Valley | 145 | -9 | 82 | 82 |
| EMC (software company)[c] | 290 | -15 | 76 | 76 |

a. FTA guidance for a general assessment typically recommends measuring from the analyzed receptor to the middle of the Project Site. However, distances were conservatively measured from the analyzed receptor to the middle of the nearest proposed in-street work (utilities/roads).

b. FTA guidance for a general assessment recommends using a utilization factor of 1 for all construction equipment, resulting in $L_{eq}$ values that are equal to $L_{max}$ values.

c. Noise levels are presented at commerical and industrial uses to inform the NEPA assessment.

AFSS = Ames Facilities Support Services

**Bold** text denotes the nearest off-site sensitive land use (residential)

### *CEQA*

The nearest noise-sensitive receptors to the proposed project would be the existing multi-family residences at Wescoat Village west of the Project Site. The nearest receptor at the existing multi-family dwelling is approximately 200 feet from the center of the nearest proposed project building. Noise levels at this receptor from on-site project construction activities were estimated to be up to 81 dBA $L_{eq}$. This noise level would exceed the applicable County threshold of 65 dBA by 16 dB (the applicable threshold is based on long-term construction activity [10 days or more] affecting a multi-family residential area). The existing average ambient daytime noise level near this receptor is approximately 56 dBA, 12-hour $L_{eq}$, based on the noise measurements at LT-1 (refer to Table 3-3). Therefore, noise levels from the worst-case loudest subphase of on-site construction could be up to 25 dB higher than existing ambient noise levels. This increase is considered substantial because it exceeds the 10 dB increase threshold established for the project.

Additional sensitive receptors include Carnegie Mellon University Silicon Valley, Moffett Field Chapel, and Ames Child Care Center. Construction noise levels would be reduced with additional distance at receptors located farther from project construction areas. Estimated noise levels from the worst-case loudest subphase type of on-site construction were modeled to be 73 dBA $L_{eq}$ at the nearest Carnegie Mellon University Silicon Valley structure, 69 dBA $L_{eq}$ at the Moffet Field Chapel, and 63 dBA $L_{eq}$ at the Ames Child Care Center. Note that the Santa Clara County thresholds for construction noise include only noise limits for single- and two-family dwellings, multi-family dwellings, or commercial areas (as shown in Table 4-10, presented previously). Although the aforementioned sensitive uses are not residential, they are generally considered to be more sensitive than commercial land uses; therefore, the construction noise threshold that applies to multi-family residential land uses, as shown in Table 4-10 (i.e., 65 dBA $L_{eq}$ for construction activities of 10 days or longer), is conservatively applied to these sensitive uses for purposes of this analysis.

At Carnegie Mellon University Silicon Valley, the daytime noise level of up to 73 dBA $L_{eq}$ from on-site construction (during demolition) is approximately 17 dB higher than the existing average daytime ambient noise level of approximately 56 dBA $L_{eq}$ (based on measurement LT-1). At the Moffett Field Chapel, the daytime noise level of 69 dBA $L_{eq}$ from the loudest on-site construction subphase type is estimated to be approximately 9 dB higher than the existing average daytime ambient noise level of approximately 60 dBA $L_{eq}$ (based on measurement LT-6). At the Ames Child Care Center, the daytime noise level of up to 63 dBA $L_{eq}$ from on-site construction is estimated to be approximately 3 dB higher the than the existing average daytime ambient noise level of approximately 60 dBA $L_{eq}$ (based on measurement LT-6). Although noise increases at Moffett Field Chapel and Ames Child Care Center do not exceed the 10 dB increase threshold established for the project during the worst-case loudest construction phase, worst-case on-site noise levels at Carnegie Mellon University Silicon Valley would exceed the 10 dB increase threshold.

The nearest sensitive receptors to proposed off-site/in-street construction would be the existing residences at Wescoat Village west of the Project Site, which would be approximately 55 feet from the center of the nearest portion of in-street work. Noise levels at these receptors from off-site/in-street construction activities were estimated to be up to 90 dBA $L_{eq}$. This noise level would exceed the applicable County threshold for daytime construction of 65 dBA by 25 dB (the applicable threshold is based on long-term construction activity [10 days or more ] affecting a multi-family residential area). The existing average daytime ambient noise level near these receptors is approximately 56 dBA $L_{eq}$, based on the noise measurements at LT-1 (refer to Table 3-3). Therefore, noise levels from the worst-case loudest subphase of off-site construction could be up to 34 dB higher than existing ambient noise levels. This increase is considered substantial because it exceeds the 10 dB increase threshold established for the project.

At the nearby Ames Child Care Center, Moffett Field Chapel, and Carnegie Mellon University Silicon Valley, estimated noise levels from the nearest off-site/in-street construction activities were estimated to be up to 87 dBA $L_{eq}$, 86 dBA $L_{eq}$, and 82 dBA $L_{eq}$, respectively. These construction noise levels all exceed the 65 dBA $L_{eq}$ threshold that is applied to these sensitive uses for the purpose of this analysis. At the Ames Child Care Center, the daytime noise level of 87 dBA $L_{eq}$ from off-site/in-street construction is estimated to be approximately 27 dB higher than the existing average daytime ambient noise level of approximately 60 dBA $L_{eq}$ (based on measurement LT-6). At the Moffett Field Chapel, the daytime noise level of 86 dBA $L_{eq}$ from off-site/in-street construction is estimated to be approximately 26 dB higher than the existing average daytime ambient noise level of approximately 60 dBA $L_{eq}$ (based on measurement LT-6). At Carnegie Mellon University Silicon Valley, the daytime noise level of 82 dBA $L_{eq}$ from off-site/in-street construction is estimated to be approximately 26 dB higher than the existing average daytime ambient noise level of approximately 56 dBA $L_{eq}$ (based on measurement LT-1). The increases at all three receptors are considered substantial because they exceed the 10 dB increase threshold established for the project.

In conclusion, daytime construction noise levels from both on- and off-site (in-street) construction would be expected to exceed County construction noise thresholds at the nearest noise-sensitive receptors. In addition, a 10 dB increase (or greater) over the existing ambient noise level would be expected to occur at the nearest noise-sensitive receptors. Because noise levels from daytime construction may exceed the applicable daytime construction noise thresholds, Mitigation Measures NOI-1 and NOI-2 have been identified to reduce construction noise levels. However, it may not be possible to reduce all daytime construction noise levels to a level below the significance thresholds used in this assessment, even with implementation of all feasible mitigation measures. Therefore, noise levels from daytime construction are expected to exceed applicable daytime construction noise limits, even with implementation of mitigation.

*Identified Mitigation Measures*

**Mitigation Measure NOI-1. Construction Noise Control Plan**

The Project Proponent or its contractor(s) shall develop a construction noise control plan to reduce noise levels to a level below the limits defined in the County Code, as well as FTA noise limits for daytime and nighttime construction noise, to the extent feasible (i.e., to the greatest extent practicable without impairing the contractors' ability to safely and effectively construct the project, causing unreasonable inefficiencies in the project's construction schedule, or substantially increasing costs such that they that are not commensurate with the noise reduction achieved). Further, the plan shall include measures to reduce construction noise levels such that a 10 dB or greater increase over the existing ambient noise level shall not occur at the nearest sensitive uses, to the extent feasible (as defined previously). The final construction noise control plan shall be provided to and approved by NASA at the time of construction permit applications for each building and/or phase of development. The plan shall include measures to reduce daytime construction noise to the following, to the extent feasible (as defined previously):

- 65 dBA $L_{eq}$, or less, at the nearest multi-family residences, per the County Code (noting that noise levels below this limit would also ensure that noise levels would be below the FTA limit for daytime noise of 90 dBA $L_{eq}$, or less, at the nearest residences)
- Less than 10 dB greater than the existing daytime ambient noise level

The plan shall also include measures to reduce nighttime noise levels to the following, to the extent feasible (as defined previously):

- 55 dBA $L_{eq}$, or less, at the nearest multi-family residences, per the County Code (noting that noise levels below this limit would also ensure that noise levels would be below the FTA limit for nighttime noise of 80 dBA $L_{eq}$, or less, at the nearest residences)
- Less than 10 dB greater than the existing nighttime ambient noise level

In order to assess construction noise increases relative to existing ambient noise levels, measurements obtained as part of this study may be used to define daytime and nighttime ambient noise levels. Alternatively, additional ambient noise measurements may be conducted as part of the construction noise control plan to further refine the ambient noise levels.

Techniques to reduce noise from construction activities to the relevant levels shall be incorporated into the plan and include, at a minimum, the following:

- Conduct construction activity that is not required to occur outside of typical construction hours because of technical or safety reasons (such as concrete pours or off-site utility installations) between 7:00 a.m. and 7:00 p.m. Monday through Saturday (excluding legal holidays), noting that construction shall not occur on Saturdays. Material/equipment deliveries shall not be permitted at the job site before 7:00 a.m. or after 7:00 p.m.
- Plan the noisiest construction activities during daytime hours when people are less sensitive to noise, when existing ambient noise levels are higher, and when quantitative noise standards pertaining to construction are less stringent.
- Use the quietest type of construction equipment readily available to the construction contractor. This applies to both stationary equipment (e.g., compressors) and mobile equipment (e.g., forklifts). Newer equipment is generally quieter than older equipment, electrically powered equipment is typically quieter than diesel, and hydraulically powered equipment is typically quieter than pneumatic. If compressors powered by diesel or gasoline engines are to be used, they shall be contained or have baffles to help abate noise levels.
- Require all construction equipment to be equipped with mufflers and sound control devices (e.g., intake silencers and noise shrouds) that are in good condition (at least as effective as those originally provided by the manufacturer) and appropriate for the equipment.
- Maintain all construction equipment to minimize noise emissions.
- Locate construction equipment (particularly stationary equipment, such as generators or compressors, that may operate at the same location for an extended period of time) as far as feasible from adjacent or nearby noise-sensitive receptors (e.g., as far as feasible from the western edge of the Project Site).
- Require stationary noise sources associated with construction (e.g., generators and compressors) in proximity to noise-sensitive receptors to be muffled and/or enclosed within temporary enclosures and shielded by barriers, which can reduce construction noise by 5 to 10 dB.
- Limit the use of impact tools (e.g., jack hammers) during nighttime/non-standard daytime hours, as feasible.
- Prohibit idling of inactive construction equipment for prolonged periods during both daytime and nighttime/non-standard hours (i.e., more than 2 minutes).
- Reduce noise from backup alarms (to the extent feasible without resulting in safety concerns) on construction vehicles and equipment by:
  - Providing a construction site layout that minimizes the need for reversing construction vehicles, or
  - Setting backup alarm noise levels to the minimum necessary for safe operation,

  - Using white-noise backup alarms, when feasible and safe, or
  - Using flagmen to keep the area behind maneuvering vehicles clear and minimize the time needed to back up vehicles.

- A construction notice shall be prepared that describes the project and the construction schedule, including the various types of activities that would occur throughout the construction period. The notice shall provide the name and telephone number of an on-site construction liaison. The notice shall be delivered to all property owners and residents within 500 feet of the Project Site at least 14 days (2 weeks) before the start of construction. The contact information shall also be posted on a sign at each entrance to the construction site from the public right-of-way; the sign shall be large enough to be legible from the public right-of-way. If construction noise is found to be intrusive to the community (i.e., if complaints are received), the construction liaison shall take reasonable efforts to investigate the source of the noise and require reasonable measures be implemented to correct the problem.

**Mitigation Measure NOI-2. Temporary Noise Barriers**

Prior to the start of construction in each Subarea, the Project Proponent or its contractor(s) shall install temporary noise barriers. The barriers shall be located along all portions of the western and southern construction Subarea perimeters within 1,400 feet of the Wescoat Village receptors. Each barrier shall be a minimum of 8 to 12 feet tall and constructed of material with a surface weight of at least 1 to 1.5 pounds per square foot and a STC of at least 25. There shall be no gaps or openings from the ground to the top of the barrier or along the length of the barrier. The barrier shall be constructed from plywood supported on a wood frame, acoustical blankets supported on a frame or metal construction fence, or another type of comparable material. A barrier may need to be temporarily moved or removed when it physically interferes with construction activities (e.g., the barrier is located on top of an area where a curb or sidewalk is to be constructed). Barriers are not required where complete project building(s) (i.e., complete with solid exterior facades, including all exterior walls and windows) fully block the line of sight from sensitive receptors to active construction areas. However, barriers are required where there are gaps or there are other locations where the line of sight is not fully shielded by complete project building(s).

***NEPA***

As shown in Table 5-3, daytime noise from on-site construction is anticipated to be up to 81 dBA at the nearest residences (multi-family residences at Wescoat Village) during the worst-case loudest on-site construction subphase (Building – Demolition). This noise level would not exceed the FTA’s general assessment criterion of 90 dBA $L_{eq}$ for residential land uses during daytime construction.

As shown in Table 5-4, daytime noise from off-site/in-street construction is anticipated to be up to 90 dBA at the nearest residences (multi-family residences at Wescoat Village) during the worst-case off-site loudest construction subphases (Utilities/Roads – Excavation and Utilities/Roads Drainage and Subgrade). This noise level would equal, but would not exceed, the FTA’s general assessment criterion of 90 dBA $L_{eq}$ for residential land uses during daytime construction. Additional sensitive receptors located farther away from on-site construction include Carnegie Mellon University Silicon Valley, Moffett Field Chapel, and the Ames Child Care Center. These sensitive uses are not residential but are generally considered to be more sensitive than commercial and industrial land uses; for this reason, the same 90 dBA $L_{eq}$ construction noise threshold that applies to residential land uses is conservatively applied to these sensitive uses for the purpose of this analysis. As shown in Table 5-3 and Table 5-4, noise levels at these sensitive land uses are not anticipated to exceed 90 dBA $L_{eq}$.

Tables 5-3 and 5-4 both show that estimated daytime construction noise levels would be below the FTA's general assessment criterion of 100 dBA $L_{eq}$ during daytime construction at commercial and industrial land uses, except one. At Hangar One, worst-case estimated noise levels would be up to 102 dBA $L_{eq}$ during off-site/in-street construction.

In conclusion, daytime construction noise levels from both on- and off-site construction activities at nearby noise-sensitive land uses were modeled to meet or be below the applicable FTA threshold (i.e., 90 dBA $L_{eq}$ for residential land uses during daytime construction). Daytime construction noise levels from off-site construction activities at one nearby industrial land use were modeled to exceed the applicable FTA threshold (i.e., 100 dBA $L_{eq}$ at industrial land uses during daytime construction), noting that noise levels at nearby commercial/industrial land from on-site construction uses were not modeled to exceed this threshold. Because noise levels from daytime off-site construction may exceed the applicable daytime construction noise limits, mitigation has been identified to reduce construction noise levels.

Mitigation Measure NOI-1 would help reduce on- and off-site construction noise effects on nearby industrial land uses through development and implementation of a construction noise control plan. Although this mitigation measure would be expected to reduce construction noise levels, it may not be possible to reduce noise levels during all construction activities to less-than-significant levels. For example, locating equipment as far as possible from noise-sensitive receptors and providing equipment with mufflers and sound control devices would reduce noise but may not be enough to reduce noise to levels to be below the significance criteria when in-street work occurs very close to a given receptor. In addition, quieter alternative types of equipment are generally not available to substitue for the equipment required for this in-street work (i.e., a grader and a concrete saw for the work near Hangar One). Further, the worst-case distance between off-site/in-street construction and the nearest industrial use, Hangar One, is only 15 feet. Because the construction activity itself is required to take place approximately 15 feet from the adjacent industrial use, increasing the separation distance between construction equipment and this nearby industrial receptor is not possible for this construction activity.

Note that, although construction noise levels were modeled to be below the NEPA significance thresholds at nearby residential receptors without mitigation, Mitigation Measure NOI-1 would reduce construction noise levels at nearby residential receptors. Mitigation Measure NOI-2 (required under CEQA) which includes the installation of temporary noise barriers along the western and southern perimeter of Subareas within 1,400 feet of Wescoat Village, would further reduce construction noise at residential receptors. Despite the noise reductions expected from implementation of mitigation, the construction noise effects at one nearby industrial land use (Hangar One) are still considered substantial.

**Nighttime Construction Noise**

The only on-site construction activities proposed for nighttime hours are concrete pours; in addition, off-site/in-street work for utilities may also occur during nighttime hours. Noise associated with each activity is discussed separately below. Concrete pours often must occur during nighttime hours because cooler temperatures and higher humidity levels provide better conditions for concrete curing. In general, approximately five individual nights of construction would be required per building for concrete pours. In some instances, nighttime concrete pours could occur on back-to-back nights. However, the concrete pours would be limited in number and would generally occur months apart from each other. Estimated combined noise levels from nighttime concrete pours were modeled at a distance of 200 feet, the estimated distance from the approximate center of the nearest proposed project building to the nearest existing multi-family residential land uses (Wescoat Village). Table 5-5 provides the modeled combined noise levels from nighttime concrete pours at various distances from a given construction area.

**Table 5-5. Estimated Construction Noise from Nighttime Concrete Pours ($L_{max}$ and $L_{eq}$)**

| Source Data | Maximum Sound Level (dBA) | Utilization Factor | $L_{eq}$ Sound Level (dBA) |
|---|---|---|---|
| **Construction Condition: Nighttime Concrete Pours** | | | |
| Source 1: concrete mixer – Sound level (dBA) at 50 feet = | 79 | 100% | 79.0 |
| Source 2: concrete pump – Sound level (dBA) at 50 feet = | 81 | 100% | 81.0 |
| **Calculated Data:** | | | |
| All sources combined – $L_{max}$ sound level (dBA) at 50 feet = | | | 83 $L_{max}$ |
| All sources combined – $L_{eq}$ sound level (dBA) at 50 feet = | | | 83 $L_{eq}$ |

| Distance between Source and Receptor (feet) | Attenuation Due to Distance (dB)[a] | Calculated $L_{max}$ Sound Level (dBA)[b] | Calculated $L_{eq}$ Sound Level (dBA)[b] |
|---|---|---|---|
| 50 | 0 | 83 | 83 |
| 100 | -6 | 77 | 77 |
| 150 | -10 | 74 | 74 |
| ***200*** | ***-12*** | ***71*** | ***71*** |
| 250 | -14 | 69 | 69 |
| 300 | -16 | 68 | 68 |
| 350 | -17 | 66 | 66 |
| 400 | -18 | 65 | 65 |
| 500 | -20 | 63 | 63 |
| 600 | -22 | 62 | 62 |
| 700 | -23 | 60 | 60 |
| 800 | -24 | 59 | 59 |
| 1,000 | -26 | 57 | 57 |

Source: FHWA 2006.

a. Distance attenuation based on 6 dB per doubling of distance.

b. This calculation does not include the effects, if any, of ground attenuation or local shielding from intervening walls, topography, or other barriers that may reduce sound levels further.

**Bold** text denotes the nearest off-site sensitive land uses (residential)

As shown in Table 5-5, construction noise during nighttime concrete pours is expected to be approximately 71 dBA $L_{eq}$ at a distance of 200 feet, the approximate distance from the center of the nearest proposed project building to the nearest off-site existing sensitive receptors (i.e., Wescoat Village residences).

Off-site construction in roadways for utility installation may also occur outside of normal business hours and on weekends, per NASA requirements. In general, this would include approximately 10 days of nighttime construction per utility system (e.g., sewer, stormwater, recycled water, power, and telecom systems). The nearest sensitive receptors to proposed in-road construction that may take place at night would be the existing residences west of the Project Site at Wescoat Village, which are approximately 55 feet from the center of the nearest portion of in-street work.

The loudest off-site/in-street subphases (i.e., Utilities/Roads – Excavation and Utilities/Roads – Drainage and Subgrade) would involve potentially concurrent operation of a grader and a concrete saw. These are the same subphases that were previously analyzed as part of the daytime construction noise assessment. The associated noise levels are reported in Table 5-4. As shown in the table, noise levels during off-site/in-street work could be up to approximately 90 dBA $L_{eq}$ at 55 feet.

***CEQA***

Construction noise levels from on-site concrete pours during nighttime hours were estimated to be up to 71 dBA $L_{eq}$ at the nearest existing noise-sensitive receptors (i.e., the nearby Wescoat Village residences). This noise level would exceed the applicable County threshold of 55 dBA by 16 dB (the applicable threshold is based on nighttime construction noise between the hours of 7:00 p.m. and 7:00 a.m. affecting a multi-family residential area). The existing average ambient nighttime noise level near the existing Wescoat Village residences is approximately 57 dBA $L_{eq}$, and the lowest 1-hour nighttime ambient noise level is approximately 52 dBA $L_{eq}$, based on the noise measurements at LT-1 (refer to Table 3-3). Therefore, noise levels from nighttime on-site construction could be up to 14 dB higher than the existing average ambient nighttime noise level and 19 dB higher than the lowest existing hourly ambient nighttime noise level. This increase is considered substantial because it exceeds the 10 dB increase threshold established for the project.

Off-site/in-street utility work that is required to take place during nighttime hours could result in noise levels of up to 90 dBA $L_{eq}$ at the nearest noise-sensitive use (the existing residences at Wescoat Village). This noise level would exceed the applicable County threshold of 55 dBA by 35 dB (the applicable threshold is based on nighttime construction noise between the hours of 7:00 p.m. and 7:00 a.m. affecting a multi-family residential area). The existing average ambient nighttime noise level near the existing Wescoat Village residences is approximately 57 dBA $L_{eq}$, and the lowest 1-hour nighttime ambient noise level is approximately 52 dBA $L_{eq}$, based on the noise measurements at LT-1 (refer to Table 3-3). Therefore, noise levels from the worst-case loudest subphase of off-site/in-road nighttime construction could be up to 33 dB higher than the existing average ambient nighttime noise levels and 38 dB higher than the lowest existing hourly ambient nighttime noise level. This increase is considered substantial because it exceeds the 10 dB increase threshold established for the project. Mitigation Measures NOI-1 and NOI-2, described previously, have been identified to reduce noise levels from nighttime construction activities. However, it may not be possible to reduce all nighttime construction noise levels to a level below the significance thresholds used in this assessment, even with implementation of all feasible mitigation measures. In addition, Mitigation Measure NOI-2 would not be expected to reduce noise from nighttime off-site/in-street work because such work would generally not take place behind the temporary noise barriers described under this measure. For these reasons, noise levels from nighttime construction are expected to exceed applicable construction noise limits, even with implementation of mitigation.

### *NEPA*

As shown in Table 5-5, noise from on-site nighttime construction (concrete pours) is anticipated to be up to 71 dBA at the nearest residences (multi-family residences at Wescoat Village). This noise level would be below the FTA's general assessment criterion of 80 dBA $L_{eq}$ for residential land uses during nighttime construction.

As shown in Table 5-4, nighttime noise from off-site/in-street construction is anticipated to be up to 90 dBA at the nearest residences (multi-family residences at Wescoat Village) during the worst-case off-site construction phases (Utilities/Roads – Excavation and Utilities/Roads Drainage and Subgrade). This noise level would exceed the FTA's general assessment criterion of 80 dBA $L_{eq}$ for residential land uses during nighttime construction.

Because noise levels from off-site/in-street construction may exceed the FTA criteria for nighttime construction noise, mitigation has been identified to reduce nighttime construction noise levels. Mitigation Measure NOI-1 would reduce construction noise effects through development and implementation of a construction noise control plan. Although this mitigation measure would reduce construction noise levels, it may not be possible to reduce noise levels during all construction activities to less-than-significant levels. For example, locating equipment as far as possible from noise-sensitive receptors and providing equipment with mufflers and sound control devices would reduce noise but may not be enough to reduce noise to levels to be below the significance criteria when in-street work occurs very close to a given receptor. Mitigation Measure NOI-2 (required under CEQA), which includes the installation of temporary noise barriers along the western and southern perimeter of Subareas within 1,400 feet of Wescoat Village, would reduce construction noise at residential receptors from nighttime on-site concrete pours, noting that noise levels from this activity were not modeled to exceed the applicable NEPA threshold. Note that Mitigation Measure NOI-2 would not be expected to reduce noise from nighttime off-site/in-street work because such work would generally not take place behind the temporary noise barriers described in this measure. Despite the noise reductions expected from implementation of mitigation, construction noise effects during nighttime hours to the nearby residential receptors would still be considered substantial.

## Haul Truck and Heavy Truck Traffic Noise

Demolition and construction activities would require the use of haul trucks to remove debris and excavated materials and vendor trucks to deliver building materials. Based on information provided for the CEQA Proposed Project, up to 91 one-way haul truck trips and 20 one-way vendor truck trips (111 total one-way heavy truck trips) would travel to and from the site on a worst-case day.[22] Haul trucks would access the site via U.S. 101, exit U.S. 101 at Ellis Street, travel through the campus guard station along Ellis Street, and continue to the Project Site via Cody Road. Trucks leaving the Project Site would exit the site via Cody Road, continue to Ellis Street, travel past the campus guard station, and enter the U.S. 101 on-ramp.

[22] Typically, haul trucks would be considered to be heavy trucks, while vendor trucks would be considered to be medium-size trucks. Under normal operating conditions, heavy trucks generally produce higher noise levels than medium trucks. This analysis conservatively assumes that all haul and vendor trucks are heavy trucks.

Table 5-6 shows the modeled noise levels for roadway segments where traffic from heavy construction trucks would occur under the CEQA Proposed Project. As shown in Table 5-6, construction-related heavy trucks could increase traffic noise levels along haul-route roadway segments by 0.5 to 2.7 dB. Note that there are also no noise-sensitive receptors along the roadway segments that comprise the haul route north of U.S. 101.

**Table 5-6. Haul Truck Traffic Noise Analysis**

| | | Traffic Noise Levels, dBA $L_{dn}$, at 50 feet | | |
|---|---|---|---|---|
| **Roadway** | **Segment** | **Existing Noise Levels** | **Existing-plus-Heavy-Truck Noise Levels** | **Noise Increase Due to Project Construction Truck Traffic, dBA** |
| Cody Road[a] | Between Ellis Street and Girard Road | 52.7 | 55.4 | 2.7 |
| Ellis Street | Between Manila Avenue and the NASA ARC driveway | 52.7 | 55.4 | 2.7 |
| Ellis Street | Between U.S. 101 northbound ramps and Manila Avenue | 61.5 | 62.4 | 0.9 |
| Ellis Street | Between U.S. 101 southbound ramps and U.S. 101 northbound ramps | 62.2 | 62.7 | 0.5 |

Refer to Appendix A for the complete traffic noise modeling results.

Note: Modeled noise levels at a fixed distance of 50 feet from the roadway centerline.

a. Traffic counts and estimated ADT volumes for roadway segments within the campus (beyond the NASA ARC guard stations) were not available/not provided by the project traffic consultant. To evaluate potential traffic noise effects within the campus, it was conservatively assumed that all traffic passing through the Ellis Street guard station would turn left and travel to the Project Site and the greater campus.

### *CEQA*

As shown in Table 5-6, haul truck modeling results indicate that increases in traffic noise from construction truck activity along the project haul routes would be in the range of 0.5 to 2.7 dB. During most subphases of construction, there would be fewer daily haul truck or heavy truck trips compared with the number presented in this analysis, resulting in even smaller noise increases. Note that there are also no noise-sensitive receptors along the roadway segments that comprise the haul route north of U.S. 101. In conclusion, the maximum modeled noise increase resulting from construction truck activity under the CEQA Proposed Project is less than the 3 dB increase threshold established for the project, and haul truck activity would not be expected to expose noise-sensitive receptors to excessive noise.

### *NEPA*

As shown in Table 5-6, haul truck modeling results indicate that increases in traffic noise from construction truck activity along the project haul routes would be in the range of 0.5 to 2.7 dB. During most subphases of construction, there would be fewer daily haul truck or heavy truck trips compared with the number presented in this analysis, resulting in even smaller noise increases. Note that there are also no noise-sensitive receptors along the roadway segments that comprise the haul route north of U.S. 101. In conclusion, the maximum modeled noise increase resulting from construction truck activity under NEPA Build Alternative 1 is less than the 3 dB increase threshold established for the project, and haul truck activity would not be expected to expose noise-sensitive receptors to excessive noise.

## Operational Noise

### Mechanical Equipment

#### *Heating, Cooling, and Ventilation Equipment*

For purposes of the noise analysis, Figure 5-1 shows the conceptual locations of the proposed buildings within each Subarea. Under the CEQA Proposed Project, buildings in Subarea 6 (i.e., Buildings 10 through 12) would be closest to off-site sensitive uses, with Building 12 located approximately 100 feet from the nearest residence in Wescoat Village. Because the Subarea 6 buildings would be closer to off-site residential land uses than any other project area, the noise analysis of mechanical heating and cooling equipment focuses on equipment on proposed project buildings within this Subarea. According to the Project Proponent, all rooftop equipment would be installed at least 5 feet from the edge of the roof and screened by a mechanical screen (with the exception of some flues and exhaust vents that may extend beyond the screen.)

Under the CEQA Proposed Project, Building 10 within Subarea 6 would be developed with R&D, academic, and office uses; Building 12 would be developed with student and faculty housing. (Note that Building 11 would be developed with a parking garage; it would not be expected to have heating and cooling equipment on the roof.) Based on information provided by the Project Proponent on what equipment might be installed for such uses, mechanical equipment noise levels were estimated for the individual R&D, academic, and office uses within Subarea 6 (i.e., Building 10) and Building 12, the proposed student faculty housing building proposed for the western corner of the Project Site.

According to the Project Proponent, mechanical heating and cooling equipment installed on the rooftop of Building 12 (student and faculty housing within Subarea 6) would be expected to include:

- 16 outdoor air-handling units (assumed to be variable-refrigerant-flow systems)

Mechanical equipment installed on the rooftops of R&D, academic, and office buildings (e.g., Building 10) would be expected to include the following:

- Two duty cooling towers (600 tons each)
- One redundant cooling tower (600 tons)
- Three air-source heat pumps (3,500 MBH[23] each)

Additional mechanical equipment required for the R&D, academic, and office buildings (e.g., Building 10) would be installed in a rooftop mechanical room, including an estimated:

- Three water-cooled chillers (500 tons each)
- Nine circulation pumps
- Two expansion tanks

[23] MBH = 1,000 British thermal units (BTU) per hour.

This assessment conservatively assumes that all equipment would operate simultaneously and be located relatively close together on a building rooftop. For equipment located in a mechanical room, 10 dB of noise reduction was assumed to represent the noise attenuation provided by the room. For rooftop equipment, 5 dB of noise reduction was applied to account for attenuation from the project's solid rooftop mechanical screens. Refer to Table 5-7 for the estimated combined noise levels of the heating, cooling, and ventilation equipment by modeled building. This analysis conservatively uses horizontal distances between the mechanical equipment noise sources and the nearest receptor (sensitive residential uses) and ignores the additional diagonal distance due to the elevated rooftop location (with building heights of up to 80 feet).

Based on the mechanical equipment modeling conducted, the estimated combined noise level from rooftop mechanical equipment on the nearest project building to a noise-sensitive use (i.e., Building 12 in the southwest portion of Subarea 6) would be approximately 75.6 dBA $L_{eq}$ at the nearest Wescoat Village residences (located approximately 100 feet from Building 12). Noise levels at these residences from mechanical equipment on the nearest R&D, academic, and office building (i.e., Building 10 in Subarea 6) was estimated to be approximately 61 dBA $L_{eq}$. Because the noise level at the nearest receptors from the rooftop equipment at Building 12 is estimated to be more than 15 dB greater than the estimated noise level from Building 10 rooftop equipment, overall equipment noise experienced by the Wescoat Village receptors would be dominated by Building 12 equipment noise.[24]

*Sewer Lift Station Noise*

Although located below grade, the project's operational sewer lift station would have the potential to generate noise from the proposed pump. The make and model of the pump associated with the sewer lift station has not been finalized; therefore, this analysis uses the estimated noise level of a typical pump, per FHWA. Based on noise levels cited in the *FHWA Roadway Construction Noise Model User's Guide,* a pump can generate noise in the range of 81 dBA at 50 feet. The sewer lift station would be approximately 140 feet from the existing Wescoat Village residences. Because the pump is proposed to be below grade, 10 dB of attenuation is applied to estimated pump noise in this analysis. At a distance of 140 feet, pump noise was modeled to be approximately 62 dBA $L_{eq}$.

*BESS Equipment*

As described in Section 5.1, *Methods for Analysis* section presented previously, a BESS would be installed at multiple project parcels. The specific makes and models of the proposed BESS units have not been identified. However, as described in Section 5.1, *Methods for Analysis*, the dominant noise source at each BESS would be the climate control system, with an estimated noise level of approximately 55 dBA at a distance of 50 feet, based on reference data for an industrial air conditioner[25] that would be compatible with a modular BESS enclosure (Marvair 2011).

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24 When the difference between noise sources is more than 10 dBA, the combined noise level is generally equal to the louder noise level.

25 The primary noise source associated with the containers would be the climate control system, which would regulate the temperature of the batteries to optimize BESS performance. For purposes of analysis, it has been assumed that the noise level from each BESS unit would be comparable to the noise level from an industrial air conditioner. The example used in the noise calculations was a Marvair ComPac air conditioner, Model AYPA72AC, which is a wall-mounted industrial air conditioner, used primarily to cool electronic and communication equipment in shelters. This model was identified during prior noise studies as a unit that would be compatible with a modular BESS enclosure. The Marvair ComPac AYPA72AC has a manufacturer's-tested noise level of 55 dBA at 50 feet.

## Table 5-7. Estimated Heating, Cooling, and Ventilation Equipment Noise – CEQA Proposed Project

| Type of Equipment | Number | dBA $L_{eq}$ Noise at 50 Feet for One Piece of Equipment (assuming 100% utilization) | Located in a Room or Exterior? | Attenuation Based on Equipment Location in Room or Behind Screen (dB) | Attenuated Noise at 50 Feet for One Equipment Piece | Combined Attenuated Noise by Equipment Type (dBA) | Source for Estimated Equipment Noise |
|---|---|---|---|---|---|---|---|
| **Individual Office, R&D, and Academic Building (i.e., Building 10 in Subarea 6)** | | | | | | | |
| Cooling towers (duty) | 2 | 74 | Exterior | 5 | 69 | 72.0 | H&K |
| Air-source heat pumps | 3 | 75 | Exterior | 5 | 70 | 74.8 | H&K |
| Water-cooled chillers | 3 | 71 | Room | 10 | 61 | 65.8 | H&K |
| Circulation pumps | 9 | 81 | Room | 10 | 71 | 80.5 | FHWA |
| Expansion tanks | 2 | N/A | Room | N/A | N/A | N/A | N/A |
| Building combined equipment noise at 50 feet | | | | — | — | 82.1 | — |
| **Building Combined Equipment Noise at Nearest Residences (Wescoat Village, approximately 560 feet from equipment and 555 feet from the roof edge)** | | | | | — | **61.1** | — |
| **Residential Building (i.e., Building 12 in Subarea 6)** | | | | | | | |
| HVAC | 16 | 75 | Screen | 5 | 70 | 82.0 | H&K |
| Residential building combined equipment noise at 50 feet | | | | | — | 82.0 | — |
| **Residential Building Combined Equipment Noise at Nearest Residences (Wescoat Village, approximately 105 feet from equipment and 100 feet from the roof edge)** | | | | | — | **75.6** | — |

Sources: Hoover and Keith 2000; FHWA 2006.

dB = decibels; dBA = A-weighted decibels; H&K = Hoover and Keith; HVAC = heating, ventilation, and air-conditioning

Conceptual plans indicate that the closest BESS unit to the existing multi-family homes west of the Project Site (Wescoat Village) would be approximately 130 feet away. At that distance, BESS noise levels would be reduced to approximately 47 dBA. The next-closest BESS units to these homes would be more than 500 feet away and shielded from view by intervening project buildings. Therefore, the contribution of noise from additional BESS units would be negligible, and 47 dBA constitutes a reasonable worst-case estimate of BESS noise levels at the nearest multi-family residence (associated with Wescoat Village, located west of the Project Site). Noise levels would be lower at homes at Wescoat Village that are farther from the BESS and/or shielded from the nearest BESS by intervening project buildings.

***CEQA***

It is assumed that project mechanical equipment could operate during both daytime and nighttime hours. Therefore, modeled mechanical equipment noise levels are compared to the more stringent nighttime noise thresholds for nearby noise-sensitive receptors. As described in Section 5.1, *Methods for Analysis*, based on the existing measured ambient noise levels, the applicable nighttime noise threshold for Wescoat Village receptors would be 55 dBA $L_{eq.}$ Referring to Table 5-7, the combined mechanical equipment noise level at these receptors was estimated to be approximately 75.6 dBA $L_{eq}$. This noise level exceeds the applicable noise exposure limit of 55 dBA $L_{eq}$ for nighttime hours at the Wescoat Village residences. In addition, the analysis provided above is based on reasonable assumptions about the equipment noise levels and on a library of data from example equipment that provided high-level details related to the types of equipment proposed under the project.

Based on the analysis above, modeled noise levels from mechanical heating, cooling, and ventilation equipment would have the potential to exceed the applicable noise standards at the nearest noise-sensitive receptors (Wescoat Village residences), and mitigation would be required.

With respect to pump noise from the sewer lift station, pump noise was modeled to be approximately 62 dBA at the nearby Wescoat Village residences. This noise level exceeds the applicable noise exposure limit of 55 dBA $L_{eq}$ at this location by approximately 7 dB. Because the noise levels exceed the applied thresholds, noise effects related to the proposed sewer lift station would be considered potentially significant.

With respect to BESS noise, at Wescoat Village, BESS noise was modeled to be approximately 47 dBA $L_{eq}$, using the specification sheets for the equipment described above. This noise level is below the applicable noise exposure limit of 55 dBA $L_{eq}$ at this location. Therefore, noise from BESS operations would not be expected to exceed the noise exposure limit for nighttime hours at the nearby Wescoat Village. However, the analysis provided above is based on reasonable assumptions about the equipment noise levels; the final mechanical equipment noise levels would be subject to change, pending selections and locations. Therefore, the potential exists for actual noise levels to be higher or lower than those presented in this analysis.

Based on the analysis above, noise levels from mechanical heating, cooling, and ventilation equipment and sewer lift station equipment have the potential to exceed the applicable noise standards at the nearest noise-sensitive receptors. In addition, although modeled levels from example BESS equipment were below applied thresholds, BESS equipment would also have the potential to exceed the applicable noise standards at the nearest noise-sensitive receptors, depending on the final makes and models of BESS equipment selected for the project. In addition, the analysis provided above is based on reasonable assumptions about the equipment noise levels; the final noise levels are subject to change, pending final equipment selections and locations. Therefore, the potential exists for actual noise levels to be higher or lower than those presented in this analysis. Mitigation Measure NOI-3 has been identified to reduce noise levels from mechanical equipment. Although the exact makes and models of project mechanical equipment are not currently known, several noise-reduction options are available to reduce mechanical equipment noise to levels below the significance thresholds used in this assessment. This includes selecting and installing quieter models, upgrading equipment acoustical enclosures, orienting or shielding equipment to protect noise-sensitive receptors to the greatest extent feasible, increasing the distance between the equipment and noise-sensitive receptors, and/or placing noise-attenuating barriers around equipment. For that reason, noise effects from project mechanical equipment would be reduced to a level below the applicable significance thresholds with implementation of mitigation.

***Identified Mitigation Measure***

**Mitigation Measure NOI-3. Design and Install Mechanical Equipment to Comply with Noise Standards**

Prior to the issuance of building permit(s) for each project building that would include mechanical equipment, the Project Proponent or its contractor(s) shall retain a qualified acoustical consultant to prepare an acoustical report and address mechanical equipment noise issues, based on the selected models and design features. (Note that the analysis of mechanical equipment noise and emergency generator noise, required under Mitigation Measure NOI-4, could be completed by the same consultant and presented in a single report.) The final report, including the analysis results and any recommended noise control measures, shall be provided to and approved by NASA at the time of construction permit applications for each building and/or phase of development. The recommendations of the report shall be incorporated into the applicable project plans (site, architectural, civil, and mechanical, as needed) and implemented during project construction. The acoustical report shall satisfy the following requirements:

- The analysis shall evaluate the design and provide recommendations, as necessary, to ensure that combined noise levels from mechanical equipment at project buildings, including recommended noise-control measures incorporated into the project design, do not exceed the County noise exposure limits for the nearby noise-sensitive receptors (i.e., 55 dBA $L_{eq}$ at Wescoat Village).
- The analysis shall consider all noise-generating equipment, including the anticipated worst-case combination(s) of equipment that could run simultaneously. Noise-generating equipment may include, but is not limited to, air conditioners, air handlers, exhaust fans, cooling towers, chillers, pumps, and BESS units.
- Noise-control recommendations may include, but are not limited to:
    - Changing equipment locations (e.g., locating equipment inside buildings, as feasible, taking into account site-specific constraints such as structural limitations, ventilation requirements, access for maintenance, and cost considerations);
    - Selecting quieter models;
    - Providing equipment sound power limits in procurement specifications;
    - Shielding equipment with rooftop parapet walls, louvers, screens, or enclosures;

- Using acoustic absorption materials in shielding materials;
- Installing mechanical equipment base isolators; and
- Installing intake or exhaust silencers.

***NEPA***

Noise levels from mechanical heating, cooling, and ventilation equipment; sewer pump station equipment; and BESS equipment would have the potential to exceed the applied noise standards at the nearest noise-sensitive receptors under NEPA Build Alternative 1. Specifically, as shown in Table 5-7, the combined mechanical equipment noise level at the nearest receptors was estimated to be approximately 75.6 dBA $L_{eq}$, which exceeds the applicable noise exposure limit of 55 dBA $L_{eq}$ for nighttime hours at the Wescoat Village residences. In addition, the analysis provided above is based on reasonable assumptions about the equipment noise levels; the final noise levels are subject to change, pending final equipment selections and locations. Therefore, the potential exists for actual noise levels to be higher or lower than those presented in this analysis. Mechanical equipment noise effects would be considered substantial. Mitigation Measure NOI-3 has been identified to reduce mechanical equipment noise levels by requiring the design and installation of mechanical equipment to comply with noise standards. Although the exact makes and models of project mechanical equipment are not currently known, several noise-reduction options are available to reduce mechanical equipment noise to levels below the significance thresholds used in this assessment. This includes selecting and installing quieter models, upgrading equipment acoustical enclosures, orienting or shielding equipment to protect noise-sensitive receptors to the greatest extent feasible, increasing the distance between the equipment and noise-sensitive receptors, and/or placing noise-attenuating barriers around equipment. For that reason, noise effects from project mechanical equipment would be reduced to below the applicable significance thresholds with implementation of mitigation.

**Emergency Generator Testing**

Note that noise from the operation of generators during an emergency is generally exempt from local noise ordinances. However, noise from the testing of emergency generators is evaluated to determine if it would be below the local noise limits for operational equipment. Periodic testing of project emergency generators would occur for 2 to 4 hours per month per generator during daytime hours. It is likely that multiple generators, but not all generators, would be tested on the same day. Thus, generator testing would most likely occur on multiple days each month. The CEQA Proposed Project would involve the installation of twelve 500-kilowatt (kW) (equal to six megawatt [MW] emergency generators). Specifically, under the CEQA Proposed Project, the 12 generators would be located in Subareas 2, 3, 5, and 6 of the Project Site (with one generator located at Building 3, 4, 7, and 8 and two generators located at Building 2, 5, 9, and 10). At each building, generators would either be located at the ground level (i.e., potentially in ground-floor outdoor working yards) or on building rooftops (i.e., approximately 80 feet above ground level). This analysis conservatively assumes that generators would be located on the ground level because this would result in a shorter (and therefore, conservative) modeled worst-case distance between generator locations and sensitive receptors. General locations for the proposed generators under the CEQA Proposed Project have been identified by the Project Proponent. The nearest sensitive receptors to any of the proposed generator locations would be the existing residences at Wescoat Village, west of the Project Site.

Although the final makes and models of the generators have not been determined, specification data for a sample 500 kW generator were used to estimate project generator noise. According to the generator specification data, a 500 kW Cummins 500DFEK generator could produce an unattenuated noise level of 101.5 dBA at 50 feet, including both engine and exhaust noise (Cummins 2019). The emergency generators associated with the project would be screened from view from interior streets and surrounding areas. Specifically, generators would be screened to the height of the generator on all four sides (buildings may be used for all or part of the enclosure). However, specific details about generator attenuation features, including the noise reduction anticipated, are not known at this time. Therefore, this analysis conservatively assumes that a generator enclosure and screen would result in approximately 5 dB of noise reduction. Refer to Table 5-8 for a summary of the emergency generator noise modeling results.

**Table 5-8. Summary of Emergency Generator Testing Noise – CEQA Proposed Project**

| Land Use Type | Distance to Nearest Generator Testing (feet) | Modeled Noise Level (dBA)[a] | Noise Standard (dBA) | Exceeds Standard? |
|---|---|---|---|---|
| Existing multi-family residential (Wescoat Village) | 560 [b] | 76 | 55 | Yes |

[a.] Emergency generators associated with the project would be screened from view from interior streets and surrounding areas to the height of the generator on all four sides (buildings may be used for all or part of the enclosure). However, because specific details about generator attenuation features, including the noise reduction anticipated, are not known at this time, this analysis conservatively assumes that a generator enclosure and screen would result in approximately 5 dB of noise reduction.

[b.] Note that 560 feet is the estimated distance between the potential generator zone associated with Building 10 under the CEQA Proposed Project with or without the CUP option and the nearest Wescoat Village receptor.

The nearest residential receptor (a Wescoat Village residence) is approximately 560 feet west of the nearest potential generator zone under the CEQA Proposed Project (i.e., the Building 10 generator zone within Subarea 6 of the Project Site). At this distance, generator testing noise was modeled to be 76 dBA. For sensitive receptors included in this evaluation that are located farther away than the nearest residential use, emergency generator testing noise would be lower but may still be in excess of the applicable standard.

***CEQA***

As described in Section 5.1, *Methods for Analysis*, the applied noise limit for daytime emergency generator testing noise at the nearby Wescoat Village receptors would be 55 dBA $L_{eq}$. At Wescoat Village, emergency generator testing was modeled to be approximately 76 dBA, based on the sample equipment described above. This noise level is approximately 21 dB higher than the applicable noise exposure limit.

Generator testing would be temporary (lasting 2 to 4 hours) and intermittent (occurring once per month). Nonetheless, estimated noise levels would exceed the applicable noise standards at the nearest noise-sensitive receptors under the CEQA Proposed Project. Mitigation Measure NOI-4 has been identified to reduce noise levels and ensure that applicable noise exposure limits would not be exceeded during generator testing.

### *Identified Mitigation Measure*

**Mitigation Measure NOI-4. Design and Install Emergency Generators to Comply with Noise Standards**

Prior to the issuance of building permit(s) for each building that would include an emergency generator, the Project Proponent or its contractor(s) shall retain a qualified acoustical consultant to prepare an acoustical report and address emergency generator testing noise issues, based on the selected generator models and design features. The analysis of emergency generator noise and mechanical equipment noise under Mitigation Measure NOI-3 could be completed by the same consultant and presented in a single report. The final report, including the analysis results and any recommended noise control measures, shall be provided to and approved by NASA prior to the issuance of building permits for each building and/or phase of development. The recommendations of the report shall be incorporated into the applicable project plans (site, architectural, civil, and mechanical, as needed) and implemented during project construction. The acoustical report shall satisfy the following requirements:

- The analysis shall evaluate the design and provide recommendations, as necessary, to ensure that combined noise levels from emergency generator testing at project buildings, including the recommended noise control measures incorporated into the project design, shall not exceed the County noise exposure limits for the nearby noise-sensitive receptors. The applicable noise exposure limit for the nearest existing residential land uses at Wescoat Village is 55 dBA $L_{eq}$. Note that additional ambient noise measurements may be conducted as part of the acoustical report to further refine the applicable noise exposure limits (should existing ambient levels already exceed the applicable County noise exposure limit).
- Noise-control recommendations may include, but are not limited to, the measures below.
  - Selecting and installing quieter generator models
  - Upgrading the generators' acoustical enclosures
  - Upgrading the generators' mufflers or silencers
  - Orienting or shielding generator(s) to protect noise-sensitive receptors to the greatest extent feasible (taking into account generator ventilation requirements, spatial limitations, and cost considerations)
  - Increasing the distance between the generator(s) and noise-sensitive receptors
  - Placing noise-attenuating barriers around generator(s)

In addition, all project generators shall be tested only between 7:00 a.m. and 7:00 p.m.

### *NEPA*

As described for the CEQA evaluation, project-related emergency generator testing noise was modeled to exceed the existing applicable noise exposure limit at Wescoat Village under NEPA Build Alternative 1. Mitigation Measure NOI-4, presented previously, has been identified to reduce noise levels and ensure that applicable noise exposure limits would not be exceeded during generator testing.

## Loading Noise

With respect to noise from delivery trucks and loading activity noise, the delivery of goods (e.g., food and parcel deliveries, etc.) is a common occurrence in cities and urban environments. The Project Site is in an urban area, and background ambient noise levels are elevated by both the nearby U.S. 101 and Moffett Federal Airfield. Measured existing noise levels at the Project Site and at nearby sensitive uses were in the range of 63 to 75 dBA $L_{dn}$. Usage at each project loading dock or zone would be short term, sporadic, and low intensity. None of the proposed project land uses are substantial truck-trip generators such as warehousing or distribution centers. During the peak hour, each project building could expect to receive between zero and nine deliveries. Each building would receive between zero and 45 daily truck deliveries. The vast majority of daily deliveries would be completed with medium-sized trucks and/or United Parcel Service- (UPS-) style delivery vans (smaller than 40 feet in length), with only 11 out of an estimated 302 total deliveries per day being made with a heavy-duty truck greater than 40 feet in length. In addition, exterior loading zones would not accommodate deliveries by large trucks (i.e., greater than 40 feet in length); all such deliveries would take place at interior project loading docks. Further, most of the project's loading areas would be loading docks internal to buildings, which would be shielded from the view of the neighboring land uses. Limited loading and delivery activities would occur along on-street loading zones that would be external to the project buildings.

On a per building basis for the CEQA Proposed Project, Building 1 (Subarea 1) would have an estimated two delivery or loading activities per hour during daytime hours at an on-street loading zone on the east side of the building. Building 2 within Subarea 2, which would have an internal loading dock but would not have any on-street loading, would have an estimated nine delivery or loading activities per hour during daytime hours. Building 3, also within Subarea 2, which would also have an internal loading dock but would not have any on-street loading, would have an estimated seven delivery or loading activities per hour during daytime hours. All loading for Buildings 4 and 5 would also take place at internal loading docks, with an estimated nine and eight delivery or loading activities per peak hour, respectively. Building 6 and Building 11, parking garages, would not be anticipated to have any daily deliveries. Buildings 7, 8, 9, and 10 (in Subareas 5 and 6) would have both on-street loading zones (along the southern perimeter of the Project Site) and internal loading docks, with an estimated six to seven delivery or loading activities predicted to occur during the peak hour at each building. Building 12 within Subarea 6, which would have both an internal loading dock and an on-street loading zone, would have approximately one delivery per peak hour during daytime hours. Buildings 13 and 14 would have two to three deliveries per peak hour each; these would be internal to the campus and would not be expected to generate meaningful noise levels outside of the Project Site.

All project loading docks that are internal to buildings would not be anticipated to generate substantial noise outside the project buildings. Buildings 1, 7, 8, 9, 10, and 12 would have some external loading zones, but all of these buildings would also have internal loading docks. As a result, external loading at these buildings would still be limited. Further, delivery or loading activities would typically occur during daytime hours when ambient noise levels are higher and when people are less sensitive to noise.

### *CEQA*

The Project Site is in an urban area with elevated existing noise levels. A large portion of project deliveries would take place inside project buildings, most likely resulting in negligible noise levels at the nearest noise-sensitive receptors. Delivery and loading activities would be temporary, intermittent, and primarily during daytime hours. Loading activities associated with the CEQA Proposed Project would not be expected to result in substantial increases in noise in the project area.

#### *NEPA*

The Project Site is in an urban area with elevated existing noise levels. A large portion of project deliveries would take place inside project buildings, most likely resulting in negligible noise levels at the nearest noise-sensitive receptors. Delivery and loading activities would be temporary, intermittent, and primarily during daytime hours. Loading activities for NEPA Build Alternative 1 would not be expected to result in substantial increases in noise in the project area.

### Traffic Noise

Traffic noise increases along nearby roadway segments resulting from project development were quantitatively modeled using traffic volumes and existing vehicle-mix assumptions (i.e., the proportion of automobiles, trucks, buses, and other vehicles) provided by the project traffic engineer (Fehr & Peers). Modeling of traffic noise from the project was conducted with use of a spreadsheet that was based on the FHWA Traffic Noise Model, version 2.5. The spreadsheet calculates the traffic noise level at a fixed distance from the centerline of a roadway, according to the traffic volume, roadway speed, and vehicle mix predicted to occur under each condition.

An initial screening evaluation of direct traffic noise increases from the project was conducted by comparing traffic noise modeling results at a fixed distance of 50 feet from the roadway centerline for the existing and the existing-plus-project traffic scenarios. This screening analysis was based on modeling alone and did not take into account measured existing noise levels. If the screening analysis predicted the potential for a 3 dB increase, the land uses along the segment were examined to determine if any would be considered noise sensitive; if land uses along a given segment were not considered to be noise sensitive, a 3 dB or greater increase in noise was not considered to be substantial. If the screening analysis predicted a 3 dB increase along segments with sensitive uses (e.g., residential or school uses), the increase was flagged in the screening analysis, and a more detailed assessment was conducted.

A detailed traffic noise evaluation is conducted for segments flagged in the screening analysis, taking into consideration actual distances to nearby sensitive uses from the roadway centerline (compared to the 50-foot fixed distance used in the screening analysis) and existing measured noise levels, which were available for all segments flagged in the screening analysis. In some cases, modeled traffic noise levels do not fully characterize the existing noise environment along a given roadway segment; for example, traffic noise from an adjacent larger-capacity roadway segment or overhead aircraft may dominate the overall noise environment in some areas. Therefore, along roadway segments where overall noise levels are influenced by traffic on other roadway segments (e.g., U.S. 101) or aircraft traffic, field-measured noise levels (when available) are also considered in the analysis of potential traffic noise effects, as appropriate.

Table 5-9 provides a summary of the traffic noise screening analysis results for existing and existing-plus-project (CEQA Proposed Project) conditions along all evaluated roadway segments. This analysis is used to identify roadway segments where a substantial noise increase might occur. The additional detailed analysis (with consideration given to existing measured noise levels and actual distance to sensitive receptors) is used to make a final impact determination.

## Table 5-9. Traffic Noise Screening Analysis for the CEQA Proposed Project (50-Foot Reference Distance)

| Roadway | Segment | Most Sensitive Land Use Type along Segment | Traffic Noise Level (dBA $L_{dn}$) Existing | Traffic Noise Level (dBA $L_{dn}$) Existing plus Project (CEQA Proposed Project) | Noise Increase Due to Project dB |
|---|---|---|---|---|---|
| **Clark Road** | **Between R T Jones Road and NASA ARC driveway** | **School & Residential** | **57.5** | **63.1** | **5.6** |
| Ellis Street | Between Manila Avenue and NASA ARC driveway | Commercial | 55.4 | 62.3 | 6.9 |
| Ellis Street | Between Middlefield Road and driveway north of Middlefield Road | Commercial | 63.2 | 64.2 | 1.0 |
| Ellis Street | Between National Avenue and Fairchild Drive | Commercial | 63.9 | 64.7 | 0.8 |
| Ellis Street | Between U.S. 101 northbound ramps and Manila Avenue | Commercial | 64.4 | 67.2 | 2.8 |
| Ellis Street | Between U.S. 101 southbound ramps and U.S. 101 northbound ramps | Commercial | 65.1 | 66.7 | 1.6 |
| Manila Avenue | Between Enterprise Way and Ellis Street | Commercial | 64.8 | 66.8 | 2.0 |
| Moffett Boulevard | Between Leong Drive and U.S. 101 southbound ramps | Residential | 67.0 | 68.5 | 1.5 |
| Moffett Boulevard | Between State Route (SR) 85 northbound off-ramp and Leong Drive | Residential | 67.2 | 68.6 | 1.4 |
| Moffett Boulevard | Between SR-85 southbound on-ramp and SR-85 northbound off-ramp | Residential | 67.3 | 68.2 | 0.9 |
| Moffett Boulevard | Between U.S. 101 northbound ramps and R T Jones Road | Residential | 67.8 | 70.1 | 2.3 |
| Moffett Boulevard | Between U.S. 101 southbound ramps and U.S. 101 northbound ramps | Commercial | 67.3 | 69.3 | 2.0 |
| Moffett Park Drive | Between Innovation Way and Enterprise Way | Commercial | 63.2 | 65.3 | 2.1 |
| Moffett Park Drive | Between Mathilda Avenue and Innovation Way | Commercial | 66.3 | 67.4 | 1.1 |
| **Wescoat Road** | **Between Clark Road and the Project Site** | Residential | **57.5** | **63.1** | **5.6** |

Refer to Appendix A for the complete traffic noise modeling results.
Note: Modeled noise levels at a fixed distance of 50 feet from the roadway centerline.
**Bold** text denotes segments with a 3 dB or greater project-related increase in noise.

According to the screening analysis results, two roadway segments near sensitive land uses were identified with the potential for a 3 dB or greater increase in traffic noise as a result of project implementation; the greatest estimated potential increase was 5.6 dB. As previously described, the screening traffic noise evaluation is based on modeled traffic noise levels only (i.e., without consideration given to other noise sources that make up the ambient noise level in a given area) at a fixed distance of 50 feet. Total existing background noise levels at receptors along the roadway segments may be greater than modeled due to traffic noise from additional nearby roads and other noise sources. This is because these additional noise sources are not accounted for in the traffic noise screening results (presented in Table 5-9), which are based on modeled noise levels from traffic volumes only. Therefore, the detailed assessment is used to more accurately determine if potential noise effects along roadway segments that were flagged in the screening analysis are actually expected to occur. The detailed assessment considers overall (not only traffic) background noise levels and actual distances to sensitive uses from a given roadway.

To conduct the detailed assessment, project-only ADT volumes (i.e., existing-plus-project minus existing volumes) for the segments where a potentially substantial increase was identified were used to calculate project-only traffic noise levels. Project-only traffic noise levels were then combined with existing measured ambient noise levels to create a composite ambient-plus-project traffic condition. These composite noise levels were then compared to nearby measured ambient noise levels to determine if a 3 dB increase from the existing measured noise level is anticipated to occur as a result of project implementation. Refer to Table 5-10 for the detailed traffic noise evaluation for the CEQA Proposed Project, which includes a comparison of the existing (measured ambient) and existing-plus-project (composite ambient-plus-project) noise levels along roadway segments where the screening analysis identified potential substantial increases.

As shown in Table 5-10, a comparison of measured existing ambient noise levels and composite ambient-plus-project traffic noise levels along these two roadway segments demonstrates that project-related traffic would increase existing ambient noise levels by up to 1.2 dB. This increase is below the 3 dB increase threshold for traffic noise.

**Table 5-10. Detailed Traffic Noise Increase Evaluation for Roadway Segments Flagged in the Screening Analysis – CEQA Proposed Project**

| Roadway | Segment | Modeled Distance to Centerline (feet) | Measured Ambient Noise Level (dBA $L_{dn}$) | Project-Only Traffic Noise Level (dBA $L_{dn}$) | Composite Ambient-plus-Project Noise Level (dBA $L_{dn}$)[a] | Change Compared to Measured Ambient Noise (dB) | 3 dB or Greater Increase? |
|---|---|---|---|---|---|---|---|
| Clark Road | Between R T Jones Road and NASA ARC driveway | 200 | 63.4[b] | 55.6 | 64.1 | 0.7 | No |
| Wescoat Road | Between Clark Road and the Project Site | 100 | 63.7[c] | 58.7 | 64.9 | 1.2 | No |

Refer to Appendix A for the complete traffic noise modeling results.

a. Project-only ADT volumes (i.e., existing-plus-project minus existing volumes) for the segments where a potentially substantial increase was identified during modeling were used to calculate project-only traffic noise levels. Modeled project-only traffic noise levels were then combined with existing measured ambient noise levels to create a composite ambient-plus-project traffic condition.

b. The measured ambient noise level representative of this segment is LT-6 (63.4 dBA $L_{dn}$)

c. The measured ambient noise level representative of this segment is LT-1 (63.7 dBA $L_{dn}$)

### *CEQA*

Based on the detailed traffic noise evaluation for the CEQA Proposed Project, which includes a comparison of measured ambient noise levels and composite ambient-plus-project traffic noise levels (Table 5-10), project-related traffic noise increases would be up to 1.2 dB under the CEQA Proposed Project. This increase is below the 3 dB or greater increase threshold for traffic noise.

### *NEPA*

As described for the CEQA evaluation, project-related traffic noise would increase existing ambient noise levels by up to a maximum of 1.2 dB along any evaluated roadway segment under NEPA Build Alternative 1. This increase is below the 3 dB or greater increase threshold for transportation noise sources.

## Parking Garage Noise

Under the CEQA Proposed Project, two parking garages would be built and operated on the Project Site (in Building 6 within Subarea 4 and in Building 11 within Subarea 6) with a total of 3,419 parking spaces. The spaces would be split roughly evenly between the two garages, according to the Project Proponent (i.e., 1,709/1,710 spaces). Although the number of vehicles that may use each garage during a peak hour is not currently known, reasonable worst-case noise levels from parking garage activity can be estimated by assuming full capacity within the garage during a single hour.

Without accounting for shielding from the parking garage, parking activity noise from 1,710 cars operating simultaneously at a reference distance of 50 feet would be approximately 58.8 dBA $L_{eq}$. Modeled parking activity noise levels from each garage are estimated at the nearest noise-sensitive receptors using the acoustical average distance[26] between the garages and the nearest sensitive receptors. The results of this analysis are shown in Table 5-11.

**Table 5-11. Parking Garage Noise Modeling Results – CEQA Proposed Project**

| Receiving Land Use | Acoustical Average Distance (feet)[a] | Average Daytime Ambient Noise Level | Modeled Noise Level at Receptor | Difference between Existing and Project Parking Garage Noise Levels, dB |
|---|---|---|---|---|
| **Parking Garage in Building 6 (Subarea 4)** | | | | |
| Wescoat Village | 1,710 | 56.4[b] | 28.0 | -28.4 |
| **Parking Garage in Building 11 (Subarea 6)** | | | | |
| Wescoat Village | 345 | 56.4[b] | 41.9 | -14.5 |

a. The acoustical average distance was calculated by multiplying the shortest distance between the nearest receptor and the parking garage by the farthest distance, then taking the square root of the product. Distances were then conservatively rounded down. The acoustical average distances from Building 6 and Building 11 to Wescoat Village were 1,713 and 347 feet, respectively.

b. Represented by measurement location LT-1.

[26] The acoustical average distance was calculated by multiplying the shortest distance between the nearest receiver and the parking garage by the farthest distance, then taking the square root of the product.

The sensitive receptors closest to the parking garages would be the existing Wescoat Village residences. The acoustical average distance between Wescoat Village and the Building 6 (Subarea 4) parking garage would be approximately 1,710 feet; the acoustical average distance between Wescoat Village and the Building 11 (Subarea 6) parking garage would be approximately 345 feet. At those distances, modeled parking garage noise levels are 28.0 and 41.9 dBA $L_{eq}$, respectively, based on the modeling assumptions described previously. Actual noise levels at Wescoat Village from the Building 6 (Subarea 4) parking garage may be even lower due to shielding from other future on-site project structures. Even without accounting for this additional attenuation, estimated noise levels from the garages in Building 6 (Subarea 4) and Building 11 (Subarea 6) would be approximately 15 dB and 28 dB lower than the existing average daytime ambient noise level at Wescoat Village (represented by LT-1), respectively. The increase from combined noise levels would be negligible (0.2 dB or less).

***CEQA***

As shown in Table 5-11, modeled parking garage noise levels under the CEQA Proposed Project are 15 to 28 dB lower than the existing average daytime noise levels at nearby noise-sensitive receptors (i.e., the existing residences at Wescoat Village). The resulting overall increases in ambient noise levels would be negligible (0.2 dB or less).

***NEPA***

As described for the CEQA evaluation, modeled parking garage noise levels under NEPA Build Alternative 1 are 15 to 28 dB lower than the existing average daytime noise levels at nearby noise-sensitive receptors (i.e., existing residences at Wescoat Village). The resulting overall increase in ambient noise levels would be negligible (0.2 dB or less).

**Amplified Music or Speech at Events**

With respect to noise from amplified music or speech associated with the project, temporary programming and events that may use amplified sound would be relatively infrequent in nature. Specifically, once operational, the project would have approximately one event per month (approximately 12 events per year) that may use amplified sound. All events would take place in the project's Central Green, which is more than 1,200 feet from the existing residences at Wescoat Village.

The estimates of noise levels from project programming and events are based on previous measurements of events with amplified music or speech. According to the Project Proponent, the project's Central Green may be used for corporate gatherings that could at times include amplified sound from a single speaker or background music from a small live band. Events are anticipated to occur monthly, with approximately 12 events per year. Noise from speech amplified by a single loudspeaker has been measured at approximately 59 dBA $L_{eq}$ at 100 feet.[27] Noise from a small live band with a guitar, vocalists, and a single amplifier has been measured at approximately 65 dBA $L_{eq}$ at 100 feet.[28] These previously recorded noise levels are expected to be reasonably representative of temporary project-related programming or events that may include amplified sound, based on the details provided by the Project Proponent (as described in Section 5.1, *Methods for Analysis*).

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27 Individual Speaker Noise: Noise measured in Lakeside, California, on February 25, 2019, at approximately 140 feet from an individual officiating over a wedding (single speaker) was measured to be between approximately 55 and 56 dBA $L_{eq}$, equating to a noise level of 58 to 59 dBA $L_{eq}$ at 100 feet.

28 Acoustic Band Noise: Noise measured at a restaurant patio in Santee, California, on June 21, 2019, at approximately 73 feet from a small live band with a single amplifier that included a guitar and vocalists was measured to be 67.5 dBA $L_{eq}$, equating to 64.8 dBA $L_{eq}$ at 100 feet.

At a distance of 1,200 feet (i.e., the distance to the Wescoat Village residences), the noise level from amplified human speech, cited above, would be reduced to approximately 37 dBA $L_{eq}$. Noise levels from the small live band, cited above, would be reduced to approximately 43 dBA $L_{eq}$ at the Wescoat Village residences.

Average existing daytime noise levels at the nearby Wescoat Village residence are in the range of 56 to 62 dBA $L_{eq}$ (LT-1 and LT-4). Refer to Table 5-12, for a summary of estimated noise levels from events with amplified sound and a comparison of estimated noise levels with existing measured noise levels at sensitive uses in the project vicinity.

**Table 5-12. Estimated Noise Levels of Amplified Music of Speech (Based on Example Data)**

| Noise Source | Receptor | Distance to Receptor (feet) | Existing Measured Daytime Noise Levels (range), dBA $L_{eq}$ | Estimated Noise Level at Receptor, dBA $L_{eq}$ | Difference between Existing and Amplified Event Noise Levels, dB |
|---|---|---|---|---|---|
| Amplified music (small live band)[a] | Wescoat Village residences | 1,200 | 56 to 62 | 43 | -17 to -13 |
| Amplified speech[b] | Wescoat Village residences | 1,200 | 56 to 62 | 37 | -25 to -19 |

a. Acoustic Band Noise: Noise measured at approximately 73 feet from a small live band with a single amplifier that included a guitar and vocalists was measured to be 67.5 dBA $L_{eq}$, equating to 64.8 dBA $L_{eq}$ at 100 feet.

b. Individual Speaker Noise: Noise measured at approximately 140 feet from an individual officiating over a wedding (single speaker) was measured to be between approximately 55 and 56 dBA $L_{eq}$, equating to a noise level of 58 to 59 dBA $L_{eq}$ at 100 feet.

Based on the example noise levels presented above, noise levels from sound-amplifying equipment at project-related programming or events would be 13 to 25 dBA below the existing daytime noise levels at the nearest noise-sensitive receptors. This would result in noise increases of 0.5 dB or less.

***CEQA***

Given the noise levels presented above, noise levels from sound-amplifying equipment at project-related programming or events would be below the existing average daytime noise levels at the nearest noise-sensitive receptors under the CEQA Proposed Project, and would not substantially increase existing ambient noise levels. In addition, events with outdoor amplified sound at the project's Central Green would be infrequent (approximately 12 per year).

***NEPA***

As described above under the CEQA conclusion, noise levels from sound-amplifying equipment at project-related programming or events under NEPA Build Alterative 1 would be below the existing average daytime noise levels at the nearest noise-sensitive receptors and would not substantially increase existing ambient noise levels. In addition, events with outdoor amplified sound at the project's Central Green would be infrequent (approximately 12 per year).

## Construction Vibration

### Vibration-Induced Damage

Construction of the proposed project would involve the use of construction equipment that could generate groundborne vibration. Typical vibration levels associated with heavy-duty construction equipment at various distances are shown in Table 5-13. All analyzed construction equipment would be classified as continuous/frequent intermittent vibration sources. The most vibration-intensive type of equipment expected to be used for the project is a vibratory roller. A vibratory roller could be used throughout the Project Site for soil compaction and on streets near the project for in-street utility work.

**Table 5-13. Vibration Source Levels for Project Construction Equipment**

| Equipment | PPV at 20 Feet | PPV at 25 Feet | PPV at 50 Feet | PPV at 75 Feet | PPV at 100 Feet | PPV at 130 Feet | PPV at 150 Feet |
|---|---|---|---|---|---|---|---|
| Vibratory roller | 0.268 | 0.210 | 0.098 | 0.063 | 0.046 | 0.034 | 0.029 |
| Auger drill | N/A[a] | 0.089[b] | N/A[a] | 0.027 | 0.019 | 0.015 | 0.012 |
| Large bulldozer[c] | 0.114 | 0.089 | 0.042 | 0.027 | 0.019 | 0.015 | 0.012 |
| Loaded trucks | 0.097 | 0.076 | 0.035 | 0.023 | 0.017 | 0.012 | 0.011 |
| Small bulldozer[d] | 0.004 | 0.003 | 0.001 | 0.001 | 0.001 | 0.000 | 0.000 |

Note: **Bold** text indicates values that are used in the analysis below.

Source: California Department of Transportation. 2013. *Technical Noise Supplement to the Traffic Noise Analysis Protocol*. September. Available: https://dot.ca.gov/-/media/dot-media/programs/environmental-analysis/ documents/env/tens-sep2013-a11y.pdf. Accessed: July 9, 2025.

a. This equipment would not be used within this distance of existing structures.

b. Although this equipment would not be used within this distance of existing structures, this value is the reference vibration level (e.g., PPV vibration at 25 feet) used in the analysis.

c. Considered representative of other heavy earthmoving equipment such as excavators, graders, backhoes, etc.

d. Considered representative of smaller equipment such as small skid steers and mini-excavators.

This analysis is based on the worst-case closest distance between a given piece of vibration-generating equipment and the nearest receptor.[29] A vibratory roller, the most vibration-intensive piece of equipment proposed for project construction, could be used anywhere on the Project Site and anywhere within the in-street/off-site construction areas. In-street/off-site construction would generally take place closer to off-site existing structures than any on-site construction. Based on the estimated footprint of construction, including construction within in-street areas, a vibratory roller could be used as close as 20 to 25 feet from existing off-site non-residential structures.

The most stringent threshold expected to apply to structures near the Project Site is the Caltrans “historic and some old buildings” category. Specifically, Buildings 6, 16, 21, 22, 126, 510, and 566, located north of Wescoat Road, were all constructed between 1933 and 1979 and conservatively considered to be similar to the “historic and some old buildings” Caltrans structure type (i.e., an applicable PPV vibration criterion of 0.25 in/sec) (Rusch pers. comm. [2025]).[30] Of these vibration-

29 Note that the construction noise analysis uses the distance between a receptor and the approximate center of a given construction site.

30 For purposes of this analysis, the structures similar to the “historic and some old buildings” Caltrans structure type are called “vibration-sensitive structures” in the vibration-related damage discussion.

sensitive structures, only Buildings 6, 16, and 510 are within approximately 20 feet of the Limits of Work (Rusch pers. comm. [2026]).[31]

At a distance of 20 feet, a vibratory roller could generate a PPV vibration level of approximately 0.268 in/sec, as shown in Table 5-13. This estimated PPV vibration level exceeds the threshold for the "historic and some old buildings" category (i.e., a PPV of 0.25 in/sec). A vibratory roller must be operated 22 feet or more from such a structure to result in PPV vibration levels below the threshold of 0.25 in/sec. None of the other equipment proposed for use during the in-street construction, besides a vibratory roller, would be expected to result in vibration levels with a PPV of more than 0.25 in/sec at a distance of 20 feet. In addition, no construction equipment proposed for on-site construction would result in vibration levels in excess of the applicable PPV criterion of 0.25 in/sec.

With respect to off-site residential structures, the residential land uses west of the Project Site are most likely in the "new residential structures" category from the Caltrans vibration damage guidelines because they were constructed around 2005 (Rusch pers. comm. [2025]). New residential structures have an applicable vibration-related damage criterion with a PPV of 0.5 in/sec for continuous/frequent intermittent sources of vibration (i.e., for all construction equipment included in this analysis). In-street construction activities may take place as close as 50 feet from the nearest residential structures. At this distance, a vibratory roller could result in a vibration level with a PPV of approximately 0.098 in/sec. This vibration level is below the damage threshold for newer residential structures (PPV of 0.5 in/sec). Because estimated worst-case vibration levels are all below the applicable damage criteria for nearby residential structures, damage-related vibration effects from on-site in-street/off-site construction to nearby residential land uses would not be expected to occur.

***CEQA***

Estimated vibration levels from use of a vibratory roller for in-street utility work within 22 feet of vibration-sensitive structures near the Project Site would be expected to exceed the applicable Caltrans damage criterion (PPV of 0.25 in/sec) under the CEQA Proposed Project. Note that vibration levels at nearby residential receptors would not be expected to exceed the applicable criterion for such structures.

Implementation of Mitigation Measure NOI-5, which would be required only if a vibratory roller were to operate within 22 feet of vibration-sensitive structures, would reduce construction-related vibration effects by ensuring that specific buffer distances between sensitive buildings and vibration-intensive equipment would be maintained during construction, as feasible. Structures within approximately 22 feet of the Limits of Work that fit into this category include Buildings 6, 16, and 510, which were all constructed between 1933 and 1979. Mitigation Measure NOI-5 would also require pre-construction surveys to document the existing condition of vibration-sensitive structures within 22 feet of construction activities involving a vibratory roller, vibration monitoring, post-construction surveys, and remediation of structures to pre-construction conditions (should damage occur) when such buffer distances are infeasible to maintain. Implementation of this mitigation measure would avoid or reduce and repair vibration-related damage effects (e.g., by returning damaged structures to pre-construction conditions).

[31] Building 510 does not qualify for listing in the National Register of Historic Places; Buildings 6 and 16 have been identified as contributors to the Naval Air Station Sunnyvale Historic District and are eligible for listing in the National Register of Historic Places.

### *Identified Mitigation Measure*

**Mitigation Measure NOI-5. Construction Vibration Control Plan for Vibratory Rollers**

This mitigation measure applies to construction with vibratory rollers that occurs within 22 feet of vibration-sensitive structures (i.e., structures in the "historic and some old buildings" category per the Caltrans vibration damage criteria). Structures within approximately 22 feet of the Limits of Work that would be expected to fit into this category, having been constructed between 1933 and 1979, include Buildings 6, 16, and 510.

The Project Proponent or its contractor(s) shall develop a construction vibration control plan to mitigate potential vibration-related damage effects. The plan shall be prepared by a qualified vibration expert, with input from a qualified historical architect and the construction contractors and submitted to NASA for review and approval prior to the start of construction with vibratory rollers within 22 feet of vibration-sensitive structures (expected to include Buildings 6, 16, and 510). The Project Proponent shall incorporate a requirement into construction specifications for the proposed project for the construction contractor(s) to use all feasible means to avoid damage to the nearby vibration-sensitive structures without resulting in safety concerns. For the purposes of this mitigation measure, feasible is defined as being possible without impairing the contractors' ability to safely and effectively construct the project, causing unreasonable inefficiencies in the project's construction schedule, or substantially increasing costs such that they that are not commensurate with the vibration reduction achieved. Methods to reduce vibration-related damage effects may include using smaller and less vibration-intensive equipment in proximity to the potentially affected building.

The construction contractor shall implement a monitoring program to minimize damage to adjacent buildings and ensure that any such damage is documented and repaired. The monitoring program shall include the following components:

- Prior to the start of any construction activity that includes the use of a vibratory roller within 22 feet of Buildings 6, 16 and 510, the construction contractor shall engage a structural engineer or other professionals with similar qualifications to document and photograph the existing conditions of potentially affected buildings within 22 feet of areas where the use of a vibratory roller is proposed.
- Based on the type, age, and existing condition of Buildings 6, 16, and 510, as observed during pre-construction surveys, the qualified vibration expert, in conjunction with project architectural historians and/or structural engineers, may establish a building-specific maximum vibration threshold for adjacent buildings that shall not be exceeded during construction. The Caltrans criterion for "historic and some old buildings" (PPV limit of 0.25 in/sec, as shown in Table 4-4) shall be used as the default criterion unless otherwise justified. Any such adjustment shall be documented and approved by NASA prior to construction.
- To ensure that vibration levels do not exceed the established standard, the Project Proponent shall monitor vibration levels at Buildings 6, 16 and 510 when a vibratory roller is used within 22 feet of said structures and prohibit vibratory construction activities that generate vibration levels in excess of the applied standard.
- Should vibration levels be observed in excess of the applicable standard, construction shall be temporarily halted, to the extent feasible (i.e., when it is safe to do so), and alternative

construction techniques used, to the extent feasible (i.e., when using alternative construction techniques, such as a static roller in lieu of a vibratory roller).

- A structural engineer shall conduct an initial inspection of the adjacent vibration-sensitive structure for damage within 7 days of construction within 22 feet of said buildings (i.e., Buildings 6, 16 and 510). If damage is observed at the initial inspection, additional inspections should be conducted every 7 days (for as long as that activity at that location takes place) to evaluate if further damage has occurred. However, if no damage occurs to a given building within the first 7 days of a given construction activity at a given location, the 7-day inspection period may be increased to 30 days for that activity (i.e., the subsequent inspection could take place 30 days after the initial inspection).
- Should damage to adjacent Vibration-Sensitive Buildings occur and be identified during the inspections described above, the buildings shall be remediated to their pre-construction condition at the conclusion of ground-disturbing activity on the site.

***NEPA***

As described in the discussion of CEQA-related vibration effects, estimated vibration levels from the use of a vibratory roller for in-street utility work within 22 feet of vibration-sensitive structures near the Project Site would be expected to exceed the applied Caltrans damage criterion (PPV of 0.25 in/sec) under NEPA Build Alternative 1. Vibration levels at nearby residential receptors would not be expected to exceed the applicable criterion.

Mitigation Measure NOI-5, described previously, would be implemented if a vibratory roller were to operate within 22 feet of vibration-sensitive structures. Such structures within approximately 22 feet of the Limits of Work that fit into this category include Buildings 6, 16, and 510, which were all constructed between 1933 and 1979. As noted, implementation of this mitigation measure would avoid or reduce and repair vibration-related damage effects (e.g., by returning damaged structures to pre-construction conditions).

**Vibration-Related Annoyance**

Most project construction would be limited to the daytime hours of 7:00 a.m. to 7:00 p.m. weekdays. However, limited nighttime or weekend construction could be required for concrete pours and in-street/off-site utility work, as described previously. In general, this would include approximately 5 nights of construction per building for concrete foundation pours and approximately 10 nights of construction per utility system.

As described previously, for the purposes of this analysis, the Caltrans “strongly perceptible” annoyance criterion (PPV of 0.1 in/sec) is used to assess the potential for sleep disturbance to occur at occupied residential land uses during nighttime hours (refer to Table 4-5). Equipment that would be used during nighttime hours for project concrete pours would generally not be vibration intensive, such as concrete mixers and pumps. Concrete mixers and pumps generally generate lower vibration levels than a small bulldozer, which is the piece of equipment with the lowest vibration level, as shown in Table 5-13. Concrete pours would take place on the Project Site, and associated equipment would generally be at least 100 feet from off-site residential land uses. At a distance of 100 feet, equipment similar to a small bulldozer would result in a vibration level with a PPV of approximately 0.001 in/sec. This level is well below the “strongly perceptible” criterion from the Caltrans guidelines (PPV of 0.1 in/sec). When nighttime construction occurs at even greater distances from nearby residences, the nighttime vibration levels would be even lower.

With respect to the off-site utility work, more vibration-intensive equipment would be used for this work than would be used for the on-site concrete pours. Specifically, the most vibration-intensive piece of equipment proposed for the nighttime in-street utility work is a vibratory roller. A vibratory roller may be used as close as 50 feet from the nearest occupied residence during nighttime hours.

A vibratory roller would generally be used for compaction of the repaired roadway after new utility infrastructure is installed. It is expected that nighttime use of a vibratory roller near occupied residences would be limited to a few nights per residence. This is because utility work would move linearly down the alignment. At a distance of 50 feet, a vibratory roller could result in a vibration level with a PPV of 0.098 in/sec. This level is below the strongly perceptible threshold (PPV of 0.1 in/sec). Note that use of a vibratory roller would usually take place more than 50 feet from occupied residences.

***CEQA***

As described in the analysis above, concrete pours would be expected to result in a vibration level with a PPV of approximately 0.001 in/sec at a distance of 100 feet. Therefore, concrete pours on the Project Site are expected to produce vibration levels well below the applied annoyance threshold (PPV of 0.1 in/sec during nighttime hours) related to sleep disturbance at nearby residential land uses.

With respect to in-street utility work, a vibratory roller may be used as close as 50 feet from the nearest occupied residence during nighttime hours; it is expected that nighttime use of a vibratory roller near occupied residences would be limited to a few nights per residence because utility work would move linearly down the alignment. As discussed previously, a vibratory roller could result in a vibration level with a PPV of 0.098 in/sec at a distance of 50 feet, based on the modeling results presented in Table 5-13. This level is below the strongly perceptible threshold (PPV of 0.1 in/sec). Note that the use of a vibratory roller would usually take place more than 50 feet from occupied residences.

Estimated vibration levels from on-site and in-street utility work during nighttime hours under the CEQA Proposed Project would not exceed the applicable “strongly perceptible” criterion. In addition, work in a given area would be short term. Effects would not be considered substantial.

***NEPA***

As described in the discussion of CEQA-related vibration effects above, on-site and off-site construction activities were modeled to result in vibration levels below the “strongly perceptible” criterion at the nearest occupied residential land uses during nighttime hours under NEPA Build Alternative 1. In addition, nighttime construction activities in a given area would be short term. Effects would not be considered substantial.

#### Vibration-Sensitive Equipment

An analysis was conducted to determine if construction-related vibration from the project could be disruptive to sensitive research equipment at nearby off-site laboratories, such as USGS Building 800, which is north of the Project Site. Vibration-sensitive machinery or instruments, such as those used in research laboratories or in hospitals, can be disrupted at much lower levels than would typically affect other uses. As described previously, the FTA has established guidelines and suggested equipment-specific criteria for evaluating such effects. The criteria for the detailed vibration analysis are presented in Table 4.3.

Modeling methodologies and guidance from FTA's *Transit Noise and Vibration Impact Assessment Manual* were used to estimate VdB vibration levels from project construction equipment at varying distances (Federal Transit Administration 2018). Although it is known that vibration-sensitive equipment is located within the nearby USGS Building 800 (and could be located within other nearby research buildings), details related to the exact equipment present and the appropriate sensitivity thresholds for individual pieces of equipment cannot be known with certainty. To address this, vibration levels were estimated for each type of construction equipment, and corresponding screening distances were developed to evaluate potential effects on different categories of sensitive laboratory instruments. Potential effects on sensitive laboratory equipment could occur if project construction equipment is estimated to result in vibration levels greater than the applicable criteria for a given piece of sensitive laboratory equipment. Refer to Table 5-14 for the distances at which various types of construction equipment could result in vibration levels in excess of the FTA criteria for detailed vibration analysis.

As shown in Table 5-14, vibration generated by project construction equipment may exceed thresholds for the various sensitive equipment categories at distances of between 9 and approximately 1,350 feet (depending on both the type of construction equipment in use and the specific sensitivity of nearby laboratory equipment).

It is important to note that the nearby USGS laboratory (Building 800) includes some vibration isolation features in select rooms, which may reduce the amount of perceived vibration within those areas. In addition, background vibration velocity levels in typical residential and educational environments are generally around 50 VdB, as referenced in FTA's *Transit Noise and Vibration Impact Assessment Manual* (Federal Transit Administration 2018). Consequently, ambient vibration levels at laboratory facilities near the Project Site, including USGS Building 800, may already exceed the VC-D and VC-E criteria established for highly sensitive equipment. However, vibration from project construction may still interfere with the use of some sensitive research equipment within nearby laboratory buildings.

### Table 5-14. Vibration-Related Buffer Distances to Ensure Vibration Limits Are Not Exceeded

| Equipment | Residential Night, Operating Rooms (buffer distance [feet])[a] | VC-A (buffer distance [feet])[a] | VC-B (buffer distance [feet])[a] | VC-C (buffer distance [feet])[a] | VC-D (buffer distance [feet])[a] | VC-E (buffer distance [feet])[a] |
|---|---|---|---|---|---|---|
| **Threshold** | **72 VdB** | **66 VdB** | **60 VdB** | **54 VdB** | **48 VdB** | **42 VdB** |
| Vibratory roller | 136 | 215 | 340 | 539 | 856 | 1,356 |
| Large bulldozer, other large earthmoving equipment | 80 | 126 | 199 | 315 | 500 | 791 |
| Auger drill | 80 | 126 | 199 | 315 | 500 | 791 |
| Small bulldozer | 9 | 14 | 21 | 33 | 52 | 83 |

[a.] Distance required to ensure threshold is not exceeded.

**Residential Night, Operating Rooms:** Vibration is not felt, but ground-borne noise may be audible inside quiet rooms. Suitable for medium-power optical microscopes (100X) and other equipment of low sensitivity.

**VC-A:** Adequate for medium- to high-power optical microscopes (400X), microbalances, optical balances, and similar specialized equipment.

**VC-B:** Adequate for high-power optical microscopes (1000X) and inspection and lithography equipment to 3-micron line widths.

**VC-C:** Appropriate for most lithography and inspection equipment to 1-micron detail size.

**VC-D:** Suitable in most instances for the most demanding equipment, including electron microscopes operating to the limits of their capabilities

**VC-E:** The most demanding criterion for extremely vibration-sensitive equipment.

***CEQA***

As described in the analysis above, vibration generated by project construction equipment may exceed applied thresholds for nearby sensitive research equipment and may disrupt the use of such equipment during project construction. Mitigation Measure NOI-6 has been identified to reduce effects on vibration-sensitive equipment. Even with implementation of all feasible mitigation, it may not be possible to fully reduce interference effects on nearby vibration-sensitive laboratory or research equipment.

**Mitigation Measure NOI-6. Construction Vibration Control Plan for Sensitive Research Equipment**

Prior to the start of construction activities, the Project Proponent or its contractor(s) shall retain a qualified vibration expert to prepare a construction vibration control plan for nearby sensitive research equipment. The plan shall be designed to minimize construction-related vibration effects on nearby facilities housing vibration-sensitive research equipment (including, but not necessarily limited to, USGS Building 800).

The plan shall include the following requirements and components:

- Conduct a pre-construction survey identifying and documenting the location, type, and sensitivity of vibration-sensitive equipment within potentially affected off-site laboratory buildings. Where feasible, the plan author may coordinate with facility managers to obtain equipment specifications and operational thresholds.
- Conduct pre-construction continuous vibration monitoring within or adjacent to potentially affected laboratory buildings to establish background vibration levels.
- Establish equipment-specific vibration criteria, based on FTA guidelines (listed below) or other resources (e.g., vibration thresholds defined in equipment manuals), applicable to equipment present within nearby research buildings. Applied criteria may vary by laboratory room or by the piece of equipment. The FTA vibration criteria that may be used are included in Table 4-3 and summarized below.
    - VC-A: 66 VdB
        - Adequate for medium- to high-power optical microscopes (400X), microbalances, optical balances, and similar specialized equipment.
    - VC-B: 60 VdB
        - Adequate for high-power optical microscopes (1000X) and inspection and lithography equipment to 3-micron line widths.
    - VC-C: 54 VdB
        - Appropriate for most lithography and inspection equipment to 1-micron detail size.
    - VC-D: 48 VdB
        - Suitable in most instances for the most demanding equipment, including electron microscopes operating to the limits of their capabilities
    - VC-E: 42 VdB
        - The most demanding criterion for extremely vibration-sensitive equipment.

Note that, when determining applicable thresholds, consideration should be given to background pre-construction vibration levels at a given building; the lowest vibration standard established shall not exceed the previously established background vibration levels for a given laboratory.

- Identify construction equipment with the potential to exceed vibration thresholds and specify minimum setback distances or alternative low-vibration equipment to be used near sensitive facilities, as feasible. Feasibility considerations include that specified restrictions would not unduly restrict the contractors' ability to safely and effectively construct the project, cause unreasonable inefficiencies in the project's construction schedule, or substantially increase costs that are not commensurate with the reduction in vibration levels achieved.
- Implement real-time vibration monitoring at potentially affected laboratory buildings during project construction. Note that the plan may include adaptive management and monitoring provisions to adjust requirements, based on observed results. For instance, vibration thresholds may be relaxed if monitoring confirms no adverse effects on the performance of specific equipment.
- Designate a vibration complaint coordinator to serve as the primary point of contact for nearby vibration-sensitive facilities. Contact information for the project vibration coordinator shall be posted at the Project Site and on a publicly available project website. The vibration coordinator would be contacted if vibration effects disrupt technical activities at nearby laboratory uses. The project vibration coordinator would then work with the construction team to adjust construction activities to reduce vibration or to reschedule activities to a less sensitive time, as feasible (as defined previously). The coordinator shall also maintain a log of communications and corrective actions taken.
- In coordination with affected facilities and based on actual identified effects (e.g., interference with the use of research equipment rather than exceedances of determined thresholds) resulting from adjacent project construction, identify vibration-sensitive equipment that most likely cannot operate at its current location during project construction. Where feasible, arrange for temporary relocation of equipment on a case-by-case basis (either during high-vibration construction activities and/or in proximity to construction activities, or for the duration of construction, as appropriate).

The vibration control plan shall be submitted to NASA for review and approval prior to the start of construction.

***NEPA***

As described in the discussion of CEQA-related vibration effects above, vibration generated by project construction equipment may exceed applied thresholds for nearby sensitive research equipment and may disrupt the use of such equipment during project construction. Mitigation Measure NOI-6 has been identified to reduce effects on vibration-sensitive equipment. Even with implementation of all feasible mitigation, it may not be possible to fully reduce interference effects on nearby vibration-sensitive laboratory or research equipment.

## Aircraft Noise

The closest airport or airstrip to the Project Site is Moffett Federal Airfield, which is directly east of the Project Site. No other airports or airstrips are within 2 miles of the Project Site. According to the 2012

Comprehensive Land Use Plan (CLUP) for Moffett Federal Airfield (Santa Clara County Airport Land Use Commission 2012), the eastern edge of the Project Site is at the outer boundary of the 65 dBA CNEL noise contour for this airfield. Most of the Project Site, including the majority of each project building along the eastern project perimeter, is outside of the 65 dBA CNEL contour; this portion of the Project Site would be developed with office and/or R&D buildings and a parking structure (i.e., Subareas 3 and 4). According to the Moffett Federal Airfield CLUP, noise levels of up to 65 dBA CNEL are generally acceptable for office and professional land uses. Noise levels of 65 to 70 dBA CNEL are considered conditionally acceptable, provided that necessary noise insulation features are included in the design of the building. No portion of the Project Site is within the 70 or 75 dBA CNEL noise contours. The exterior-to-interior noise attenuation of buildings with closed windows is approximately 25 dBA, according to EPA's national average data (U.S. Environmental Protection Agency 1974). The office and R&D buildings would be expected to have similar exterior-to-interior noise attenuation. As such, given that exterior noise levels at all project buildings would be approximately 65 dBA CNEL or less, interior noise levels would most likely be around 40 dBA CNEL or less at the office and R&D buildings. The proposed Student/Faculty Housing and Short-Term Lodging uses would also be exposed to aircraft noise. However, these uses would be required to comply with the interior noise performance standards prescribed by Title 24 of the California Code of Regulations (refer to Section 4.2.1.1), ensuring these uses would be designed to provide interior noise levels of 45 dBA CNEL or less.

***CEQA***

The project land uses potentially located along the edge of the 65 dBA CNEL contour (i.e., office and business uses) under the CEQA Proposed Project would be considered conditionally compatible with that noise level. In addition, interior noise levels would be expected to be below the maximum acceptable level for such uses, based on estimated exterior noise levels and commonly accepted exterior-to-interior noise attenuation factors (i.e., approximately 25 dBA with windows closed, according to EPA's national average data from 1974 (U.S. Environmental Protection Agency 1974). The proposed Student/Faculty Housing and Short-Term Lodging uses would also be exposed to aircraft noise; however, compliance with Title 24 of the California Code of Regulations would ensure that interior noise levels at these uses would be adequately controlled.

***NEPA***

The project land uses potentially located along the edge of the 65 dBA CNEL contour (i.e., office, business and professional) under NEPA Build Alternative 1 would be considered conditionally compatible with that noise level. In addition, interior noise levels would be expected to be below the maximum acceptable level for such uses. The proposed Student/Faculty Housing and Short-Term Lodging uses would also be exposed to aircraft noise; however, compliance with Title 24 of the California Code of Regulations would ensure that interior noise levels at these uses would be adequately controlled.

### 5.3.2.2 Cumulative Assessment

The cumulative geographic context for noise and vibration varies, depending on the source of the noise or vibration. Specifically, the geographic context for cumulative construction noise effects typically encompasses cumulative projects within 1,000 feet of a project site. Beyond 1,000 feet, the contributions of noise from the construction of other projects would be greatly attenuated through both distance and intervening structures, and their contribution would be expected to be minimal. The cumulative context for stationary-source noise effects, such as noise effects from heating and cooling or other mechanical equipment, as well as vibration effects from construction activities, is generally smaller than that distance (a few hundred feet, at most). Finally, cumulative effects related to vehicular traffic noise are based on overall forecast average daily traffic along roadway segments near a project site, which includes traffic increases from all growth in a project area, as predicted in the applicable traffic model. The cumulative projects within the vicinity of the Project Site are described in Section 4.5, *Approach to Cumulative Impact Analysis*, in Chapter 4, *Environmental Impacts*, and shown in Figure 3.1-1, including the cumulative projects within 1,000 feet of the Project Site.

**<u>Construction Noise</u>**

Construction noise is a localized impact that reduces as distance from the noise source increases. In addition, intervening features (e.g., buildings) between construction areas and nearby noise-sensitive receptors result in additional noise attenuation by providing barriers that break the line of sight between noise-generating equipment and sensitive receptors. These barriers can block sound wave propagation and somewhat reduce noise at a given receiver.

The cumulative setting for construction noise effects is considered to be approximately 1,000 feet from the Project Site because projects located within this distance could expose receptors between, or equidistant from, two projects to greater overall noise levels, depending on the intervening distances.

The following cumulative projects are within approximately 1,000 feet of the Project Site.

- Rehabilitation and relocation of USGS Building 19 (complete)
- Construction of USGS Building 800 (complete)
- Reskinning of Hangar One (complete)

Worst-case daytime and nighttime noise levels resulting from project construction may exceed the applicable criteria for daytime and nighttime construction noise in the county (under CEQA) and per FTA (under NEPA). In addition, a 10 dB increase (or greater) over the existing ambient noise level would be expected to occur at the nearest noise-sensitive receptors (considered to be significant under CEQA).

Construction of the cumulative projects is already complete; consequently, cumulative project construction would not be expected to occur concurently with project construction activities (beginning in 2027). Construction noise from cumulative projects would therefore not be expected to combine with construction noise from the proposed project and expose nearby sensitive receptors to greater overall construction noise levels. However, because project construction noise levels during both daytime and nighttime hours were modeled to exceed applicable thresholds, cumulative construction noise effects would conservatively be considered substantial. Although mitigation measures would be expected to somewhat reduce project construction noise, it may not be possible to reduce all construction noise to a level below the significance thresholds used in this assessment, even with implementation of all feasible mitigation measures. Therefore, cumulative construction noise effects during daytime and nighttime hours are considered to be substantial, even with implementation of project-specific mitigation.

## Operational Noise

### *Mechanical Equipment*

In general, most operational sources of noise do not generate noise that is perceptible far beyond the edge of a project site. Although project mechanical equipment noise would be localized and would attenuate rapidly with distance, it is possible that heating and cooling equipment could generate noise in excess of allowable levels at nearby sensitive uses before mitigation is applied, as described previously.

There are no cumulative projects between the nearest noise-sensitive receptors (residences at Wescoat Village) and the proposed project or within a similar distance. The nearest cumulative project to Wescoat Village is at USGS Building 800, which is more than 1,000 feet from the nearest Wescoat Village residence (with the nearest project building being an estimated 100 feet from the Project Site). However, construction of that project is already completed, and the building is currently operational. Because of the distance between USGS Building 800 and the Wescoat Village residences (i.e., more than 1,000 feet), and because project buildings would be expected to block the line of sight between USGS Building 800 and the Wescoat Village residences once construction is complete, noise-generating uses (e.g., mechanical equipment) at USGS Building 800 would not be expected to combine with noise from project mechanical equipment and result in a cumulative operational noise impact. However, because project-specific mechanical equipment effects were determined to be potentially substantial, cumulative effects related to operational equipment noise levels would conservatively be considered substantial. Project Mitigation Measure NOI-3 has been identified to reduce noise levels from project mechanical equipment. With implementation of this mitigation measure, mechanical equipment noise levels would be reduced to below applicable significance thresholds. Therefore, cumulative effects related to mechanical equipment noise would not be considered substantial with implementation of project mitigation.

### *Emergency Generator Testing*

Emergency generators included in development of the Project Site would result in the generation of audible noise during testing. With regard to the potential for cumulative effects, the nearest cumulative projects to the Project Site involve rehabilitation and relocation of USGS Building 19, construction of USGS Lab Building 800, and reskinning Hangar One. Should nearby projects (e.g., USGS buildings) also install emergency generators and should generator testing occur simultaneously at a nearby project and the proposed project, a cumulative impact could occur.

Emergency generators are tested intermittently (often on the order of once per month for 30 to 60 minutes), and their use is often exempted during actual emergencies. Although specific details regarding the emergency generators proposed for nearby cumulative projects are not known at this time, it is known that periodic testing of project emergency generators would occur for 2 to 4 hours per month per generator during daytime hours.

In general, it is very unlikely that the testing of an emergency generator for the proposed project would occur concurrently with the testing of a generator at a nearby project. Even if testing were to occur simultaneously, which is unlikely, it is not likely that the generators would be close enough to one another for the noise to combine at a given individual receptor. However, because noise from emergency generator testing was determined to potentially exceed applicable standards, cumulative effects related to noise from emergency generator testing would conservatively be considered substantial. Project Mitigation Measure NOI-4 has been identified to reduce noise levels and ensure that applicable noise exposure limits would not be exceeded during project emergency generator testing. With implementation of this mitigation measure, emergency generator noise would be reduced to levels below applicable significance thresholds. Therefore, cumulative effects related to emergency generator noise would not be considered substantial with implementation of project mitigation.

***Loading Noise***

Delivery and loading activity at loading docks and zones associated with the project could result in the generation of audible noise. However, the Project Site is in an urban area with existing levels of elevated noise. A large portion of project deliveries would take place inside project buildings, thereby greatly reducing exterior audible noise from said loading activities. In addition, delivery and loading activities would be temporary and intermittent, primarily during daytime hours. The nearest cumulative projects to the Project Site involve rehabilitation and relocation of USGS Building 19, construction of USGS Lab Building 800, and reskinning Hangar One. Should nearby cumulative projects also include loading docks or zones that receive daily deliveries, loading activity noise could be generated near the cumulative projects. In general, however, loading activity noise is intermittent, and noise levels are often abated by intervening buildings. Even if loading activities for nearby buildings were to occur simultaneously, which is unlikely, it is not likely that the loading docks or zones would be close enough to one another for the noise to combine at a given individual receptor. Cumulative noise effects related to loading dock activity would not be considered substantial.

***Traffic Noise***

To evaluate potential direct and cumulative traffic noise effects in the project area, traffic noise modeling for cumulative conditions was conducted at a reference distance of 50 feet from the roadway centerline, using a spreadsheet based on the FHWA Traffic Noise Model, version 2.5. For the purposes of this analysis, the thresholds applied to assess cumulative traffic noise effects are:

- A 3 dB increase in noise in areas where existing and resulting noise levels are above the "satisfactory" range for that land use (as defined in the County General Plan [55 dBA $L_{dn}$ for residential land uses, 65 dBA $L_{dn}$ for commercial land uses])
- A 5 dB increase in noise in areas where existing and resulting noise levels are below the "satisfactory" range for that land use

Should a cumulative traffic noise effect be identified, the project's contribution to the cumulative effect would be evaluated. The applied threshold for the assessment of the project's contribution to a cumulative traffic noise effect is 1 dB.

An initial screening evaluation of cumulative traffic noise increases was conducted by comparing traffic noise modeling results for the existing and the cumulative-plus-project traffic scenarios. If the screening analysis showed a potential 3 dB increase, the land uses along the segment were examined to determine if any would be considered noise sensitive; if land uses along a given segment were not considered to be noise sensitive, a 3 dB or greater increase in noise was not considered to be potentially substantial. If the screening analysis showed a potential 3 dB increase along segments with sensitive uses (e.g., residential or school uses), the increase was flagged and a more detailed assessment (with consideration given to existing measured noise levels and the actual distances between the roadway centerline and the nearest sensitive use) was conducted. Refer to Section 5.1, *Methods for Analysis*, in the Noise and Vibration Technical Report for additional details related to the sumulative traffic noise modeling approach.

According to the screening traffic noise analysis results for the CEQA Proposed Project (contained in Table 5-15), the screening analysis flagged six roadway segments with the potential for a 3 dB or greater increase in traffic noise along segments with sensitive land uses when comparing existing and cumulative-plus-project conditions. The screening also found that three of these six segments have the potential to experience a 1 dB or greater increase in noise as a result of project implementation (i.e., when comparing cumulative-no-project conditions to cumulative-plus-project conditions). The results from the screening analysis are included in Table 5-15.

For the reasons described previously, a detailed traffic noise evaluation, taking into consideration actual distances to nearby sensitive uses from the roadway centerline and existing measured noise levels (which were available for all segments flagged in the screening analysis), was then conducted for segments flagged in the screening analysis. The results of the detailed cumulative traffic noise analysis are included in Table 5-16.

**Table 5-15. Cumulative Assessment Screening Analysis for Segments for Build Alternative 1**

| Roadway | Segment | Most Sensitive Land Use Type along Segment | Traffic Noise Level (dBA $L_{dn}$) | | | Change in Sound Level from Existing to Cumulative plus Project (dB) | Change in Sound Level from Cumulative No Project to Cumulative plus Project (dB) | Potential Significant Cumulative Increase?[b] | Potential Cumulatively Considerable Contribution?[b] |
|---|---|---|---|---|---|---|---|---|---|
| | | | Existing | Cumulative No Project | Cumulative plus Project | | | | |
| **Clark Road** | **Between R T Jones Road and NASA Ames driveway** | **School & Residential** | **57.5** | **62.4** | **65.0** | **7.5** | **2.6** | **Yes** | **Yes** |
| Ellis Street | Between Manila Avenue and NASA Ames driveway | Commercial | 55.4 | 61.5 | 64.3 | 8.9 | 2.8 | No | N/A |
| Ellis Street | Between Middlefield Road and driveway north of Middlefield Road | Commercial | 63.2 | 67.9 | 68.2 | 5.0 | 0.3 | No | N/A |
| Ellis Street | Between National Avenue and Fairchild Drive | Commercial | 63.9 | 67.6 | 67.9 | 4.0 | 0.3 | No | N/A |
| Ellis Street | Between U.S. 101 northbound ramps and Manila Avenue | Commercial | 64.4 | 67.6 | 69.1 | 4.7 | 1.5 | No | N/A |
| Ellis Street | Between U.S. 101 southbound ramps and U.S. 101 northbound ramps | Commercial | 65.1 | 68.3 | 69.1 | 4.0 | 0.8 | No | N/A |
| Manila Avenue | Between Enterprise Way and Ellis Street | Commercial | 63.4 | 66.3 | 67.4 | 4.0 | 1.1 | No | N/A |
| Moffett Boulevard | Between Leong Drive and U.S. 101 southbound ramps | Residential | 67.0 | 70.3 | 71.0 | 4.0 | 0.7 | Yes | No |
| Moffett Boulevard | Between SR-85 northbound off-ramp and Leong Drive | Residential | 67.2 | 70.4 | 71.1 | 3.9 | 0.7 | Yes | No |
| Moffett Boulevard | Between SR-85 southbound on-ramp and SR-85 northbound off-ramp | Residential | 67.3 | 70.3 | 70.7 | 3.4 | 0.4 | Yes | No |
| **Moffett Boulevard** | **Between U.S. 101 northbound ramps and R T Jones Road** | **Residential** | **67.8** | **70.0** | **71.5** | **3.7** | **1.5** | **Yes** | **Yes** |
| Moffett Boulevard | Between U.S. 101 southbound ramps and U.S. 101 northbound ramps | Commercial | 67.3 | 70.4 | 71.5 | 4.2 | 1.1 | No | N/A |
| Moffett Park Drive | Between Innovation Way and Enterprise Way | Commercial | 63.2 | 65.8 | 67.0 | 3.8 | 1.2 | No | N/A |
| Moffett Park Drive | Between Mathilda Avenue and Innovation Way | Commercial | 66.3 | 68.2 | 68.9 | 2.6 | 0.7 | No | N/A |
| **Wescoat Road[a]** | **Between Clark Road and the Project Site** | **Residential** | **57.5** | **62.4** | **65.0** | **7.5** | **2.6** | **Yes** | **Yes** |

Refer to Appendix A for the complete traffic noise screening results.

Note: Screening noise levels at a fixed distance of 50 feet from the roadway centerline.

Underlined text denotes segments with a 3 dB or greater potential significant increase in noise along roadways with sensitive land uses from existing to cumulative-plus-project conditions.

**Bold** text denotes segments with a 3 dB or greater potential significant increase in noise and a 1 dB or more potentially cumulatively considerable contribution.

a. Traffic counts and estimated ADT volumes for roadway segments within the campus (beyond the NASA AMES guard stations) were not available/not provided by the project traffic consultant. To evaluate potential traffic noise effects on existing residential land uses within the campus, it was conservatively assumed that all vehicles that enter at the Clark Road guard station would continue on Clark Road and turn right onto Wescoat Road to access the Project Site.

b. A potential cumulative impact would occur under this screening analysis if the modeled noise increase is greater than 3 dB and land uses along the roadway segment are sensitive to noise (e.g., residential)

c. No = Project would not result in cumulatively considerable contribution because the land use type along the segment is not a sensitive use. N/A = A cumulatively considerable contribution is not applicable because a significant cumulative impact due to a noise level increase would not occur along the roadway segment.

**Table 5-16. Cumulative Traffic Noise Evaluation for Potentially Affected Segments, CEQA Proposed Project – Detailed Assessment**

| Roadway | Segment Location | Modeled Distance to Centerline (feet) | Representative Measurement Location | Measured Ambient Noise Level, Existing (dBA $L_{dn}$) | Ambient with Cumulative-No-Project Traffic Noise Levels (dBA $L_{dn}$) | Ambient with Cumulative-plus-Project Traffic Noise Levels (dBA $L_{dn}$) | Change in Sound Level (dBA $L_{dn}$) from Existing to Ambient with Cumulative-plus-Project Noise Levels | Substantial Cumulative Increase?[a] | Change in Sound Level (dBA $L_{dn}$) between Cumulative Scenarios[b] | Cumulatively Considerable Project Contribution?[b] |
|---|---|---|---|---|---|---|---|---|---|---|
| Clark Road | Between R T Jones Road and NASA Ames driveway | 200 | LT-6 | 63.4 | 63.9 | 64.5 | 1.1 | No | 0.6 | N/A |
| Moffett Boulevard | Between U.S. 101 northbound ramps and R T Jones Road | 400 | LT-6 | 63.4 | 64.2 | 64.8 | 1.4 | No | 0.6 | N/A |
| Wescoat Road | Between Clark Road and Project Site | 100 | LT-1 | 63.7 | 64.7 | 65.6 | 1.9 | No | 0.9 | N/A |

a. A detailed assessment was conducted to determine if the potential cumulative traffic noise increases identified in the screening analysis are actual cumulative traffic noise increases, with consideration given to existing measured noise levels and the actual distances between the roadway centerline and the nearest sensitive use.

b. Although no substantial cumulative increases were determined to occur in the detailed assessment, the project contribution to the cumulative increase is still presented here for informational purposes. "N/A" is used to emphasize that the project-related increase is presented for informational purposes only.

According to the detailed traffic noise assessment for the CEQA Proposed Project, none of the flagged segments would have a 3 dB increase over existing measured noise levels. Although no substantial cumulative noise effects were identified, the project's contribution to the increases is still presented in Table 5-16 for informational purposes. As shown in the table, the project would also not result in a 1 dB or greater increase in cumulative-with-project noise levels along any evaluated segment. Cumulative traffic noise effects under the CEQA Proposed Project (NEPA Build Alternative 1) would not be considered substantial.

#### *Parking Garage Noise*

Parking activity noise at project parking structures was evaluated; based on the modeling results, parking garage noise levels would be well below the existing ambient noise level at the nearest receivers (i.e., 15 to 28 dB lower than the existing average daytime noise levels). The resulting overall increases in ambient noise levels would be negligible. Noise effects related to parking garage activity were not considered to be substantial. In addition, no cumulative projects have parking garages between the nearest noise-sensitive receptors (residences at Wescoat Village) and the proposed project or within a similar distance. Therefore, noise from parking garage activity within project parking garages would not be expected to combine with noise from parking garage activity at nearby cumulative projects. Cumulative noise effects related to parking garage activity would not be considered substantial.

#### *Amplified Music or Speech at Events*

With respect to amplified music or speech at events, although cumulative projects could involve events with amplified music or speech, it is very unlikely that these events would occur on the same day and at the same time as an event associated with the project. Even if an event were to occur simultaneously, which is unlikely due to the infrequent nature (i.e., approximately 12 per year) of events under the project, it is not likely that the events would be close enough to one another for the noise to combine at a given individual receiver. Cumulative noise effects associated with amplified sound from infrequent events would not be considered substantial.

### Construction Vibration

With respect to the potential for cumulative vibration effects to result in damage, the evaluation of vibration-related damage effects is based on instantaneous PPV levels. Because PPV is a measure of the peak instantaneous vibration level rather than an average, other sources of vibration operating simultaneously (e.g., on other project sites or even on the same site) would not be expected to combine to raise the overall peak vibration level experienced at a nearby sensitive use. Worst-case groundborne vibration levels are generally determined by whichever piece of equipment generates the highest vibration level at the affected location; therefore, vibration would be dominated by the closest and most vibration-intensive equipment being used at a given time. For example, unlike the analysis for average noise levels, in which noise levels from multiple pieces of equipment can be combined to generate a maximum combined noise level, instantaneous peak vibration levels do not combine in that way. Vibration from multiple construction sites, even if they are close to one another, would not combine to raise the maximum PPV level at sensitive uses near the Project Site.

In summary, the cumulative geographic context for vibration is highly localized, and vibration from multiple construction projects near one another (or even adjacent to one another) would generally not combine to increase PPV vibration levels. The majority of the cumulative projects in the vicinity have either already undergone construction and are complete or have not yet begun construction and do not have specific locations within NRP or construction dates set at this time. The nearest cumulative projects to the Project Site involve rehabilitation and relocation of USGS Building 19 (complete), construction of USGS Building 800 (complete), and reskinning Hangar One (complete).

Because vibration from multiple pieces of equipment would not be expected to combine and raise the overall peak vibration level experienced at a nearby sensitive use, vibration felt by the nearby Wescoat Village residents and experienced at other nearby residential structures would be dominated by vibration from the closest project with vibration-generating equipment. Overall vibration levels at nearby structures/receptors would be governed by the nearest and closest ground-disturbing equipment associated with any project. Because project effects related to annoyance were not considered to be substantial, and because construction of nearby cumulative projects is complete, cumulative vibration-related annoyance effects would similarly not be considered substantial. However, project-specific vibration effects on vibration-sensitive structures were determined to be potentially substantial. As a result, cumulative vibration-related damage effects would conservatively be considered substantial. Implementation of project Mitigation Measure NOI-5 would avoid or reduce and repair vibration-related damage effects. Therefore, cumulative vibration-related damage effects would not be considered substantial with implementation of project mitigation.

With respect to vibration-sensitive equipment, note that vibration-sensitive equipment criteria are expressed in VdB, which is an average vibration level. However, the cumulative projects list does not include construction projects in proximity to the nearby USGS Building 800 (with construction of all nearby cumulative projects already complete). For the reasons described above, vibration from project construction would not be expected to combine with vibration from the construction of cumulative projects and result in greater levels of interference with nearby vibration-sensitive research equipment. However, because project-specific effects related to interference with vibration-sensitive research equipment were considered substantial, cumulative effects related to interference with vibration-sensitive research equipment would therefore conservatively be considered substantial. Project-specific Mitigation Measure NOI-6 has been identified to reduce effects on vibration-sensitive equipment. Even with implementation of all feasible mitigation, it may not be possible to fully reduce interference effects on nearby vibration-sensitive laboratory or research equipment. Cumulative vibration effects related to interference with vibration-sensitive equipment would be conservatively considered substantial, even with implementation of mitigation.

**Aircraft Noise**

Development of the project would not result in an increase in aircraft activity at Moffett Federal Airfield. Consequently, development of the project in conjunction with nearby cumulative projects would not result in a significant cumulative effect related to the exposure of persons residing or working in the project area to excessive aircraft noise levels. Therefore, there would be no cumulative effects related to aircraft noise.

# 5.3.3 CEQA Proposed Project (NEPA Build Alternative 1) with WRF Option

## 5.3.3.1 Project-Level Impacts

### Construction Noise

**Daytime Construction Noise**

Daytime construction activities for the project would generally be the same for the CEQA Proposed Project with WRF Option, as described for the CEQA Proposed Project without the WRF Option. Under the WRF Option, portions of the non-potable supply would be provided on-site rather than by Mountain View. By adding the WRF Option to the CEQA Proposed Project, three additional on-site subphases of construction would be required. No additional equipment would be required for construction of the WRF Option compared with that already required for construction of the CEQA Proposed Project (as shown in Table 5-1, presented previously). The construction noise modeling results for the CEQA Proposed Project, which would apply to the CEQA Proposed Project with the WRF Option, are included in Table 5-3. Table 5-17 provides the estimated combined noise levels for the three additional WRF-specific subphases at a reference distance of 50 feet.

**Table 5-17. Combined Project Construction Noise Levels at 50 Feet for the CEQA Proposed Project with Water Reuse Facility Subphases**

| Subphase Type/Construction Activity | Combined Noise Level at 50 Feet (dBA, $L_{eq}$) |
|---|---|
| Water Reuse Facility: Site preparation | 87 |
| Water Reuse Facility: Grading | 87 |
| Water Reuse Facility: Vertical construction | 82 |

As shown in Table 5-17, combined noise levels at a reference distance of 50 feet during the on-site WRF construction subphases are estimated to be between 82 and 87 dBA $L_{eq}$. Overall construction noise levels from the CEQA Proposed Project would be in the range of 78 to 93 dBA $L_{eq}$ at 50 feet. Because construction associated with the WRF subphases would not result in higher noise levels than overall construction activities for the CEQA Proposed Project, the loudest on-site construction subphase under this option would still be Building – Demolition. This construction subphase was modeled to result in a noise level of 81 dBA $L_{eq}$ at the nearest sensitive receptor. Refer to Table 5-3 for a summary of estimated worst-case noise levels at the nearest receptors from on-site construction activities under the CEQA Proposed Project.

Off-site construction activities, as well as associated noise levels, would also be the same as previously analyzed under the CEQA Proposed Project because all off-site construction would be the same for the WRF Option. Therefore, the loudest off-site construction phase would still be Utilities/Roads – Excavation and Utilities/Roads – Drainage and Subgrade, which would result in a noise level of 90 dBA $L_{eq}$ at the nearest sensitive receptor (i.e., Wescoat Village residences). Refer to Table 5-4 for a summary of noise levels at the nearest receptors from off-site construction.

Because construction of a WRF would not change the worst-case noise levels, the conclusions for daytime construction noise under the CEQA Proposed Project would also apply to the CEQA Proposed Project with the WRF Option. Refer to the daytime construction noise analysis for the CEQA Proposed Project, presented previously, for an in-depth analysis of worst-case daytime construction noise.

***CEQA***

Worst-case daytime construction noise levels from the CEQA Proposed Project with WRF Option may exceed the applicable criterion for daytime construction noise in the county and a 10 dB increase (or greater) over the existing ambient noise level would be expected to occur at the nearest noise-sensitive receptors. Mitigation Measures NOI-1 and NOI-2, presented previously, have been identified to reduce construction noise levels. However, it may not be possible to reduce all daytime construction noise levels to a level below the significance thresholds, even with implementation of all feasible mitigation measures. Therefore, noise levels from daytime construction are expected to exceed applicable daytime construction noise limits, even with implementation of mitigation.

***NEPA***

Worst-case daytime construction noise levels from off-site construction activities under NEPA Build Alternative 1 with the WRF Option would be expected to exceed the applicable FTA threshold at one nearby industrial land use (Hangar One). Mitigation Measures NOI-1 and NOI-2, presented previously, have been identified to reduce construction noise levels. However, it may not be possible to reduce all daytime construction noise levels to a level below the significance thresholds, even with implementation of all feasible mitigation measures. For example, locating equipment as far as possible from noise-sensitive receptors and providing mufflers and sound control devices would reduce noise; however, this may not be enough to reduce noise to levels below the significance criteria when in-street work occurs close to a given receptor. In addition, quieter alternative types of equipment are generally not available to substitue for the equipment required for this in-street work (i.e., a grader and a concrete saw). Further, the worst-case distance between off-site/in-street construction and the nearest industrial use, Hangar One, is only 15 feet. Because the construction activity itself is required to take place approximately 15 feet from the adjacent industrial use, increasing the separation distance between construction equipment and this nearby receptor is not possible for this construction activity. Finally, Mitigation Measure NOI-2 would not be expected to reduce noise from off-site/in-street work because such work would generally not take place behind the temporary noise barriers described in this measure. For these reasons, noise levels from daytime construction are expected to exceed the applicable daytime construction noise limit at one nearby industrial land use, even with implementation of mitigation.

**Nighttime Construction**

Potential effects related to nighttime construction noise would be the same under the CEQA Proposed Project with the WRF Option as the effects described for the CEQA Proposed Project because none of the WRF construction subphases would occur at night. Therefore, the nighttime construction noise analysis presented previously for the CEQA Proposed Project would apply to this option. Refer to the nighttime construction noise analysis for the CEQA Proposed Project, presented previously, for an in-depth analysis of worst-case nighttime construction noise.

***CEQA***

Nighttime construction noise levels from the CEQA Proposed Project with WRF Option may exceed the applicable County criterion of 55 dBA for multi-family residential land uses. A 10 dB (or greater) increase over the existing ambient noise level would be expected to occur at the nearest noise-sensitive receptors. Mitigation Measures NOI-1 and NOI-2 have been identified to reduce construction noise levels. However, it may not be possible to reduce all nighttime construction noise levels to a level below the significance thresholds, even with implementation of all feasible mitigation measures. In addition, Mitigation Measure NOI-2 would not be expected to reduce noise from nighttime off-site/in-street work because such work would generally not take place behind the temporary noise barriers described under this measure. For these reasons, noise levels from nighttime construction are expected to exceed applicable construction noise limits, even with implementation of mitigation.

***NEPA***

Nighttime construction noise levels from NEPA Build Alternative 1 with the WRF Option may exceed the FTA criteria for nighttime construction at the nearest residences. Mitigation Measures NOI-1 and NOI-2, described previously, have been identified to reduce nighttime construction noise levels. However, it may not be possible to reduce all nighttime construction noise levels to a level below the significance thresholds, even with implementation of all feasible mitigation measures. In addition, Mitigation Measure NOI-2 would not be expected to reduce noise from nighttime off-site/in-street work because such work would generally not take place behind the temporary noise barriers described under this measure. For these reasons, noise levels from nighttime construction are expected to exceed applicable construction noise limits at nearby noise-sensitive receptors, even with implementation of mitigation.

**Haul Truck and Heavy Truck Noise**

The haul truck route and the worst-case number of haul trucks and heavy trucks per day along the route would be the same under the CEQA Proposed Project with the WRF Option as discussed under the CEQA Proposed Project. The existing noise levels along haul routes would also be the same. Therefore, the heavy truck noise analysis presented for the CEQA Proposed Project would also apply to the CEQA Proposed Project with the WRF Option, and the same results would occur. Refer to the haul truck and heavy truck noise analysis for the CEQA Proposed Project, presented previously, for details.

***CEQA***

The CEQA Proposed Project with the WRF Option would result in traffic noise increases in the range of 0.5 to 2.7 dB along the project haul routes due to construction truck activity. During most subphases of construction, there would be fewer daily haul truck or heavy truck trips and the traffic noise increases would be even smaller. Note that there are also no noise-sensitive receptors along the roadway segments that comprise the haul route north of U.S. 101. In conclusion, the maximum modeled noise increase resulting from construction truck would be less than the 3 dB increase threshold established for the project, and haul truck activity would not be expected to expose noise-sensitive receptors to excessive noise.

***NEPA***

NEPA Build Alternative 1 with WRF Option would result in traffic noise increases in the range of 0.5 to 2.7 dB along project haul routes. During most subphases of construction, there would be fewer daily haul truck or heavy truck trips and the traffic noise increases would be even smaller. Note that there are also no noise-sensitive receptors along the roadway segments that comprise the haul route north of U.S. 101. In conclusion, the maximum modeled noise increase resulting from construction truck would be less than the 3 dB increase threshold established for the project, and haul truck activity would not be expected to expose noise-sensitive receptors to excessive noise.

## Operational Noise

### Mechanical Equipment

*Heating, Cooling, and Ventilation Equipment*

Project heating, cooling, and ventilation equipment under the CEQA Proposed Project with the WRF Option would be the same as proposed under the CEQA Proposed Project. Therefore, the same analysis and results would apply. Refer to the heating, cooling, and ventilation equipment analysis for the CEQA Proposed Project, presented previously, for details.

*Water Reuse Facility Equipment*

With respect to WRF-specific equipment, nearly all equipment associated with the WRF (e.g., tanks, screens, pumps) would be inside the basement of Building 11 within Subarea 6, thereby greatly reducing exterior noise levels from said equipment. WRF equipment with external components would most likely be limited to blowers and exhaust fans. A blower or exhaust fan can result in an estimated noise level of 79 dBA at a distance of 50 feet, which would equate to approximately 66 dBA $L_{eq}$ at a distance of 220 feet (i.e., the distance to the nearest sensitive use, the existing Wescoat Village residences development to the west, from equipment locations in Building 11) (Federal Highway Administration 2006). Any exhaust vents would be on the roof and behind the rooftop screens proposed under the project, most likely reducing noise from such fans. This analysis assumes an estimated 5 dB of reduction from such solid screens. Therefore, each external exhaust fan for the WRF could result in a noise level of up to 61 dBA $L_{eq}$ at the nearest sensitive uses. Note that this noise level is below the worst-case equipment noise levels predicted to occur at Wescoat Village (approximately 76 dBA) from mechanical heating, cooling, and ventilation equipment. However, because this noise level still exceeds the applied thresholds, noise impacts related to WRF equipment would be considered potentially significant.

*Sewer Lift Station*

The same sewer lift station would be installed under the CEQA Proposed Project with the WRF Option as under the CEQA Proposed Project. Therefore, the same analysis would apply and the same results would occur. Refer to the sewer lift station analysis for the CEQA Proposed Project, presented previously, for details.

*BESS Equipment*

The same BESS units would be installed under the CEQA Proposed Project with the WRF Option as under the CEQA Proposed Project. Therefore, the same analysis would apply and the same results would occur. Refer to the BESS equipment analysis for the CEQA Proposed Project, presented previously, for details.

### *CEQA*

Noise levels from mechanical equipment, including mechanical heating, cooling, and ventilation equipment; WRF equipment; and the sewer lift station and BESS equipment, would have the potential to exceed the applicable noise standards at the nearest noise-sensitive receptors. In addition, the analysis provided above is based on reasonable assumptions about the equipment noise levels; the final noise levels would be subject to change, pending final equipment selections and locations. Therefore, the potential exists for actual noise levels to be higher or lower than those presented in this analysis. Accordingly, noise levels from project mechanical equipment, including heating and cooling equipment, WRF-specific equipment, sewer lift station equipment, and BESS equipment, may exceed applicable noise limits. Mitigation Measure NOI-3 has been identified to reduce noise levels from mechanical equipment. With implementation of this mitigation measure, mechanical equipment noise levels would be reduced to below applicable significance thresholds.

### *NEPA*

As described for the CEQA evaluation, noise from project-related mechanical equipment would have the potential to exceed the applicable noise standards at the nearest noise-sensitive receptors. In addition, the analysis provided above is based on reasonable assumptions about the equipment noise levels; the final noise levels would be subject to change, pending final equipment selections and locations. Therefore, the potential exists for actual noise levels to be higher or lower than those presented in this analysis. Accordingly, noise levels from project mechanical equipment, including heating and cooling equipment, WRF-specific equipment, sewer lift station equipment, and BESS equipment, may exceed applicable noise limits. Mitigation Measure NOI-3 has been identified to reduce noise levels from mechanical equipment. With implementation of this mitigation measure, mechanical equipment noise levels would be reduced to below applicable significance thresholds.

## Emergency Generator Noise

Under the CEQA Proposed Project with the WRF Option, thirteen 500 kW emergency generators would be installed at the Project Site, compared to the 12 emergency generators proposed under the CEQA Proposed Project. Specifically, the thirteen generators would be located in Subareas 2, 3, 5, and 6 of the proposed Project Site (one generator would be located a Buildings 3, 4, 7, 8, and 11, and two generators would be located at Buildings 2, 5, 9, and 10). The additional generator installed at Building 11 under this option would become the nearest project generator to the Wescoat Village residences, as opposed to the generator at Building 10 under the CEQA Proposed Project.

The nearest generator to Wescoat Village (the Building 11 generator associated with the WRF) could be as close as 230 feet from existing residences. Generator testing noise levels at this location could be up to 83 dBA $L_{eq}$, exceeding the County's 55 dBA noise exposure limit for multi-family residences. Refer to Table 5-18 for a summary of modeling results for the CEQA Proposed Project with the WRF Option.

**Table 5-18. Summary of Emergency Generator Testing Noise – CEQA Proposed Project with the WRF Option**

| Land Use Type | Distance to Nearest Generator (feet) | Modeled Noise Level (dBA)[a] | Noise Standard (dBA) | Exceeds Standard? |
|---|---|---|---|---|
| Existing multi-family residential (Wescoat Village) | 230 [b] | 83.2 | 55 | Yes |

a. Emergency generators associated with the project would be screened from view from interior streets and surrounding areas to the height of the generator on all four sides (buildings may be used for all or part of the enclosure). However, because specific details about generator attenuation features, including the noise reduction anticipated, are not known at this time, this analysis conservatively assumes that a generator enclosure and screen would result in approximately 5 dB of noise reduction.

b. Note that 230 feet is the estimated distance between the potential generator zone associated with Building 11 under the CEQA Proposed Project with WRF Option and the nearest Wescoat Village receptor.

***CEQA***

For the nearest sensitive uses (residences at Wescoat Village), the modeled generator testing noise level of 83 dBA is approximately 28 dB higher than the applicable noise exposure limit of 55 dBA.

Generator testing would be temporary (lasting 2 to 4 hours) and intermittent (occurring once per month). Nonetheless, estimated noise levels would exceed the applicable noise standards at the nearest noise-sensitive receptors under the CEQA Proposed Project with WRF Option. Mitigation Measure NOI-4 has been identified to reduce noise levels and ensure that applicable noise exposure limits would not be exceeded during generator testing.

***NEPA***

As described for the CEQA evaluation, emergency generator testing noise was estimated to exceed the applicable noise exposure limit at Wescoat Village by approximately 28 dB. Generator testing would be temporary (lasting 2 to 4 hours) and intermittent (occurring once per month). Nonetheless, noise levels would exceed the applicable noise standards under NEPA Build Alternative 1 with WRF Option. Mitigation Measure NOI-4 has been identified to reduce noise levels and ensure that applicable noise exposure limits would not be exceeded during generator testing.

**Loading Noise**

Loading activity under the CEQA Proposed Project with the WRF Option would be the same as under the CEQA Proposed Project, and the same findings would apply. Refer to the loading noise analysis for the CEQA Proposed Project, presented previously, for details.

***CEQA***

The Project Site is in an urban area with elevated existing noise levels. A large portion of project deliveries would take place inside project buildings, most likely resulting in negligible noise levels at the nearest noise-sensitive receptors. Delivery or loading activities would be temporary, intermittent, and primarily during daytime hours. Loading activities under the CEQA Proposed Project with WRF Option would not be expected to result in substantial increases in noise in the project area.

#### *NEPA*

The Project Site is in an urban area with elevated existing noise levels. A large portion of project deliveries would take place inside project buildings, most likely resulting in negligible noise levels at the nearest noise-sensitive receptors. Delivery or loading activities would be temporary, intermittent, and primarily during daytime hours. Loading activities under NEPA Build Alternative 1 with WRF Option would not be expected to result in substantial increases in noise in the project area.

### Traffic Noise

Project-related traffic under the CEQA Proposed Project with the WRF Option would be the same as under the CEQA Proposed Project. Consequently, the same traffic noise levels and associated traffic noise increases would apply. Refer to the traffic noise analysis for the CEQA Proposed Project, presented previously, for details.

#### *CEQA*

No analyzed roadway segments would experience a 3 dB or greater increase in noise at noise-sensitive receptors from project implementation when comparing existing noise levels to existing-plus-project noise levels. Therefore, traffic noise increases associated with the CEQA Proposed Project with the WRF Option would not be considered substantial.

#### *NEPA*

No analyzed roadway segments would experience a 3 dB or greater increase in noise at noise-sensitive receptors from project implementation when comparing existing noise levels to existing-plus-project noise levels. Therefore, traffic noise increases associated with NEPA Build Alternative 1 with the WRF Option would not be considered substantial.

### Parking Garage Noise

Parking garage spaces and assumed usage for the CEQA Proposed Project with the WRF Option would be the same as for the CEQA Proposed Project. Consequently, the same analysis and results would apply. Modeled parking garage noise levels are 15 to 28 dB lower than the existing (measured) average daytime noise levels at nearby noise-sensitive receptors (i.e., the Wescoat Village residences). Refer to the parking garage analysis for the CEQA Proposed Project, presented previously, for details.

#### *CEQA*

Modeled parking garage noise levels for the CEQA Proposed Project with WRF Option are 15 to 28 dB lower than the existing average daytime noise levels at nearby noise-sensitive receptors (i.e., the Wescoat Village residences). The resulting overall increases in ambient noise levels would be negligible (0.2 dB or less).

#### *NEPA*

Modeled parking garage noise levels for the NEPA Build Alternative 1 with WRF Option are 15 to 28 dB lower than the existing average daytime noise levels at nearby noise-sensitive receptors (i.e., the Wescoat Village). The resulting overall increase in ambient noise levels would be negligible (0.2 dB or less).

### Amplified Music or Speech at Events

Potential effects related to amplified music or speech would be the same under the CEQA Proposed Project with the WRF Option as described for the CEQA Proposed Project. Therefore, the same analysis would apply and the same results would occur. Refer to amplified music or speech analysis for the CEQA Proposed Project, presented previously, for details.

***CEQA***

Noise levels from sound-amplifying equipment at project-related programming or events for the CEQA Proposed Project with WRF Option would be below the existing average daytime noise levels at the nearest noise-sensitive receptors and would not substantially increase existing ambient noise levels. In addition, events, including outdoor events with amplified sound at the project's Central Green, would be infrequent (approximately 12 per year).

***NEPA***

Noise levels from sound-amplifying equipment at project-related programming or events for the NEPA Build Alternative 1 with WRF Option would be below the existing average daytime noise levels at the nearest noise-sensitive receptors and would not substantially increase existing ambient noise levels. In addition, events, including outdoor events with amplified sound at the project's Central Green, would be infrequent (approximately 12 per year).

## Construction Vibration

### Vibration-Induced Damage

Potential effects related to vibration-induced damage would be the same under the CEQA Proposed Project with the WRF Option as described for the CEQA Proposed Project because the equipment proposed for use and the general footprint of construction would be the same with or without the WRF Option. Therefore, as was the case for the CEQA Proposed Project, estimated vibration levels from the use of a vibratory roller for in-street utility work within 22 feet of vibration-sensitive structures would be expected to exceed the applied Caltrans damage criterion for such buildings (a PPV of 0.25 in/sec) under the CEQA Proposed Project with WRF Option.

***CEQA***

Vibration from construction of the CEQA Proposed Project with WRF Option could exceed the applied vibration-related damage criterion at nearby vibration-sensitive structures (a PPV of 0.25 in/sec). Implementation of Mitigation Measure NOI-5 would avoid or reduce and repair vibration-related damage effects.

***NEPA***

Vibration from construction of NEPA Build Alternative 1 with WRF Option could exceed the applied vibration-related damage criterion at nearby vibration-sensitive structures (a PPV of 0.25 in/sec). Implementation of Mitigation Measure NOI-5 would avoid or reduce and repair vibration-related damage effects.

### Vibration-Related Annoyance

Vibration-related annoyance effects would be the same under the CEQA Proposed Project with the WRF Option as described for the CEQA Proposed Project. Nighttime on-site concrete pours and off-site in-street utility work would both be expected to result in vibration levels below the "strongly perceptible" annoyance threshold at nearby residential land uses.

#### *CEQA*

Estimated vibration levels from on-site and in-street utility work during nighttime hours would not exceed the applicable "strongly perceptible" criterion at the nearest occupied residential land uses during nighttime hours under the CEQA Proposed Project with WRF Option. In addition, nighttime construction activities in a given area would be short term.

#### *NEPA*

Estimated vibration levels from on-site and in-street utility work during nighttime hours would not exceed the applicable "strongly perceptible" criterion at the nearest occupied residential land uses during nighttime hours under NEPA Build Alternative 1 with WRF Option. In addition, nighttime construction activities in a given area would be short term.

### Vibration-Sensitive Equipment

Potential effects from project construction to nearby vibration-sensitive equipment would be the same under the CEQA Proposed Project with the WRF Option as described for the CEQA Proposed Project.

#### *CEQA*

Vibration generated by project construction equipment may exceed applied thresholds for nearby sensitive research equipment and may disrupt the use of such equipment during project construction. Mitigation Measure NOI-6 has been identified to reduce impacts on vibration-sensitive equipment. Even with implementation of all feasible mitigation, it may not be possible to fully reduce interference effects on nearby vibration-sensitive laboratory or research equipment.

#### *NEPA*

As described in the discussion of CEQA-related vibration effects above, vibration generated by project construction equipment may exceed applied thresholds for nearby sensitive research equipment and may disrupt the use of such equipment during project construction. Mitigation Measure NOI-6 has been identified to reduce impacts on vibration-sensitive equipment. Even with implementation of all feasible mitigation, it may not be possible to fully reduce interference effects on nearby vibration-sensitive laboratory or research equipment.

### Aircraft Noise

The aircraft noise analysis and findings for the CEQA Proposed Project with the WRF Option are the same as described for the CEQA Proposed Project.

#### *CEQA*

The project land uses potentially located along the edge of the 65 dBA CNEL contour (i.e., office and business uses) under the CEQA Proposed Project with WRF Option would be considered conditionally compatible with that noise level. In addition, interior noise levels would be expected to be below the maximum acceptable level for such uses. The proposed Student/Faculty Housing and Short-Term Lodging uses would also be exposed to aircraft noise; however, compliance with Title 24 of the California Code of Regulations would ensure that interior noise levels at these uses would be adequately controlled.

***NEPA***

The project land uses potentially located along the edge of the 65 dBA CNEL contour (i.e., office and business uses) under NEPA Build Alternative 1 with WRF Option would be considered conditionally compatible with that noise level. In addition, interior noise levels would be expected to be below the maximum acceptable level for such uses. The proposed Student/Faculty Housing and Short-Term Lodging uses would also be exposed to aircraft noise; however, compliance with Title 24 of the California Code of Regulations would ensure that interior noise levels at these uses would be adequately controlled.

### 5.3.3.2 Cumulative Assessment

**Construction Noise**

Daytime and nighttime construction activities for the CEQA Proposed Project (NEPA Alternative 1) with the WRF Option would generally be the same as described for the CEQA Proposed Project without the WRF because all development alternatives and options would include roughly the same demolition and construction activities, footprint of construction, construction equipment, and construction hours. As described for the CEQA Proposed Project (NEPA Build Alternative 1), construction of the cumulative projects is already complete; consequently, cumulative project construction would not occur concurently with project construction activities (beginning in 2027). Cconstruction noise from cumulative proejcts would therefore not be expected to combine with construction noise from the proposed project and expose nearby sensitive receptors to greater overall construction noise levels. However, because project construction noise levels during both daytime and nighttime hours were modeled to exceed applicable thresholds, cumulative construction noise impacts would conservatively be considered substantial. Although Mitigation Measures NOI-1 and NOI-2 would be expected to somewhat reduce project construction noise, it may not be possible to reduce all construction noise to a level below the significance thresholds used in this assessment, even with implementation of all feasible mitigation measures. Therefore, cumulative construction noise effects during daytime and nighttime hours are considered to be substantial, even with the implementation of project-specific mitigation.

**Operational Noise**

***Mechanical Equipment***

Operational mechanical equipment for the CEQA Proposed Project (NEPA Alternative 1) with the WRF Option would generally be the same as described for the CEQA Proposed Project without the WRF, with the exception of the WRF-specific equipment. However, overall noise effects with or without the option were determined to be the same. As described previously, most operational sources of noise do not generate noise that is perceptible far beyond the edge of a project site. Project mechanical equipment noise would be localized and associated noise would attenuate rapidly with distance.

There are no cumulative projects between the nearest noise-sensitive receptors (i.e., the Wescoat Village residences) and the proposed project or within a similar distance. The nearest cumulative project to Wescoat Village is at USGS Building 800, which is more than 1,000 feet from the nearest Wescoat Village residence (with the nearest project building being an estimated 100 feet from the

Project Site). However, construction of that project is already completed, and the building is currently operational. Because of the distance between USGS Building 800 and the Wescoat Village residences (i.e., more than 1,000 feet), and because project buildings would be expected to block the line of sight between USGS Building 800 and the Wescoat Village residences once construction is complete, noise-generating uses (e.g., mechanical equipment) at USGS Building 800 would not be expected to combine with noise from project mechanical equipment . However, because project-specific mechanical equipment effects were determined to be potentially substantial, cumulative impacts related to operational equipment noise levels would conservatively be considered substantial. Project Mitigation Measure NOI-3 has been identified to reduce noise levels from project mechanical equipment. With implementation of this mitigation measure, mechanical equipment noise would be reduced to levels below applicable significance thresholds. Therefore, cumulative effects related to mechanical equipment noise would not be considered substantial with implementation of project mitigation.

#### *Emergency Generator Testing*

As described under the cumulative analysis for the CEQA Proposed Project (NEPA Build Alternative 1), it is very unlikely that the testing of an emergency generator for the proposed project would occur concurrently with the testing of a generator at a nearby project. Even if testing were to occur simultaneously, which is unlikely, it is not likely that the generators would be close enough to one another for the noise to combine at a given individual receptor. However, because noise from emergency generator testing was determined to potentially exceed applicable standards, cumulative effects related to noise from emergency generator testing would conservatively be considered substantial. Project Mitigation Measure NOI-4 has been identified to reduce noise levels and ensure that applicable noise exposure limits would not be exceeded during project emergency generator testing. With implementation of this mitigation measure, emergency generator noise would be reduced to levels below applicable significance thresholds. Therefore, cumulative effects related to emergency generator noise would not be considered substantial with implementation of project mitigation.

#### *Loading Noise*

As described under the cumulative analysis for the CEQA Proposed Project (NEPA Build Alternative 1), loading activity noise is generally intermittent, and noise levels are often abated by intervening buildings. Even if loading activities for nearby cumulative projects were to occur simultaneously, which is unlikely, it is not likely that the loading docks or zones would be close enough to one another for the noise to combine at a given individual receptor. Cumulative noise impacts related to loading dock activity would not be considered substantial.

#### *Traffic Noise*

Cumulative traffic noise effects would be the same as described for the CEQA Proposed Project (NEPA Build Alternative 1). According to the detailed traffic noise assessment for the CEQA Proposed Project, no evaluated segments would have a 3 dB increase over existing measured noise levels. The project would also not result in a 1 dB or greater increase in cumulative-with-project noise levels along any evaluated segment. Cumulative traffic noise effects would not be considered substantial.

***Parking Garage Noise***

Cumulative parking activity noise effects would be the same as described for the CEQA Proposed Project (NEPA Build Alternative 1). Cumulative noise effects related to parking garage activity would not be considered substantial.

***Amplified Music or Speech at Events***

Noise effects from amplified music or speech noise at events would be the same as described for the CEQA Proposed Project (NEPA Build Alternative 1). Cumulative noise effects associated with amplified sound from infrequent events would not be considered substantial.

**Construction Vibration**

Daytime and nighttime construction activities for all the CEQA Proposed Project (NEPA Alternative 1) with the WRF Option would generally be the same because this option would involve the same demolition and construction activity, footprint of construction, construction equipment, and construction hours.

Because construction of nearby cumulative projects is complete, vibration from multiple pieces of equipment would not be expected to combine and raise the overall peak vibration level experienced at a nearby sensitive use. Consequently, overall vibration levels at nearby structures/receptors would be governed by the nearest and closest ground-disturbing equipment associated with a project. Because project impacts related to annoyance were not considered substantial, cumulative vibration-related annoyance impacts would similarly not be considered substantial. However, project-specific vibration effects on vibration-sensitive structures were determined to be potentially substantial. As a result, cumulative vibration-related damage effects would conservatively be considered substantial. Implementation of project Mitigation Measure NOI-5 would avoid or reduce and repair vibration-related damage effects. Therefore, cumulative vibration-related damage effects would not be considered substantial with implementation of project mitigation.

Because the list of cumulative projects does not include construction projects in proximity to the nearby USGS Building 800 (where construction of all nearby cumulative projects is already complete), vibration from project construction would not be expected to combine with vibration from the construction of cumulative projects and result in greater levels of interference with nearby vibration-sensitive research equipment. However, because project-specific effects related to interference with vibration-sensitive research equipment were considered substantial, cumulative effects related to interference with vibration-sensitive research equipment would conservatively be considered substantial. Project-specific Mitigation Measure NOI-6 has been identified to reduce impacts on vibration-sensitive equipment. Even with implementation of all feasible mitigation, it may not be possible to fully reduce interference effects on nearby vibration-sensitive laboratory or research equipment. Cumulative vibration effects related to interference with vibration-sensitive equipment would be conservatively considered substantial, even with implementation of mitigation.

**Aircraft Noise**

Noise effects related to aircraft noise would be the same as described for the CEQA Proposed Project (NEPA Build Alternative 1). Consequently, development of the project in conjunction with nearby cumulative projects would not result in a significant cumulative effect related to the exposure of persons residing or working in the project area to excessive aircraft noise levels. There would be no cumulative effects related to aircraft noise.

# 5.3.4 CEQA Proposed Project (NEPA Build Alternative 1) with CUP Option

## 5.3.4.1 Project-Level Impacts

### Construction Noise

**Daytime Construction Noise**

Daytime construction activities for the project would generally be the same for the CEQA Proposed Project with CUP Option, as described for the CEQA Proposed Project without the CUP Option. The CUP Option would provide a centralized heating and cooling system for all buildings instead of building-by-building HVAC systems. By adding the CUP to the CEQA Proposed Project, three additional on-site subphases of construction would be required. Note that no additional equipment would be required for construction of the CUP than would already be required for construction of the CEQA Proposed Project (shown in Table 5-1, presented previously). The construction noise modeling results for the CEQA Proposed Project, which would apply to the CEQA Proposed Project with the CUP, are included in Table 5-3. Table 5-19 provides the estimated combined noise levels for the three additional CUP-specific subphases at a reference distance of 50 feet.

**Table 5-19. Combined Project Construction Noise Levels at 50 Feet for the CEQA Proposed Project with CUP Subphases**

| Subphase Type/Construction Activity | Combined Noise Level at 50 Feet (dBA, $L_{eq}$) |
|---|---|
| CUP: Site preparation | 87 |
| CUP: Grading | 87 |
| CUP: Vertical construction | 82 |

As shown in Table 5-19, combined noise levels at a reference distance of 50 feet during the CUP construction subphases are estimated to be between 82 and 87 dBA $L_{eq}$. Overall construction noise levels from Build Alternative 1 without the CUP, as presented previously, would be in the range of 78 and 93 dBA $L_{eq}$. Because construction associated with the CUP subphases would not result in higher noise levels than overall construction activities for the CEQA Proposed Project, the loudest on-site construction phase under this option would still be Building – Demolition. This construction subphase was modeled to result in a noise level of 93 dBA $L_{eq}$ at 50 feet. Refer to Table 5-3 for a summary of noise levels at the nearest receptors for on-site construction activities under the CEQA Proposed Project.

Note that construction activities for the CUP would all take place on the Project Site. Off-site construction activities, as well as associated noise levels, would remain the same as previously analyzed under the CEQA Proposed Project without the CUP. Therefore, the loudest off-site construction phase would still be Utilities/Roads – Excavation and Utilities/Roads – Drainage and Subgrade. This phase was modeled to result in a noise level of 91 dBA $L_{eq}$ at 50 feet, or 90 dBA $L_{eq}$ at the nearest sensitive receptor (i.e., Wescoat Village residences). Refer to Table 5-4 for a summary of noise levels at the nearest receptors for in-street construction.

Because construction of a CUP would not change the worst-case levels, the conclusions for daytime construction noise under the CEQA Proposed Project would also apply to the CEQA Proposed Project with the CUP. Refer to the daytime construction noise analysis for the CEQA Proposed Project, presented previously, for an in-depth analysis of worst-case daytime construction noise.

***CEQA***

Construction associated with the CUP subphases would not result in higher noise levels than those from the construction of the CEQA Proposed Project. Therefore, the worst-case daytime construction noise levels (i.e., estimated noise levels from the worst-case loudest construction subphase) from the CEQA Proposed Project with CUP Option would be the same as for the CEQA Proposed Project. These noise levels may exceed the applicable criterion for daytime construction noise in the county, and a 10 dB increase (or greater) over the existing ambient noise level would be expected to occur at the nearest noise-sensitive receptors. Mitigation Measures NOI-1 and NOI-2, presented previously, have been identified to reduce construction noise levels. However, it may not be possible to reduce all daytime construction noise levels to a level below the significance thresholds, even with implementation of all feasible mitigation measures. Therefore, noise levels from daytime construction are expected to exceed applicable daytime construction noise limits, even with implementation of mitigation.

***NEPA***

Construction associated with the CUP subphases would not result in higher noise levels than those from construction of NEPA Build Alternative 1. Therefore, the worst-case daytime construction noise levels (i.e., estimated noise levels from the worst-case loudest construction subphase) from NEPA Build Alternative 1 with the CUP Option would be the same as for NEPA Build Alternative 1. Daytime construction noise levels from off-site construction activities at one nearby industrial land use would be expected to exceed the applicable FTA thresholds. Mitigation Measures NOI-1 and NOI-2, presented previously, have been identified to reduce construction noise levels. However, it may not be possible to reduce all daytime construction noise levels to a level below the significance thresholds, even with implementation of all feasible mitigation measures. For example, locating equipment as far as possible from noise-sensitive receptors and providing mufflers and sound control devices would reduce noise; however, this may not be enough to reduce noise to levels below the significance criteria when in-street work occurs close to a given receptor. In addition, quieter alternative types of equipment are generally not available to substitue for the equipment required for this in-street work (i.e., a grader and a concrete saw). Further, the worst-case distance between off-site/in-street construction and the nearest industrial use, Hangar One, is only 15 feet. Because the construction activity itself is required to take place approximately 15 feet from the adjacent industrial use, increasing the separation distance between construction equipment and this nearby receptor is not possible for this construction activity. Finally, Mitigation Measure NOI-2 would not be expected to reduce noise from off-site/in-street work because such work would generally not take place behind the temporary noise barriers described in this measure. For these reasons, noise levels from daytime construction are expected to exceed applicable daytime construction noise limits at one nearby industrial land use, even with implementation of mitigation.

**Nighttime Construction**

Potential effects related to nighttime construction noise would be the same under the CEQA Proposed Project with the CUP Option as described for the CEQA Proposed Project because none of the CUP construction subphases would occur at night. Therefore, the nighttime construction noise analysis presented previously for the CEQA Proposed Project would apply to this option. Refer to the nighttime construction noise analysis for the CEQA Proposed Project, presented previously, for an in-depth analysis of worst-case nighttime construction noise.

***CEQA***

Nighttime construction noise levels from the CEQA Proposed Project with CUP Option would be the same as for the CEQA Proposed Project. Nighttime construction noise may exceed the applicable County criterion of 55 dBA for multi-family residential land uses; a 10 dB (or greater) increase over the existing ambient noise level would be expected to occur at the nearest noise-sensitive receptors. Mitigation Measures NOI-1 and NOI-2 have been identified to reduce construction noise levels. However, it may not be possible to reduce all nighttime construction noise levels to a level below the significance thresholds, even with implementation of all feasible mitigation measures. In addition, Mitigation Measure NOI-2 would not be expected to reduce noise from nighttime off-site/in-street work because such work would generally not take place behind the temporary noise barriers described under this measure. For these reasons, noise levels from nighttime construction are expected to exceed applicable construction noise limits, even with implementation of mitigation.

***NEPA***

Nighttime construction noise levels from NEPA Build Alternative 1 with the CUP Option would be the same as for NEPA Build Alternative 1. Nighttime construction noise may exceed the FTA criteria for nighttime construction. Mitigation Measures NOI-1 and NOI-2, described previously, have been identified to reduce nighttime construction noise levels. However, it may not be possible to reduce all nighttime construction noise levels to a level below the significance thresholds, even with implementation of all feasible mitigation measures. In addition, Mitigation Measure NOI-2 would not be expected to reduce noise from nighttime off-site/in-street work because such work would generally not take place behind the temporary noise barriers described under this measure. For these reasons, noise levels from nighttime construction are expected to exceed applicable construction noise limits, even with implementation of mitigation.

**Haul Truck and Heavy Truck Noise**

The haul truck route and the worst-case number of haul trucks and heavy trucks per day along the route would be the same under the CEQA Proposed Project with the CUP Option as discussed under the CEQA Proposed Project. The existing noise levels along haul routes would also be the same. Therefore, the heavy truck noise analysis presented for the CEQA Proposed Project would also apply to the CEQA Proposed Project with the CUP Option, and the same results would occur. Refer to the haul truck and heavy truck noise analysis for the CEQA Proposed Project, presented previously, for details.

***CEQA***

The CEQA Proposed Project with the CUP would result in traffic noise increases in the range of 0.5 to 2.7 dB along the project haul routes due to construction truck activity. During most subphases of construction, there would be fewer daily haul truck or heavy truck trips and the traffic noise increases would be even smaller. Note that there are also no noise-sensitive receptors along the roadway segments that comprise the haul route north of U.S. 101. In conclusion, the maximum modeled noise increase resulting from construction truck would be less than the 3 dB increase threshold established for the project, and haul truck activity would not be expected to expose noise-sensitive receptors to excessive noise.

***NEPA***

NEPA Build Alternative 1 with CUP Option would result in traffic noise increases in the range of 0.5 to 2.7 dB along project haul routes. During most subphases of construction, there would be fewer daily haul truck or heavy truck trips and the traffic noise increases would be even smaller. Note that there are also no noise-sensitive receptors along the roadway segments that comprise the haul route north of U.S. 101. In conclusion, the maximum modeled noise increase resulting from construction truck would be less than the 3 dB increase threshold established for the project, and haul truck activity would not be expected to expose noise-sensitive receptors to excessive noise.

## Operational Noise

### Mechanical Equipment

*Heating, Cooling, and Ventilation Equipment*

The CUP Option under the CEQA Proposed Project would provide a centralized heating and cooling system for all buildings instead of building-by-building heating, ventilation, air-conditioning (HVAC) systems. The CUP would be on the ground floor of the parking garage in Building 6. The CUP would require additional equipment on the roof deck of the parking structure compared to the CEQA Proposed Project without the CUP Option; the equipment would be screened from public view at ground level, with a limited number of minor protrusions allowed for exhaust fans and other small appurtenances. The final makes and models for the equipment that would be included in the CUP, as well as the number of pieces, are not known in this time, but a representative selection of the equipment that would be expected to be installed was provided by the Project Proponent, as outlined below.

- Four chillers
- Three heat recovery chillers
- Four cooling towers
- Twelve air-source heat pumps
- Seven primary chilled water pumps
- Four secondary chilled water pumps
- Seven primary-heating hot water pumps
- Four secondary-heating hot water pumps
- Four condenser water pumps
- One chilled water thermal energy storage tank (located adjacent to the parking garage)
- One hot water thermal energy storage tank (located adjacent to the parking garage)

Additional equipment would be installed as needed during future phases to meet the demands of the buildings as they are constructed and become operational.

Estimates of combined noise levels from the CUP were based on data for similar (example) types of equipment from readily available data sources (e.g., FHWA and Hoover and Keith manuals). This assessment conservatively assumes that all equipment would operate simultaneously and be located relatively close together. All equipment would be behind screens, according to the Project Proponent (equipment is not proposed to be located inside mechanical equipment rooms). Therefore, this analysis includes 5 dB of noise reduction to account for attenuation from the project's solid mechanical screens. Refer to Table 5-20 for the estimated combined noise levels of mechanical equipment associated with the CUP. Note that this analysis conservatively uses horizontal distances between the mechanical equipment noise sources and the nearest receptor for all CUP equipment (even though some may be on the rooftop) and ignores the additional diagonal distance due to the elevated rooftop location for rooftop equipment (with building heights of up to 80 feet).

Based on the modeling conducted for mechanical equipment similar to CUP equipment (as described previously), the estimated combined noise level from CUP equipment at the nearest sensitive use could be approximately 61 dBA $L_{eq}$.[32] That noise level is less than the estimated noise level of rooftop equipment, as presented in the noise analysis for each office, R&D, and academic building (i.e., Building 10) and for the CEQA Proposed Project residential building (Building 12 in the southwest portion of Subarea 6). According to that analysis, the nearest project building (i.e., the student/faculty housing building) could produce an estimated noise level of 75.6 dBA $L_{eq}$ at the nearest residences (i.e., the Wescoat Village residences). Therefore, worst-case mechanical heating and cooling equipment noise levels under the CEQA Proposed Project with the CUP would not be greater than those presented under the CEQA Proposed Project without the CUP Option. Overall, estimated combined noise levels from project mechanical equipment associated with each project building would be up to 75.6 dBA $L_{eq}$, based on the analyses contained in the CEQA Proposed Project subsection.

*Sewer Lift Station*

The same sewer lift station would be installed under the CEQA Proposed Project with the CUP Option as under the CEQA Proposed Project. Therefore, the same analysis would apply and the same results would occur. Refer to the sewer lift station analysis for the CEQA Proposed Project, presented previously, for details.

*BESS Equipment*

The same BESS units would be installed under CEQA Proposed Project with the CUP Option as would be installed under the CEQA Proposed Project. Therefore, the same analysis would apply the same and results would occur. Refer to the BESS equipment analysis for the CEQA Proposed Project, presented previously, for details of the BESS noise analysis.

***CEQA***

Modeled noise levels from mechanical equipment would have the potential to exceed the applicable noise standards at nearby noise-sensitive receptors. In addition, the analysis provided above is based on reasonable assumptions about equipment noise levels and on a library of data from example equipment that provided high-level details related to the types of equipment proposed under the project; the final mechanical equipment noise levels would be subject to change, pending final selections and locations. Therefore, the potential exists for actual noise levels to be higher or lower than those presented in this analysis. In conclusion, mechanical heating and cooling equipment noise levels under the CEQA Proposed Project with the CUP Option would potentially exceed applicable significance thresholds, but would be no greater than the noise levels estimated under the CEQA Proposed Project without the CUP Option.

[32] The CUP would be more than 1,500 feet from the nearest residence at Wescoat Village. At a distance of 1,500 feet, estimated combined noise levels from the CUP would be reduced to approximately 61 dBA $L_{eq}$.

**Table 5-20. Estimated Heating, Cooling, and Ventilation Equipment Noise for the CUP**

| Type of Equipment | Quantity | dBA $L_{eq}$ Noise at 50 Feet for One Piece of Equipment (assuming 100% utilization) | Located in a Room or Exterior? | Attenuation Based on Equipment Location in Room or behind Screen (dB) | Attenuated Noise at 50 Feet for One Piece Equipment | Combined Attenuated Noise by Equipment Type (dBA) | Source for Estimated Equipment Noise |
|---|---|---|---|---|---|---|---|
| **CUP (Building 6, Subarea 4)** | | | | | | | |
| Chillers | 4 | 71 | Exterior | 5 | 66 | 72.0 | H&K |
| Heat recovery chillers | 3 | 71 | Exterior | 5 | 66 | 70.8 | H&K |
| Cooling towers | 4 | 74 | Exterior | 5 | 69 | 75.0 | H&K |
| Air-source heat pumps | 12 | 75 | Exterior | 5 | 70 | 80.8 | FHWA |
| Primary chilled water pumps | 7 | 81 | Exterior | 5 | 76 | 84.5 | FHWA |
| Secondary chilled water pumps | 4 | 81 | Exterior | 5 | 76 | 82.0 | FHWA |
| Primary-heating hot water pumps | 7 | 81 | Exterior | 5 | 76 | 84.5 | FHWA |
| Secondary-heating hot water pumps | 4 | 81 | Exterior | 5 | 76 | 82.0 | FHWA |
| Condenser water pumps | 4 | 81 | Exterior | 5 | 76 | 82.0 | FHWA |
| CUP combined equipment noise at 50 feet | | | | — | — | 90.8 | — |
| **CUP Combined Equipment Noise at Nearest Residences (Wescoat Village, approximately 1,575 feet from the CUP and 1,570 feet from the roof edge)** | | | | | — | **60.9** | — |

Sources: Hoover and Keith 2000; FHWA 2006.

dB = decibels; dBA = A-weighted decibels; H&K = Hoover and Keith; HVAC = heating, ventilation, and air-conditioning

Mitigation Measure NOI-3 has been identified to reduce noise levels from mechanical equipment. Although the exact makes and models of project mechanical equipment are not currently known, several noise-reduction options are available to reduce mechanical equipment noise levels to below the significance thresholds used in this assessment. This includes selecting and installing quieter models, upgrading equipment acoustical enclosures, orienting or shielding equipment to protect noise-sensitive receptors to the greatest extent feasible, increasing the distance between the equipment and noise-sensitive receptors, and/or placing noise-attenuating barriers around equipment. With implementation of this mitigation measure, mechanical equipment noise levels would be reduced to below applicable significance thresholds.

***NEPA***

As described for the CEQA evaluation above, noise from project-related mechanical equipment would have the potential to exceed the applicable noise standards at nearby noise-sensitive receptors under the NEPA Build Alternative 1 with CUP Option. In addition, the analysis provided above is based on reasonable assumptions about the mechanical equipment noise levels, but the final noise levels are subject to change, pending the final equipment selections and locations. Therefore, the potential exists for actual noise levels to be higher or lower than those presented in this analysis. Mitigation Measure NOI-3 has been identified to reduce noise levels from mechanical equipment. Although the exact makes and models of project mechanical equipment are not currently known, several noise-reduction options are available to reduce mechanical equipment noise levels to below the significance thresholds used in this assessment. This includes selecting and installing quieter models, upgrading equipment acoustical enclosures, orienting or shielding equipment to protect noise-sensitive receptors to the greatest extent feasible, increasing the distance between the equipment and noise-sensitive receptors, and/or placing noise-attenuating barriers around equipment. With implementation of this mitigation measure, mechanical equipment noise levels would be reduced to below applicable significance thresholds.

**Emergency Generator Noise**

Under the CEQA Proposed Project with the CUP, thirteen 500 kW emergency generators would be installed at the Project Site compared to the 12 proposed under the CEQA Proposed Project. Specifically, one additional generator would be installed in Subarea 4 of the Project Site (at Building 6) under this option. This new generator would be no closer to off-site sensitive uses than the distances evaluated for the CEQA Proposed Project. Therefore, the reasonable worst-case emergency generator noise level under this option would be the same as those presented for the CEQA Proposed Project, which was estimated to be 76 dBA at the closest existing residences west of the Project Site (Wescoat Village). This noise level would exceed the applicable noise standard of 55 dBA at this location. Refer to the emergency generator noise analysis for the CEQA Proposed Project, presented previously, for additional details.

***CEQA***

Emergency generator testing would be temporary (lasting 2 to 4 hours) and intermittent (occurring once per month). Nonetheless, emergency generator testing noise was modeled to exceed the applicable daytime noise standards at the nearest existing noise-sensitive receptors under the CEQA Proposed Project with CUP Option. Therefore, Mitigation Measure NOI-4 has been identified to reduce noise levels and ensure that applicable noise exposure limits would not be exceeded during generator testing.

***NEPA***

Emergency generator testing would be temporary (lasting 2 to 4 hours) and intermittent (occurring once per month). Nonetheless, emergency generator testing noise was modeled to exceed the applicable daytime noise standards at the nearest existing noise-sensitive receptors under NEPA Build Alternative 1 with CUP Option. Therefore, Mitigation Measure NOI-4 has been identified to reduce noise levels and ensure that applicable noise exposure limits would not be exceeded during generator testing.

**Loading Noise**

Loading activity under the CEQA Proposed Project with the CUP Option would be the same as under the CEQA Proposed Project, and the same findings would apply. Refer to the loading noise analysis for the CEQA Proposed Project, presented previously, for details.

***CEQA***

The Project Site is in an urban area with elevated existing noise levels. A large portion of project deliveries would take place inside project buildings, most likely resulting in negligible noise levels at the nearest noise-sensitive receptors. Delivery and loading activities would be temporary, occurring primarily during daytime hours. Intermittent loading activities for the CEQA Proposed Project with the CUP would not be expected to result in substantial increases in noise in the project area.

***NEPA***

The Project Site is in an urban area with elevated existing noise levels. A large portion of project deliveries would take place inside project buildings, most likely resulting in negligible noise levels at the nearest noise-sensitive receptors. Delivery and loading activities would be temporary, occurring primarily during daytime hours. Intermittent loading activities for NEPA Build Alternative 1 with the CUP Option would not be expected to result in substantial increases in noise in the project area.

**Traffic Noise**

Project-related traffic under the CEQA Proposed Project with the CUP would be the same as under the CEQA Proposed Project. Consequently, the same traffic noise levels by scenario and associated traffic noise increases would apply. Refer to the traffic noise analysis for the CEQA Proposed Project, presented previously, for details.

***CEQA***

No analyzed roadway segments would experience a 3 dB or greater increase in noise at noise-sensitive receptors from project implementation when comparing existing noise levels to existing-plus-project noise levels. Therefore, traffic noise increases associated with the CEQA Proposed Project with the CUP Option would not be considered substantial.

***NEPA***

No analyzed roadway segments would experience a 3 dB or greater increase in noise at noise-sensitive receptors from project implementation when comparing existing noise levels to existing-plus-project noise levels. Therefore, traffic noise increases associated with NEPA Build Alternative 1 with CUP Option would not be considered substantial.

### Parking Garage Noise

Parking garage spaces and assumed usage under the CEQA Proposed Project with the CUP would be the same as presented under the analysis of the CEQA Proposed Project. Consequently, the same analysis and results would apply. Modeled parking garage noise levels are 15 to 28 dB lower than the existing (measured) average daytime noise levels at nearby noise-sensitive receptors (i.e., the Wescoat Village residences). Refer to the parking garage analysis for the CEQA Proposed Project, presented previously, for details.

#### *CEQA*

Modeled parking garage noise levels under the CEQA Proposed Project with the CUP are 15 to 28 dB lower than the existing average daytime noise levels at nearby noise-sensitive receptors (i.e., the Wescoat Village residences). The resulting overall increases in ambient noise levels would be negligible (0.2 dB or less).

#### *NEPA*

Modeled parking garage noise levels under NEPA Build Alternative 1 with CUP Option are 15 to 28 dB lower than the existing average daytime noise levels at nearby noise-sensitive receptors (i.e., Wescoat Village residences). The resulting overall increase in ambient noise levels would be negligible (0.2 dB or less).

### Amplified Music or Speech at Events

Potential effects related to amplified music or speech would be the same under the CEQA Proposed Project with the CUP as described for the CEQA Proposed Project. Therefore, the same analysis would apply and the same results would occur. Refer to amplified music or speech analysis for the CEQA Proposed Project, presented previously, for details.

#### *CEQA*

Noise levels from sound-amplifying equipment at project-related programming or events would be below the existing average daytime noise levels at the nearest noise-sensitive receptors and would not substantially increase existing ambient noise levels under the CEQA Proposed Project with the CUP. In addition, events, including outdoor events with amplified sound at the project’s Central Green, would be infrequent (approximately 12 per year).

#### *NEPA*

Noise levels from sound-amplifying equipment at project-related programming or events would be below the existing average daytime noise levels at the nearest noise-sensitive receptors and would not substantially increase existing ambient noise levels under NEPA Build Alternative 1 with the CUP Option. In addition, events, including outdoor events with amplified sound at the project’s Central Green, would be infrequent (approximately 12 per year).

## Construction Vibration

### Vibration-Induced Damage

Potential effects related to vibration-induced damage would be the same under the CEQA Proposed Project with the CUP as described for the CEQA Proposed Project because the equipment proposed for use and the general footprint of construction would be the same with or without the CUP. Therefore, as was the case for the CEQA Proposed Project, estimated vibration levels from the use of a vibratory roller for in-street utility work within 22 feet of vibration-sensitive structures would be expected to exceed the applied Caltrans damage criterion for such buildings (a PPV of 0.25 in/sec) under the CEQA Proposed Project with CUP Option.

#### *CEQA*

Vibration from construction of the CEQA Proposed Project with CUP Option could exceed the applied vibration-related damage criterion at nearby vibration-sensitive structures (a PPV of 0.25 in/sec). Implementation of Mitigation Measure NOI-5 would avoid or reduce and repair vibration-related damage effects.

#### *NEPA*

Vibration from construction of the NEPA Build Alternative 1 with CUP Option could exceed the applied vibration-related damage criterion at nearby vibration-sensitive structures (a PPV of 0.25 in/sec).

Implementation of Mitigation Measure NOI-5 would avoid or reduce and repair vibration-related damage effects.

### Vibration-Related Annoyance

Vibration-related annoyance effects would be the same under the CEQA Proposed Project with the CUP as described for the CEQA Proposed Project. Nighttime on-site concrete pours and off-site in-street utility work would both be expected to result in vibration levels below the "strongly perceptible" annoyance threshold at nearby residential land uses.

#### *CEQA*

Estimated vibration levels from on-site and in-street utility work during nighttime hours would not exceed the applicable "strongly perceptible" criterion at the nearest occupied residential land uses during nighttime hours under the CEQA Proposed Project with CUP Option. In addition, nighttime construction activities in a given area would be short term.

#### *NEPA*

Estimated vibration levels from on-site and in-street utility work during nighttime hours would not exceed the applicable "strongly perceptible" criterion at the nearest occupied residential land uses during nighttime hours under NEPA Build Alternative 1 with the CUP Option. In addition, nighttime construction activities in a given area would be short term.

## Vibration-Sensitive Equipment

Potential effects from project construction to nearby vibration-sensitive equipment would be the same under the CEQA Proposed Project with the CUP Option as described for the CEQA Proposed Project.

### *CEQA*

Vibration generated by project construction equipment may exceed applied thresholds for nearby sensitive research equipment and may disrupt the use of such equipment during project construction. Mitigation Measure NOI-6 has been identified to reduce impacts on vibration-sensitive equipment. Even with implementation of all feasible mitigation, it may not be possible to fully reduce interference effects on nearby vibration-sensitive laboratory or research equipment.

### *NEPA*

As described in the discussion of CEQA-related vibration effects above, vibration generated by project construction equipment may exceed applied thresholds for nearby sensitive research equipment and may disrupt the use of such equipment during project construction. Mitigation Measure NOI-6 has been identified to reduce impacts on vibration-sensitive equipment. Even with implementation of all feasible mitigation, it may not be possible to fully reduce interference effects on nearby vibration-sensitive laboratory or research equipment.

## Aircraft Noise

The aircraft noise analysis and findings for the CEQA Proposed Project with the CUP Option are the same as described for the CEQA Proposed Project because the project footprint would be the same, and the exterior noise levels from aircraft at the Project Site would be the same.

### *CEQA*

The project land uses potentially located along the edge of the 65 dBA CNEL contour (i.e., office, business and professional) under the CEQA Proposed Project with the CUP Option would be considered conditionally compatible with such noise levels. In addition, interior noise levels would be expected to be below the maximum acceptable level for such uses. The proposed Student/Faculty Housing and Short-Term Lodging uses would also be exposed to aircraft noise; however, compliance with Title 24 of the California Code of Regulations would ensure that interior noise levels at these uses would be adequately controlled.

### *NEPA*

The project land uses potentially located along the edge of the 65 dBA CNEL contour (i.e., office and business uses) under NEPA Build Alternative 1 with CUP Option would be considered conditionally compatible with such noise levels. Interior noise levels would be expected to be below the maximum acceptable level for such uses. The proposed Student/Faculty Housing and Short-Term Lodging uses would also be exposed to aircraft noise; however, compliance with Title 24 of the California Code of Regulations would ensure that interior noise levels at these uses would be adequately controlled.

### 5.3.4.2 Cumulative Assessment

**Construction Noise**

Daytime and nighttime construction activities for the CEQA Proposed Project (NEPA Alternative 1) with the CUP Option would generally be the same as described for the CEQA Proposed Project without the CUP because it would include roughly the same demolition and construction activities, footprint of construction, construction equipment, and construction hours. As described for the CEQA Proposed Project (NEPA Build Alternative 1), construction of the cumulative projects is already complete; consequently, cumulative project construction would not occur concurently with project construction activities (beginning in 2027). Construction noise from cumulative proejcts would therefore not be expected to combine with construction noise from the proposed project and expose nearby sensitive receptors to greater overall construction noise levels. However, because project construction noise levels during both daytime and nighttime hours were modeled to exceed applicable thresholds, cumulative construction noise impacts would conservatively be considered substantial. Although Mitigation Measures NOI-1 and NOI-2 would be expected to somewhat reduce project construction noise, it may not be possible to reduce all construction noise levels to a level below the significance thresholds used in this assessment, even with implementation of all feasible mitigation measures. Therefore, cumulative construction noise effects during daytime and nighttime hours are considered to be substantial, even with the implementation of project-specific mitigation.

**Operational Noise**

***Mechanical Equipment***

Operational Mechanical Equipment for the CEQA Proposed Project (NEPA Alternative 1) with the CUP Option would generally be the same as described for the CEQA Proposed Project without the CUP, with the exception of the CUP-specific equipment. However, overall noise effects with or without the option were determined to be the same. As described previously, most operational sources of noise do not generate noise that is perceptible far beyond the edge of a project site. Project mechanical equipment noise would be localized and associated noise would attenuate rapidly with distance.

There are no cumulative projects between the nearest noise-sensitive receptors (i.e., the Wescoat Village residences) and the proposed project or within a similar distance. The nearest cumulative project to Wescoat Village is at USGS Building 800, which is more than 1,000 feet from the nearest Wescoat Village residence (with the nearest project building being an estimated 100 feet from the Project Site). However, construction of that project is already completed, and the building is currently operational. Because of the distance between USGS Building 800 and the Wescoat Village residences (i.e., more than 1,000 feet), and because project buildings would be expected to block the line of sight between USGS Building 800 and the Wescoat Village residences once construction is complete, noise-generating uses (e.g., mechanical equipment) at USGS Building 800 would not be expected to combine with noise from project mechanical equipment., However, because project-specific mechanical equipment effects were determined to be potentially substantial, cumulative effects related to operational equipment noise levels would conservatively be considered substantial. Project Mitigation Measure NOI-3 has been identified to reduce noise levels from project mechanical equipment. With implementation of this mitigation measure, mechanical equipment noise would be reduced to levels below applicable significance thresholds. Therefore, cumulative effects related to mechanical equipment noise would not be considered substantial with implementation of project mitigation.

#### *Emergency Generator Testing*

As described under the cumulative analysis for the CEQA Proposed Project (NEPA Build Alternative 1), it is very unlikely that the testing of an emergency generator for the proposed project would occur concurrently with the testing of a generator at a nearby project. Even if testing were to occur simultaneously, which is unlikely, it is not likely that the generators would be close enough to one another for the noise to combine at a given individual receptor. However, because noise from emergency generator testing was determined to potentially exceed applicable standards, cumulative effects related noise from emergency generator testing would conservatively be considered substantial. Project Mitigation Measure NOI-4 has been identified to reduce noise levels and ensure that applicable noise exposure limits would not be exceeded during project emergency generator testing. With implementation of this mitigation measure, emergency generator noise would be reduced to levels below applicable significance thresholds. Therefore, cumulative effects related to emergency generator noise would not be considered substantial with implementation of project mitigation.

#### *Loading Noise*

As described under the cumulative analysis for the CEQA Proposed Project (NEPA Build Alternative 1), loading activity noise is generally intermittent, and noise levels are often abated by intervening buildings. Even if loading activities for nearby cumulative projects were to occur simultaneously, which is unlikely, it is not likely that the loading docks or zones would be close enough to one another for the noise to combine at a given individual receptor. Cumulative noise impacts related to loading dock activity would not be considered substantial.

#### *Traffic Noise*

Cumulative traffic noise effects would be the same as described for the CEQA Proposed Project (NEPA Build Alternative 1). According to the detailed traffic noise assessment for the CEQA Proposed Project, no evaluated segments would have a 3 dB increase over existing measured noise levels. The project would also not result in a 1 dB or greater increase in cumulative-with-project noise levels along any evaluated segment. Cumulative traffic noise effects would not be considered substantial.

#### *Parking Garage Noise*

Cumulative parking activity noise effects would be the same as described for the CEQA Proposed Project (NEPA Build Alternative 1). Cumulative noise effects related to parking garage activity would not be considered substantial.

#### *Amplified Music or Speech at Events*

Noise effects from amplified music or speech noise at events would be the same as described for the CEQA Proposed Project (NEPA Build Alternative 1). Cumulative noise effects associated with amplified sound from infrequent events would not be considered substantial.

### Construction Vibration

Daytime and nighttime construction activities for the CEQA Proposed Project (NEPA Alternative 1) with the CUP Option would generally be the same as described for the CEQA Proposed Project (NEPA Alternative 1) because this option would involve the same demolition and construction activity, footprint of construction, construction equipment, and construction hours.

Because construction of nearby cumulative projects is complete, vibration from multiple pieces of equipment would not be expected to combine and raise the overall peak vibration level experienced at a nearby sensitive use. Consequently, overall vibration levels at nearby structures/receptors would be governed by the nearest and closest ground-disturbing equipment associated with a project. Because project impacts related to annoyance were not considered substantial, cumulative vibration-related annoyance impacts would similarly not be considered substantial. However, project-specific vibration effects on vibration-sensitive structures were determined to be potentially substantial. As a result, cumulative vibration-related damage effects would conservatively be considered substantial. Implementation of project Mitigation Measure NOI-5 would avoid or reduce and repair vibration-related damage effects. Therefore, cumulative vibration-related damage effects would not be considered substantial with implementation of project mitigation.

Because the list of cumulative projects does not include construction projects in proximity to the nearby USGS Building 800 (where construction of all nearby cumulative projects is already complete), vibration from project construction would not be expected to combine with vibration from the construction of cumulative projects and result in greater levels of interference with nearby vibration-sensitive research equipment. However, because project-specific effects related to interference with vibration-sensitive research equipment were considered substantial, cumulative effects related to interference with vibration-sensitive research equipment would conservatively be considered substantial. Project-specific Mitigation Measure NOI-6 has been identified to reduce effects on vibration-sensitive equipment Even with implementation of all feasible mitigation, it may not be possible to fully reduce interference effects on nearby vibration-sensitive laboratory or research equipment. Cumulative vibration effects related to interference with vibration-sensitive equipment would be conservatively considered substantial, even with implementation of mitigation.

**Aircraft Noise**

Noise effects related to aircraft noise would be the same as described for the CEQA Proposed Project (NEPA Build Alternative 1). Consequently, development of the project in conjunction with nearby cumulative projects would not result in a significant cumulative effect related to the exposure of persons residing or working in the project area to excessive aircraft noise levels. There would be no cumulative effects related to aircraft noise.

## 5.3.5 CEQA Proposed Project (NEPA Build Alternative 1) with Variant

### 5.3.5.1 Project-Level Impacts

The CEQA Proposed Project with the Variant would include research and office uses instead of student/faculty housing in Subarea 6, Building 12. The Variant would not change the basic characteristics of the CEQA Proposed Project. The Variant would occur in the same footprint as the CEQA Proposed Project.

## Construction Noise

### Daytime Construction

Construction of the CEQA Proposed Project with the Variant would include the same demolition, ground disturbance and excavation, schedule and phasing, construction equipment, and construction hours as the CEQA Proposed Project. In place of the student/faculty housing building, additional office and R&D space would be constructed. For this reason, potential effects related to daytime construction noise would be the same as described for the CEQA Proposed Project. Refer to the daytime construction noise analysis for the CEQA Proposed Project, presented previously, for an in-depth analysis of worst-case daytime construction noise.

#### *CEQA*

Worst-case daytime construction noise levels from both on- and off-site construction activities for the CEQA Proposed Project with the Variant may exceed the applicable criterion for daytime construction noise in the county, and a 10 dB increase (or greater) over the existing ambient noise level would be expected to occur at the nearest noise-sensitive receptors. Mitigation Measures NOI-1 and NOI-2, presented previously, have been identified to reduce construction noise levels. However, it may not be possible to reduce all daytime construction noise levels to a level below the significance thresholds, even with implementation of all feasible mitigation measures. Therefore, noise levels from daytime construction are expected to exceed applicable daytime construction noise limits, even with implementation of mitigation.

#### *NEPA*

Worst-case daytime construction noise levels from off-site construction activities under NEPA Build Alternative 1 with the Sub-Alternative would be expected to exceed the applicable FTA thresholds at one industrial land use. Mitigation Measures NOI-1 and NOI-2, presented previously, have been identified to reduce construction noise levels. However, it may not be possible to reduce all daytime construction noise levels to a level below the significance thresholds, even with the implementation of all feasible mitigation measures. For example, locating equipment as far as possible from noise-sensitive receptors and providing mufflers and sound control devices would reduce noise; however, this may not be enough to reduce noise to levels below the significance criteria when in-street work occurs close to a given receptor. In addition, quieter alternative types of equipment are generally not available to substitue for the equipment required for this in-street work (i.e., a grader and a concrete saw). Further, the worst-case distance between off-site/in-street construction and the nearest industrial use, Hangar One, is only 15 feet. Because the construction activity itself is required to take place approximately 15 feet from the adjacent industrial use, increasing the separation distance between construction equipment and this nearby receptor is not possible for this construction activity. Finally, Mitigation Measure NOI-2 would not be expected to reduce noise from off-site/in-street work because such work would generally not take place behind the temporary noise barriers described in this measure. For these reasons, noise levels from daytime construction are expected to exceed the applicable daytime construction noise limit at one nearby industrial land use, even with implementation of mitigation.

## Nighttime Construction

Potential effects related to nighttime construction noise with the CEQA Proposed Project with the Variant would be the same as the effects described for the CEQA Proposed Project. Therefore, the nighttime construction noise analysis presented previously for the CEQA Proposed Project would apply to this Variant. Refer to the nighttime construction noise analysis for the CEQA Proposed Project, presented previously, for an in-depth analysis of worst-case nighttime construction noise.

### *CEQA*

Nighttime construction noise levels from the CEQA Proposed Project with the Variant may exceed the applicable County criterion of 55 dBA for multi-family residential land uses; a 10 dB (or greater) increase over the existing ambient noise level would be expected to occur at the nearest noise-sensitive receptors. Mitigation Measures NOI-1 and NOI-2 have been identified to reduce construction noise levels. However, it may not be possible to reduce all nighttime construction noise levels to a level below the significance thresholds, even with implementation of all feasible mitigation measures. In addition, Mitigation Measure NOI-2 would not be expected to reduce noise from nighttime off-site/in-street work because such work would generally not take place behind the temporary noise barriers described under this measure. For these reasons, noise levels from nighttime construction are expected to exceed applicable construction noise limits, even with implementation of mitigation.

### *NEPA*

Nighttime construction noise levels from NEPA Build Alternative 1 with the Sub-Alternative may exceed the FTA criteria for nighttime construction noise. Mitigation Measures NOI-1 and NOI-2, described previously, have been identified to reduce nighttime construction noise levels. However, it may not be possible to reduce all nighttime construction noise levels to a level below the significance thresholds, even with implementation of all feasible mitigation measures. In addition, Mitigation Measure NOI-2 would not be expected to reduce noise from nighttime off-site/in-street work because such work would generally not take place behind the temporary noise barriers described under this measure. For these reasons, noise levels from nighttime construction are expected to exceed applicable construction noise limits, even with implementation of mitigation.

## Haul Truck and Heavy Truck Noise

The haul truck route and the worst-case number of haul trucks and heavy trucks per day would be the same under the CEQA Proposed Project with the Variant as discussed under the CEQA Proposed Project. The existing noise levels along haul routes would also be the same. Therefore, the heavy truck noise analysis presented for the CEQA Proposed Project would also apply to the CEQA Proposed Project with the Variant and the same results would occur. Refer to the haul truck and heavy truck noise analysis for the CEQA Proposed Project, presented previously, for details.

### *CEQA*

The CEQA Proposed Project with the Variant would result in traffic noise increases in the range of 0.5 to 2.7 dB along the project haul routes due to construction truck activity. During most subphases of construction, there would be fewer daily haul truck or heavy truck trips and the traffic noise increases would be even smaller. Note that there are also no noise-sensitive receptors along the roadway segments that comprise the haul route north of U.S. 101. In conclusion, the maximum modeled noise increase resulting from construction truck would be less than the 3 dB increase threshold established for the project, and haul truck activity would not be expected to expose noise-sensitive receptors to excessive noise.

***NEPA***

NEPA Build Alternative 1 No Student/Faculty Housing Sub-Alternative would result in traffic noise increases in the range of 0.5 to 2.7 dB along project haul routes. During most subphases of construction, there would be fewer daily haul truck or heavy truck trips and the traffic noise increases would be even smaller. Note that there are also no noise-sensitive receptors along the roadway segments that comprise the haul route north of U.S. 101. In conclusion, the maximum modeled noise increase resulting from construction truck would be less than the 3 dB increase threshold established for the project, and haul truck activity would not be expected to expose noise-sensitive receptors to excessive noise.

## Operational Noise

### Mechanical Equipment

*Heating, Cooling, and Ventilation Equipment*

Project heating, cooling, and ventilation equipment under the CEQA Proposed Project with the Variant would be essentially the same as the equipment proposed under the CEQA Proposed Project, with the exception of the equipment associated with Building 12 in Subarea 6. Building 12 would be developed with an office, R&D, and academic building under this Variant in lieu of a residential building. The previously presented analysis related to operational mechanical equipment under the CEQA Proposed Project at all project buildings besides Building 12 in Subarea 6 (i.e., the analysis of noise from each individual office, R&D, and academic building, such as Building 10 in Table 5-7 presented previously) would therefore apply to this Variant.

Based on the example mechanical equipment modeling conducted for the CEQA Proposed Project, as described previously, the estimated combined noise level from rooftop mechanical equipment at the proposed residential building (Building 12 in Subarea 6) was stated to be approximately 75.6 dBA $L_{eq}$ at Wescoat Village. If Building 12 were to be developed with an office, R&D, and academic building, estimated noise from the associated equipment would be 77 dBA $L_{eq}$ at a distance of 105 feet (the distance to the nearest Wescoat Village residence). Refer to Table 5-21 for the estimated combined noise levels from the heating, cooling, and ventilation equipment for Building 12 under this Variant.

*Sewer Lift Station*

The same sewer lift station would be installed under the CEQA Proposed Project with the Variant as under the CEQA Proposed Project. Therefore, the same analysis would apply and the same results would occur. Refer to the sewer lift station analysis for the CEQA Proposed Project, presented previously, for details.

*BESS Equipment*

The same BESS units would be installed under the CEQA Proposed Project with the Variant as under the CEQA Proposed Project. Therefore, the same analysis would apply and the same results would occur. Refer to the BESS equipment analysis for the CEQA Proposed Project, presented previously, for details.

**Table 5-21. Estimated Heating, Cooling, and Ventilation Equipment Noise – Building 12 (Subarea 6), CEQA Proposed Project with Variant**

| Type of Equipment | Number of Pieces | dBA $L_{eq}$ Noise at 50 Feet for One Piece of Equipment (assuming 100% utilization) | Located in a Room or Exterior? | Attenuation Based on Equipment Location in Room or behind Screen (dB) | Attenuated Noise at 50 Feet for One Piece of Equipment | Combined Attenuated Noise by Equipment Type (dBA) | Source for Estimated Equipment Noise |
|---|---|---|---|---|---|---|---|
| **Building 12, Subarea 6 (Office, R&D and Academic Building under This Variant/Sub-Alternative)** | | | | | | | |
| Cooling towers (duty) | 2 | 74 | Exterior | 5 | 69 | 72.0 | H&K |
| Air-source heat pumps | 3 | 75 | Exterior | 5 | 70 | 74.8 | H&K |
| Water-cooled chillers | 3 | 71 | Room | 10 | 61 | 65.8 | H&K |
| Circulation pumps | 9 | 81 | Room | 10 | 71 | 80.5 | FHWA |
| Expansion tanks | 2 | N/A | Room | N/A | N/A | N/A | N/A |
| Building combined equipment noise at 50 feet | | | | — | — | 82.1 | — |
| **Building Combined Equipment Noise at Nearest Residences (Wescoat Village, approximately 105, including 5-foot setback for all equipment from roof edge)** | | | | | — | **77.0** | — |

Sources: Hoover and Keith 2000; FHWA 2006.

dB = decibels; dBA = A-weighted decibels; H&K = Hoover and Keith; HVAC = heating, ventilation, and air-conditioning

#### *CEQA*

Noise levels from mechanical equipment, including mechanical heating, cooling, and ventilation equipment and the sewer lift station and BESS equipment, would have the potential to exceed the applicable noise standards at the nearest noise-sensitive receptors under the CEQA Proposed Project with the Variant. In addition, the analysis provided and results are based on reasonable assumptions about the mechanical equipment noise levels, the final noise levels are subject to change, and the potential exists for actual noise levels to be higher or lower than those presented in this analysis. Mitigation Measure NOI-3 has been identified to reduce noise levels from mechanical equipment. Although the exact makes and models of project mechanical equipment are not currently known, several noise-reduction options are available to reduce mechanical equipment noise to levels below the significance thresholds used in this assessment. This includes selecting and installing quieter models, upgrading equipment acoustical enclosures, orienting or shielding equipment to protect noise-sensitive receptors to the greatest extent feasible, increasing the distance between the equipment and noise-sensitive receptors, and/or placing noise-attenuating barriers around equipment. For that reason, noise impacts from project mechanical equipment would be reduced to below the applicable significance thresholds with implementation of mitigation.

#### *NEPA*

Noise levels from mechanical equipment under NEPA Build Alternative 1 No Student/Faculty Housing Sub-Alternative would have the potential to exceed the applicable noise standards at Wescoat Village. In addition, the analysis and results are based on reasonable assumptions about the mechanical equipment noise levels; the final noise levels are subject to change. The potential exists for actual noise levels to be higher or lower than those presented in this analysis. Mitigation Measure NOI-3 has been identified to reduce noise levels from mechanical equipment. Although the exact makes and models of project mechanical equipment are not currently known, several noise-reduction options are available to reduce mechanical equipment noise to levels below the significance thresholds used in this assessment. This includes selecting and installing quieter models, upgrading equipment acoustical enclosures, orienting or shielding equipment to protect noise-sensitive receptors to the greatest extent feasible, increasing the distance between the equipment and noise-sensitive receptors, and/or placing noise-attenuating barriers around equipment. For that reason, noise impacts from project mechanical equipment would be reduced to below the applicable significance thresholds with implementation of mitigation.

### Emergency Generator Noise

Under the CEQA Proposed Project with the Variant, thirteen 500 kW emergency generators would be installed at the Project Site compared to the 12 proposed under the CEQA Proposed Project. Specifically, one additional generator would be installed in Subarea 6 of the proposed Project Site, at Building 12, under this Variant because this building would be developed with an office, R&D, and academic building in lieu of a student/faculty housing building. Under the CEQA Proposed Project with the Variant, the nearest 500 kW generator to Wescoat Village would be located at Building 12, which could be as close as 160 feet from these existing residences. Generator testing noise levels at this location could be up to 86.4 dBA $L_{eq}$. Under the CEQA Proposed Project with the Variant, worst-case emergency generator testing noise is predicted to be 10 dB greater than the noise levels predicted under the CEQA Proposed Project (76 dBA $L_{eq}$ [refer to Table 5-8]) and 3 dB greater than the noise levels predicted under the CEQA Proposed Project with WRF (83 dBA $L_{eq}$ [refer to Table 5-18]). The predicted noise level would exceed the applicable noise exposure limit (i.e., 55 dBA $L_{eq}$). Refer to Table 5-22 for a summary of modeling results for the CEQA Proposed Project with the Variant.

**Table 5-22. Summary of Emergency Generator Testing Noise – CEQA Proposed Project with Variant**

| Land Use Type | Distance to nearest Generator Testing (feet) | Modeled Noise Level (dBA)[a] | Noise Standard (dBA) | Exceeds Standard? |
|---|---|---|---|---|
| Existing multi-family residential (Wescoat Village) | 160 [b] | 86.4 | 55 | Yes |

a. Emergency generators associated with the project would be screened from view from interior streets and surrounding areas to the height of the generator on all four sides (buildings may be used for all or part of the enclosure). However, because specific details about generator attenuation features, including the noise reduction anticipated, are not known at this time, this analysis conservatively assumes that a generator enclosure and screen would result in approximately 5 dB of noise reduction.

b. Note that 160 feet is the estimated distance between the potential generator zone associated with Building 12 under the CEQA Proposed Project with the Variant and the nearest Wescoat Village receptor.

***CEQA***

Emergency generator testing under the CEQA Proposed Project with the Variant would have the potential to exceed the daytime noise exposure limit of 55 dBA $L_{eq}$ at Wescoat Village by approximately 31 dB. Generator testing would be temporary (lasting 2 to 4 hours) and intermittent (occurring once per month). Nonetheless, estimated noise levels would exceed the applicable noise standards at the nearest noise-sensitive receptors. Mitigation Measure NOI-4, presented previously, has been identified to reduce noise levels and ensure that applicable noise exposure limits would not be exceeded during generator testing.

***NEPA***

Emergency generator testing under the NEPA Build Alternative 1 No Student/Faculty Housing Sub-Alternative would have the potential to exceed the daytime noise exposure limit of 55 dBA $L_{eq}$ at Wescoat Village by approximately 31 dB. Generator testing would be temporary (lasting 2 to 4 hours) and intermittent (occurring once per month). Nonetheless, estimated noise levels would exceed the applicable noise standards at the nearest noise-sensitive receptors. Mitigation Measure NOI-4, presented previously, has been identified to reduce noise levels and ensure that applicable noise exposure limits would not be exceeded during generator testing.

### Loading Noise

Under the CEQA Proposed Project with the Variant, usage at each project loading dock or loading zone would be very similar to the usage under the CEQA Proposed Project, with up to seven additional deliveries expected to occur at the Project Site overall in a given day (309 per day instead of 302). This small increase (approximately 2 percent) would have a negligible impact on overall loading noise levels, and the analysis and findings would be the same as for the CEQA Proposed Project, which concluded loading activities associated with the project would not be expected to result in substantial increases in noise in the project area. Refer to the loading noise analysis for the CEQA Proposed Project, presented previously, for details.

***CEQA***

Potential effects related to loading noise under CEQA Proposed Project with the Variant would be as described for the CEQA Proposed Project. The Project Site is in an urban area with elevated existing noise levels. A large portion of project deliveries would take place inside project buildings, most likely resulting in negligible noise levels at the nearest noise-sensitive receptors. Delivery and loading activities would be temporary, intermittent, and primarily during daytime hours. Loading activities associated with the CEQA Proposed Project with the Variant would not be expected to result in substantial increases in noise in the project area.

***NEPA***

Potential effects related to loading noise under the NEPA Build Alternative 1 No Student/Faculty Housing Sub-Alternative would be as described for the CEQA Proposed Project. The Project Site is in an urban area with elevated noise levels. A large portion of project deliveries would take place inside project buildings, most likely resulting in negligible noise levels at the nearest noise-sensitive receptors. Delivery and loading activities would be temporary, intermittent, and primarily during daytime hours. Loading activities associated with the NEPA Build Alternative 1 No Student/Faculty Housing Sub-Alternative would not be expected to result in substantial increases in noise in the project area.

**Traffic Noise**

Potential effects related to traffic noise under CEQA Proposed Project with the Variant would be as described for the CEQA Proposed Project but with a slight increase in overall traffic volumes under this Variant due to an expected slight increase in the need for students and faculty to commute to the site if no on-site housing is developed. ADT volumes for the CEQA Proposed Project with the Variant were provided for existing, existing-plus-project, cumulative, and cumulative-plus-project scenarios. The cumulative traffic noise increases are evaluated separately below in Section 5.3.5.2, *Cumulative Assessment*. Table 5-23 includes a summary of the quantitative traffic noise modeling results for existing and existing-plus-project conditions on all evaluated roadway segments.

As was the case for the CEQA Proposed Project, an initial screening evaluation of direct traffic noise increases from the project was conducted for the existing and the existing-plus-project traffic scenarios. If a 3 dB increase was predicted to occur along segments with sensitive uses (e.g., residential or school land uses), the increase was flagged in the screening analysis and a more detailed assessment was conducted.

Table 5-23 summarizes the quantitative traffic noise results for the screening analysis. Two segments were flagged in the screening analysis as having a potential 3 dB or greater increase in traffic noise as a result of project implementation. A detailed traffic noise assessment, as described in the traffic noise analysis for the CEQA Proposed Project, was then conducted for the CEQA Proposed Project with the Variant. Refer to Table 5-24 for a comparison of the existing (measured ambient) and existing-plus-project (composite ambient-plus-project) noise levels along roadway segments where the screening analysis identified potential substantial increases.

As shown in Table 5-24, the detailed traffic noise evaluation for the CEQA Proposed Project with the Variant, which includes a comparison of measured ambient noise levels and composite existing-plus-project traffic noise levels along these two roadway segments, demonstrates that project-related traffic noise would increase existing ambient noise levels by up to a maximum of 1.2 dB under this Variant. This increase is below the 3 dB or greater increase threshold for traffic noise.

### Table 5-23. Traffic Noise Screening Analysis for the CEQA Proposed Project with the Variant (50-Foot Reference Distance)

| Roadway | Segment | Most Sensitive Land Use Type along Segment | Traffic Noise Level (dBA $L_{dn}$) Existing | Traffic Noise Level (dBA $L_{dn}$) Existing plus Project (CEQA Proposed Project with the Variant) | Noise Increase Due to Project dB |
|---|---|---|---|---|---|
| **Clark Road** | **Between R T Jones Road and NASA Ames driveway** | **School & Residential** | **57.5** | **63.2** | **5.7** |
| Ellis Street | Between Manila Avenue and NASA ARC driveway | Commercial | 55.4 | 62.4 | 7.0 |
| Ellis Street | Between Middlefield Road and driveway north of Middlefield Road | Commercial | 63.2 | 64.2 | 1.0 |
| Ellis Street | Between National Avenue and Fairchild Drive | Commercial | 63.9 | 64.7 | 0.8 |
| Ellis Street | Between U.S. 101 northbound ramps and Manila Avenue | Commercial | 64.4 | 67.3 | 2.9 |
| Ellis Street | Between U.S. 101 southbound ramps and U.S. 101 northbound ramps | Commercial | 65.1 | 66.7 | 1.6 |
| Manila Avenue | Between Enterprise Way and Ellis Street | Commercial | 64.8 | 65.4 | 2.0 |
| Moffett Boulevard | Between Leong Drive and U.S. 101ssouthbound ramps | Residential | 67.0 | 68.5 | 1.5 |
| Moffett Boulevard | Between SR-85 northbound off-ramp and Leong Drive | Residential | 67.2 | 68.6 | 1.4 |
| Moffett Boulevard | Between SR-85 southbound on-ramp and SR-85 northbound off-ramp | Residential | 67.3 | 68.2 | 0.9 |
| Moffett Boulevard | Between U.S. 101 northbound ramps and R T Jones Road | Residential | 67.8 | 70.1 | 2.3 |
| Moffett Boulevard | Between U.S. 101 southbound ramps and U.S. 101 northbound ramps | Commercial | 67.3 | 69.3 | 2.0 |
| Moffett Park Drive | Between Innovation Way and Enterprise Way | Commercial | 63.2 | 65.3 | 2.1 |
| Moffett Park Drive | Between Mathilda Avenue and Innovation Way | Commercial | 66.3 | 67.4 | 1.1 |
| **Wescoat Road** | **Between Clark Road and the Project Site** | **Residential** | **57.5** | **63.2** | **5.7** |

Refer to Appendix A for the complete traffic noise modeling results.
Note: Screening noise levels at a fixed distance of 50 feet from the roadway centerline.
**Bold** text denotes segments with a 3 dB or greater project-related increase in noise.

**Table 5-24. Detailed Traffic Noise Increase Evaluation for Roadway Segments Flagged in the Screening Analysis - CEQA Proposed Project with the Variant**

| Roadway | Segment | Modeled Distance to Centerline (feet) | Measured Ambient Noise Level (dBA $L_{dn}$) | Project-Only Traffic Noise Level (dBA $L_{dn}$) | Composite Ambient plus Project Noise Level (dBA $L_{dn}$)[a] | Change Compared to Measured Ambient Noise (dB) | 3 dB or Greater Increase? |
|---|---|---|---|---|---|---|---|
| Clark Road | Between R T Jones Road and NASA ARC driveway | 200 | 63.4[b] | 55.7 | 64.1 | 0.7 | No |
| Wescoat Road | Between Clark Road and the Project Site | 100 | 63.7[c] | 58.7 | 64.9 | 1.2 | No |

Refer to Appendix A for the complete traffic noise modeling results.

a. Project-only ADT volumes (i.e., existing-plus-project minus existing volumes) for the segments where a potentially substantial increase was identified during modeling were used to calculate project-only traffic noise levels. Modeled project-only traffic noise levels were then combined with existing measured ambient noise levels to create a composite ambient-plus-project traffic condition.

b. The measured ambient noise level representative of this segment is LT-6 (63.4 dBA $L_{dn}$)

c. The measured ambient noise level representative of this segment is LT-1 (63.7 dBA $L_{dn}$)

***CEQA***

Based on the detailed traffic noise evaluation, which includes a comparison of measured ambient noise levels and composite ambient-plus-project traffic noise levels for the CEQA Proposed Project with the Variant, project-related traffic noise increases would be up to 1.2 dB. This increase is below the 3 dB or greater increase threshold for traffic noise.

***NEPA***

As described for the CEQA evaluation, project-related traffic noise associated with the NEPA Build Alternative 1 No Student/Faculty Housing Sub-Alternative would increase existing ambient noise levels by up to a maximum of 1.2 dB along any evaluated roadway segment. This increase is below the 3 dB or greater increase threshold for transportation noise sources.

**Parking Garage Noise**

Parking garage spaces and assumed usage for the CEQA Proposed Project with the Variant would be the same as for the analysis of the CEQA Proposed Project. Consequently, the same analysis and results would apply. Modeled parking garage noise levels are 15 to 28 dB lower than the existing (measured) average daytime noise levels at nearby noise-sensitive receptors (i.e., the Wescoat Village residences). Refer to the parking garage analysis for the CEQA Proposed Project, presented previously, for details.

***CEQA***

Modeled parking garage noise levels for the CEQA Proposed Project with the Variant are 15 to 28 dB lower than the existing average daytime noise levels at nearby noise-sensitive receptors (i.e., Wescoat Village). The resulting overall increases in ambient noise levels would be negligible (0.2 dB or less).

***NEPA***

Modeled parking garage noise levels for the NEPA Build Alternative 1 No Student/Faculty Housing Sub-Alternative are 15 to 28 dB lower than the existing average daytime noise levels at nearby noise-sensitive receptors (i.e., Wescoat Village). The resulting overall increase in ambient noise levels would be negligible (0.2 dB or less).

**Amplified Music or Speech at Events**

Potential effects related to amplified music or speech would be the same for the CEQA Proposed Project with the Variant as presented for the CEQA Proposed Project because the number and types of programming and events at the Central Green would be the same. Therefore, the same analysis would apply and the same results would occur. Refer to the amplified music or speech analysis for the CEQA Proposed Project, presented previously, for details.

***CEQA***

Noise levels from sound-amplifying equipment at project-related programming or events under the CEQA Proposed Project with the Variant would be below the existing average daytime noise levels at the nearest noise-sensitive receptors and would not substantially increase existing ambient noise levels. In addition, events, including outdoor events with amplified sound, at the project’s Central Green would be infrequent (approximately 12 per year).

***NEPA***

Noise levels from sound-amplifying equipment at project-related programming or events under the NEPA Build Alternative 1 No Student/Faculty Housing Sub-Alternative would be below the existing average daytime noise levels at the nearest noise-sensitive receptors and would not substantially increase existing ambient noise levels. In addition, events, including outdoor events with amplified sound, at the project's Central Green would be infrequent (approximately 12 per year).

## Construction Vibration

### Vibration-Induced Damage

Potential effects related to vibration-induced damage would be the same for the CEQA Proposed Project with the Variant as presented for the CEQA Proposed Project because the equipment proposed for use and the general footprint of construction would be the same. Therefore, as was the case for the CEQA Proposed Project, estimated vibration levels from the use of a vibratory roller for in-street utility work within 22 feet of vibration-sensitive structures would be expected to exceed the applied Caltrans damage criterion for such buildings (i.e., a PPV of 0.25 in/sec) under the CEQA Proposed Project with the Variant.

***CEQA***

Vibration from construction of the CEQA Proposed Project with the Variant could exceed the applied vibration-related damage criterion at nearby vibration-sensitive structures (i.e., a PPV of 0.25 in/sec). Implementation of Mitigation Measure NOI-5 would avoid or reduce and repair vibration-related damage effects.

***NEPA***

Vibration from construction of the NEPA Build Alternative 1 No Student/Faculty Housing Sub-Alternative could exceed the applied vibration-related damage criterion at nearby vibration-sensitive structures (i.e., a PPV of 0.25 in/sec). Implementation of Mitigation Measure NOI-5 would avoid or reduce and repair vibration-related damage effects.

### Vibration-Related Annoyance

Vibration-related annoyance effects would be the same for the CEQA Proposed Project with the Variant as described for the CEQA Proposed Project. Nighttime on-site concrete pours and off-site in-street utility work would both be expected to result in vibration levels below the "strongly perceptible" annoyance threshold at nearby residential land uses.

***CEQA***

Estimated vibration levels from on-site and in-street utility work during nighttime hours would not exceed the applicable "strongly perceptible" criterion at the nearest occupied residential land uses during nighttime hours under the CEQA Proposed Project with the Variant. In addition, nighttime construction activities in a given area would be short term.

***NEPA***

Estimated vibration levels from on-site and in-street utility work during nighttime hours would not exceed the applicable "strongly perceptible" criterion at the nearest occupied residential land uses during nighttime hours under NEPA Build Alternative 1 No Student/Faculty Housing Sub-Alternative. In addition, nighttime construction activities in a given area would be short term.

### Vibration-Sensitive Equipment

Potential effects from project construction on nearby vibration-sensitive equipment would be the same under the CEQA Proposed Project with the Variant as described for the CEQA Proposed Project.

***CEQA***

Vibration generated by project construction equipment may exceed applied thresholds for nearby sensitive research equipment and may disrupt the use of such equipment during project construction. Mitigation Measure NOI-6 has been identified to reduce impacts on vibration-sensitive equipment. Even with implementation of all feasible mitigation, it may not be possible to fully reduce interference effects on nearby vibration-sensitive laboratory or research equipment.

***NEPA***

As described in the discussion of CEQA-related vibration effects above, vibration generated by project construction equipment may exceed applied thresholds for nearby sensitive research equipment and may disrupt the use of such equipment during project construction. Mitigation Measure NOI-6 has been identified to reduce impacts on vibration-sensitive equipment. Even with implementation of all feasible mitigation, it may not be possible to fully reduce interference effects on nearby vibration-sensitive laboratory or research equipment.

### Aircraft Noise

The aircraft noise analysis and findings for the CEQA Proposed Project with the Variant are the same as described for the CEQA Proposed Project because the project footprint would be the same, and the exterior noise levels from aircraft at the Project Site would be the same.

***CEQA***

The project land uses potentially located along the edge of the 65 dBA CNEL contour (i.e., office and business uses) under the CEQA Proposed Project with the Variant would also be considered conditionally compatible with that noise level. In addition, interior noise levels would be expected to be below the maximum acceptable level for such uses.

***NEPA***

The project land uses potentially located along the edge of the 65 dBA CNEL contour (i.e., office and business uses) under the NEPA Build Alternative 1 No Student/Faculty Housing Sub-Alternative would also be considered conditionally compatible with that noise level. In addition, interior noise levels would be expected to be below the maximum acceptable level for such uses.

## 5.3.5.2 Cumulative Assessment

### Construction Noise

Daytime and nighttime construction activities for the CEQA Proposed Project (NEPA Alternative 1) with the Variant would generally be the same as described for the CEQA Proposed Project because it would include roughly the same demolition and construction activities, footprint of construction, construction equipment, and construction hours. As described for the CEQA Proposed Project (NEPA Build Alternative 1), construction of the cumulative projects is already complete; consequently, cumulative project construction would not occur concurently with project construction activities (beginning in 2027). Construction noise from cumulative proejcts would therefore not be expected to combine with construction noise from the proposed project and expose nearby sensitive receptors to greater overall construction noise levels. However, because project construction noise levels during both daytime and nighttime hours were modeled to exceed applicable thresholds, cumulative construction noise impacts would conservatively be considered substantial. Although Mitigation Measures NOI-1 and NOI-2 would be expected to somewhat reduce project construction noise, it may not be possible to reduce all construction noise to a level below the significance thresholds used in this assessment, even with implementation of all feasible mitigation measures. Therefore, cumulative construction noise effects during daytime and nighttime hours are considered to be substantial, even with the implementation of project-specific mitigation.

## Operational Noise

### *Mechanical Equipment*

Operational mechanical equipment for the CEQA Proposed Project (NEPA Alternative 1) with the Variant would generally be the same as described for the CEQA Proposed Project. As described previously, most operational sources of noise do not generate noise that is perceptible far beyond the edge of a project site. Noise from project mechanical equipment would be localized and associated noise would attenuate rapidly with distance.

There are no cumulative projects between the nearest noise-sensitive receptors (i.e., the Wescoat Village residences) and the proposed project or within a similar distance. The nearest cumulative project to Wescoat Village is at USGS Building 800, which is more than 1,000 feet from the nearest Wescoat Village residence (with the nearest project building being an estimated 100 feet from the Project Site). However, construction of that project is already completed, and the building is currently operational. Because of the distance between USGS Building 800 and the Wescoat Village residences (i.e., more than 1,000 feet), and because project buildings would be expected to block the line of sight between USGS Building 800 and the Wescoat Village residences once construction is complete, noise-generating uses (e.g., mechanical equipment) at USGS Building 800 would not be expected to combine with noise from project mechanical equipment. However, because project-specific mechanical equipment effects were determined to be potentially substantial, cumulative impacts related to operational equipment noise levels would conservatively be considered substantial. Project Mitigation Measure NOI-3 has been identified to reduce noise levels from project mechanical equipment. With implementation of this mitigation measure, mechanical equipment noise would be reduced to levels below applicable significance thresholds. Therefore, cumulative effects related to mechanical equipment noise would not be considered substantial with implementation of project mitigation.

### *Emergency Generator Testing*

As described under the cumulative analysis for the CEQA Proposed Project (NEPA Build Alternative 1), it is very unlikely that the testing of an emergency generator for the proposed project would occur concurrently with the testing of a generator at a nearby project. Even if testing were to occur simultaneously, which is unlikely, it is not likely that the generators would be close enough to one another for the noise to combine at a given individual receptor. However, because noise from emergency generator testing was determined to potentially exceed applicable standards, cumulative impacts related to noise from emergency generator testing would conservatively be considered substantial. Project Mitigation Measure NOI-4 has been identified to reduce noise levels and ensure that applicable noise exposure limits would not be exceeded during project emergency generator testing. With implementation of this mitigation measure, emergency generator noise would be reduced to levels below applicable significance thresholds. Therefore, cumulative effects related to emergency generator noise would not be considered substantial with implementation of project mitigation.

#### *Loading Noise*

As described under the cumulative analysis for the CEQA Proposed Project (NEPA Build Alternative 1), loading activity noise is generally intermittent, and noise levels are often abated by intervening buildings. Even if loading activities for nearby cumulative projects were to occur simultaneously, which is unlikely, it is not likely that the loading docks or zones would be close enough to one another for the noise to combine at a given individual receptor. Cumulative noise impacts related to loading dock activity would not be considered substantial.

#### *Traffic Noise*

Cumulative traffic noise effects would be similar to those described for the CEQA Proposed Project (NEPA Build Alternative 1). According to the screening traffic noise analysis results for the CEQA Proposed Project with the Variant (contained in Table 5-25), six roadway segments were flagged in the screening analysis as having a potential 3 dB or greater increase in traffic noise along segments with sensitive land uses when comparing existing and cumulative-plus-project conditions. Three of these segments would also experience a greater than 1 dB increase in noise as a result of project implementation (i.e., when comparing cumulative-no-project conditions to cumulative-plus-project conditions). Results from the screening analysis are included in Table 5-25.

A detailed assessment (as described previously), with consideration given to existing measured noise levels and the actual distances between the roadway centerline and the nearest sensitive use, was conducted for these three segments. The results of the detailed traffic noise modeling assessment for the CEQA Proposed Project with the Variant are included in Table 5-26.

According to the detailed traffic noise assessment for the CEQA Proposed Project with the Variant, no evaluated segments would have a 3 dB increase over existing measured noise levels. Although no significant cumulative noise impacts were identified, note that the project's contribution to the increases is still presented in Table 5-26 for informational purposes. As shown in the table, the project would not result in a 1 dB or greater increase in cumulative-with-project noise levels along any evaluated segment. Cumulative traffic noise impacts under the CEQA Proposed Project (NEPA Build Alternative 1) with the Variant would not be considered substantial.

#### *Parking Garage Noise*

Cumulative parking activity noise effects would be the same as described for the CEQA Proposed Project (NEPA Build Alternative 1). Cumulative noise effects related to parking garage activity would not be considered substantial.

**Table 5-25. Screening Level Traffic Noise for Segments for Build Alternative 1 with the No Student/Faculty Housing Variant/Sub-Alternative – Cumulative Assessment**

| Roadway | Segment | Most Sensitive Land Use Type along Segment | Traffic Noise Level (dBA $L_{dn}$) | | | Change in Sound Level from Existing to Cumulative plus Project (dB) | Change in Sound Level from Cumulative No Project to Cumulative plus Project (dB) | Potential Significant Cumulative Increase?[b] | Potential Cumulatively Considerable Contribution?[c] |
|---|---|---|---|---|---|---|---|---|---|
| | | | Existing | Cumulative No Project | Cumulative plus Project | | | | |
| **Clark Road** | **Between R T Jones Road and NASA Ames driveway** | **School & Residential** | **57.5** | **62.4** | **65.0** | **7.5** | **2.6** | **Yes** | **Yes** |
| Ellis Street | Between Manila Avenue and NASA Ames driveway | Commercial | 55.4 | 61.5 | 64.3 | 8.9 | 2.8 | No | N/A |
| Ellis Street | Between Middlefield Road and Driveway north of Middlefield Road | Commercial | 63.2 | 67.9 | 68.2 | 5.0 | 0.3 | No | N/A |
| Ellis Street | Between National Avenue and Fairchild Drive | Commercial | 63.9 | 67.6 | 67.9 | 4.0 | 0.3 | No | N/A |
| Ellis Street | Between U.S. 101 northbound ramps and Manila Avenue | Commercial | 64.4 | 67.6 | 69.2 | 4.8 | 1.6 | No | N/A |
| Ellis Street | Between U.S. 101 southbound ramps and U.S. 101 northbound ramps | Commercial | 65.1 | 68.3 | 69.1 | 4.0 | 0.8 | No | N/A |
| Manila Avenue | Between Enterprise Way and Ellis Street | Commercial | 63.4 | 66.3 | 67.4 | 4.0 | 1.1 | No | N/A |
| Moffett Boulevard | Between Leong Drive and U.S. 101 southbound ramps | Residential | 67.0 | 70.3 | 71.0 | 4.0 | 0.7 | Yes | No |
| Moffett Boulevard | Between SR-85 northbound off-ramp and Leong Drive | Residential | 67.2 | 70.4 | 71.1 | 3.9 | 0.7 | Yes | No |
| Moffett Boulevard | Between SR-85 southbound on-ramp and SR-85 northbound off-ramp | Residential | 67.3 | 70.3 | 70.7 | 3.4 | 0.4 | Yes | No |
| **Moffett Boulevard** | **Between U.S. 101 northbound ramps and R T Jones Road** | Residential | **67.8** | **70.0** | **71.5** | **3.7** | **1.5** | **Yes** | **Yes** |
| Moffett Boulevard | Between U.S. 101 southbound ramps and U.S. 101 northbound ramps | Commercial | 67.3 | 70.4 | 71.5 | 4.2 | 1.1 | No | N/A |
| Moffett Park Drive | Between Innovation Way and Enterprise Way | Commercial | 63.2 | 65.8 | 67.0 | 3.8 | 1.2 | No | N/A |
| Moffett Park Drive | Between Mathilda Avenue and Innovation Way | Commercial | 66.3 | 68.2 | 68.9 | 2.6 | 0.7 | No | N/A |
| **Wescoat Road[a]** | **Between Clark Road and the Project Site** | Residential | **57.5** | **62.4** | **65.0** | **7.5** | **2.6** | **Yes** | **Yes** |

Refer to Appendix A for the complete traffic noise modeling results.
Note: Screening noise levels at a fixed distance of 50 feet from the roadway centerline.
Underlined text denotes segments with a 3 dB or greater potential significant increase in noise along roadways with sensitive land uses from existing to cumulative-plus-project conditions.
**Bold** text denotes segments with a 3 dB or greater potential significant increase in noise and a 1 dB or more potentially cumulatively considerable contribution.

a. Traffic counts and estimated ADT volumes for roadway segments within the campus (beyond the NASA AMES guard stations) were not available/not provided by the project traffic consultant. To evaluate potential traffic noise effects on existing residential land uses within the campus, it was conservatively assumed that all vehicles that enter at the Clark Road guard station would continue on Clark Road and turn right onto Wescoat Road to access the Project Site.

b. A potential cumulative impact would occur under this screening analysis if the modeled noise increase is greater than 3 dB and land uses along the roadway segment are sensitive to noise (e.g., residential)

c. No = Project would not result in a cumulatively considerable contribution because the land use type along the segment is not a sensitive use. N/A = A cumulatively considerable contribution is not applicable because a significant cumulative impact due to a noise-level increase would not occur along the roadway segment

### Table 5-26. Cumulative Traffic Noise Evaluation for Potentially Affected Segments, CEQA Proposed Project with Variant – Detailed Assessment

| Roadway | Segment Location | Modeled Distance to Centerline (feet) | Representative Measurement Location | Measured Ambient Noise Level, Existing (dBA $L_{dn}$) | Ambient with Cumulative-No-Project Traffic Noise Levels (dBA $L_{dn}$) | Ambient with Cumulative-plus-Project Traffic Noise Levels (dBA $L_{dn}$) | Change in Sound Level (dBA $L_{dn}$) from Existing to Ambient with Cumulative plus Project | Significant Cumulative Increase?[a] | Change in Sound Level (dBA $L_{dn}$) between Cumulative Scenarios[b] | Cumulatively Considerable Project Contribution?[b] |
|---|---|---|---|---|---|---|---|---|---|---|
| Clark Road | Between R T Jones Road and NASA Ames driveway | 200 | LT-6 | 63.4 | 63.9 | 64.5 | 1.1 | No | 0.5 | N/A |
| Moffett Boulevard | Between U.S. 101 northbound ramps and R T Jones Road | 400 | LT-6 | 63.4 | 64.2 | 64.8 | 1.4 | No | 0.6 | N/A |
| Wescoat Road | Between Clark Road and Project Site | 100 | LT-1 | 63.7 | 64.7 | 65.5 | 1.8 | No | 0.9 | N/A |

a. A detailed assessment was conducted to determine if the potential cumulative traffic noise increases identified in the screening analysis are actual cumulative traffic noise increases, with consideration given to existing measured noise levels and the actual distances between the roadway centerline and the nearest sensitive use.

b. Although no significant cumulative increases were determined to occur in the detailed assessment, the project contribution to the cumulative increase is still presented here for informational purposes. "N/A" is used to emphasize that the project-related increase is presented for informational purposes only.

#### *Amplified Music or Speech at Events*

Noise effects from amplified music or speech noise at events would be the same as described for the CEQA Proposed Project (NEPA Build Alternative 1). Cumulative noise effects associated with amplified sound from infrequent events would not be considered substantial.

### Construction Vibration

Daytime and nighttime construction activities for the CEQA Proposed Project (NEPA Alternative 1) with the Variant would generally be the same because this option would involve the same demolition and construction activity, footprint of construction, construction equipment, and construction hours. Because construction for nearby cumulative projects is complete, vibration from multiple pieces of equipment would not be expected to combine and raise the overall peak vibration level experienced at a nearby sensitive use. Consequently, overall vibration levels at nearby structures/receptors would be governed by the nearest and closest ground-disturbing equipment associated with a project. Because project impacts related to annoyance were not considered substantial, cumulative vibration-related annoyance impacts would similarly not be considered substantial. However, project-specific vibration effects on vibration-sensitive structures were determined to be potentially substantial. As a result, cumulative vibration-related damage effects would conservatively be considered substantial. Implementation of project Mitigation Measure NOI-5 would avoid or reduce and repair vibration-related damage effects. Therefore, cumulative vibration-related damage effects would not be considered substantial with implementation of project mitigation.

Because the list of cumulative projects does not include construction projects in proximity to the nearby USGS Building 800 (where construction of all nearby cumulative projects is already complete), vibration from project construction would not be expected to combine with vibration from the construction of cumulative projects and result in greater levels of interference with nearby vibration-sensitive research equipment. However, because project-specific effects related to interference with vibration-sensitive research equipment were considered substantial, cumulative effects related to interference with vibration-sensitive research equipment would conservatively be considered substantial. Project-specific Mitigation Measure NOI-6 has been identified to reduce effects on vibration-sensitive equipment. Even with implementation of all feasible mitigation, it may not be possible to fully reduce interference effects on nearby vibration-sensitive laboratory or research equipment. Cumulative vibration effects related to interference with vibration-sensitive equipment would be conservatively considered substantial, even with implementation of mitigation.

### Aircraft Noise

Noise effects related to aircraft noise would be the same as described for the CEQA Proposed Project (NEPA Build Alternative 1). Consequently, development of the project in conjunction with nearby cumulative projects would not result in a significant cumulative effect related to the exposure of persons residing or working in the project area to excessive aircraft noise levels. There would be no cumulative effects related to aircraft noise.

# 5.3.6 CEQA Reduced Density Alternative (NEPA Build Alternative 2)

## 5.3.6.1 Project-Level Impacts

The CEQA Reduced Density Alternative would create approximately 1.4 million square feet of Research and Office Uses, Conference Center Uses, Active Uses, Student/Faculty Housing, and Short-Term Lodging for visitors and conference attendees. Compared to the CEQA Proposed Project, the CEQA Reduced Density Alternative would provide less space for Research and Office uses, but the overall footprint of construction, as well as the types of equipment proposed for construction, would be the same. In addition, the intensity of construction for the CEQA Proposed Project and CEQA Reduced Density Alternative would be the same, except for a slight reduction in the duration of the "core and shell" and "architectural coating" subphases for research buildings under the CEQA Reduced Density Alternative.

### Construction Noise

#### Daytime Construction Noise

Daytime construction activities for the CEQA Reduced Density Alternative would generally be the same as for the CEQA Proposed Project because both would include the same demolition, ground disturbance and excavation, schedule and phasing, construction equipment, and construction hours. For this reason, potential effects related to daytime construction noise would be the same as described for the CEQA Proposed Project. Refer to the daytime construction noise analysis for the CEQA Proposed Project, presented previously, for an in-depth analysis of worst-case daytime construction noise.

***CEQA***

Worst-case daytime construction noise levels from both on- and off-site construction activities for the CEQA Reduced Density Alternative may exceed the applicable criterion for daytime construction noise in the county. A 10 dB increase (or greater) over the existing ambient noise level would be expected to occur at the nearest noise-sensitive receptors. Mitigation Measures NOI-1 and NOI-2, presented previously, have been identified to reduce construction noise levels. However, it may not be possible to reduce all daytime construction noise levels to a level below the significance thresholds, even with implementation of all feasible mitigation measures. Therefore, noise levels from daytime construction are expected to exceed applicable daytime construction noise limits, even with implementation of mitigation.

***NEPA***

Worst-case daytime construction noise levels from off-site construction activities for the NEPA Build Alternative 2 would be expected to exceed the applicable FTA thresholds at one nearby industrial land use. Mitigation Measures NOI-1 and NOI-2, presented previously, have been identified to reduce construction noise levels. However, it may not be possible to reduce all daytime construction noise levels to a level below the significance thresholds, even with implementation of all feasible mitigation measures. For example, locating equipment as far as possible from noise-sensitive receptors and providing mufflers and sound control devices would reduce noise; however, this may not be enough to reduce noise to levels below the significance criteria when in-street work occurs close to a given receptor. In addition, quieter alternative equipment types are generally not available to substitue for the equipment required for this in-street work (i.e., a grader and a concrete saw). Further, the worst-case distance between off-site/in-street construction and the nearest industrial use, Hangar One, is only 15 feet. Because the construction activity itself is required to take place approximately 15 feet from the adjacent industrial use, increasing the separation distance between construction equipment and this nearby receptor is not possible for this construction activity. Finally, Mitigation Measure NOI-2 would not be expected to reduce noise from off-site/in-street work because such work would generally not take place behind the temporary noise barriers described in this measure. For these reasons, noise levels from daytime construction are expected to exceed applicable daytime construction noise limits at one nearby industrial land use, even with implementation of mitigation.

**Nighttime Construction**

Potential effects related to nighttime construction noise would be the same under the CEQA Reduced Density Alternative as the effects described for the CEQA Proposed Project. Therefore, the nighttime construction noise analysis presented previously for the CEQA Proposed Project would apply to this alternative. Refer to the nighttime construction noise analysis for the CEQA Proposed Project, presented previously, for an in-depth analysis of worst-case nighttime construction noise.

***CEQA***

Nighttime construction noise levels from the CEQA Reduced Density Alternative may exceed the applicable County criterion of 55 dBA $L_{eq}$ for multi-family residential land uses. A 10 dB (or greater) increase over the existing ambient noise level would be expected to occur at the nearest noise-sensitive receptors. Mitigation Measures NOI-1 and NOI-2 have been identified to reduce construction noise levels. However, it may not be possible to reduce all nighttime construction noise levels to a level below the significance thresholds, even with implementation of all feasible mitigation measures. In addition, Mitigation Measure NOI-2 would not be expected to reduce noise from nighttime off-site/in-street work because such work would generally not take place behind the temporary noise barriers described under this measure. For these reasons, noise levels from nighttime construction are expected to exceed applicable construction noise limits, even with implementation of mitigation.

***NEPA***

Nighttime construction noise levels from NEPA Build Alternative 2 may exceed the FTA criteria for nighttime construction noise. Mitigation Measures NOI-1 and NOI-2, described previously, have been identified to reduce nighttime construction noise levels. However, it may not be possible to reduce all nighttime construction noise levels to a level below the significance thresholds, even with implementation of all feasible mitigation measures. In addition, Mitigation Measure NOI-2 would not be expected to reduce noise from nighttime off-site/in-street work because such work would generally not take place behind the temporary noise barriers described under this measure. For these reasons, noise levels from nighttime construction are expected to exceed applicable construction noise limits, even with implementation of mitigation.

#### Haul Truck and Heavy Truck Noise

The haul truck route and the worst-case number of haul trucks and heavy trucks per day along the route would be the same under the CEQA Reduced Density Alternative as discussed under the CEQA Proposed Project. The existing noise levels along haul routes would also be the same. Therefore, the heavy truck noise analysis presented for the CEQA Proposed Project would also apply to the CEQA Reduced Density Alternative, and the same results would occur. Refer to the haul truck and heavy truck noise analysis for the CEQA Proposed Project, presented previously, for details.

***CEQA***

The CEQA Reduced Density Alternative would result in traffic noise increases in the range of 0.5 to 2.7 dB along the project haul routes due to construction truck activity. During most subphases of construction, there would be fewer daily haul truck or heavy truck trips and the traffic noise increases would be even smaller. Note that there are also no noise-sensitive receptors along the roadway segments that comprise the haul route north of U.S. 101. In conclusion, the maximum modeled noise increase resulting from construction truck would be less than the 3 dB increase threshold established for the project, and haul truck activity would not be expected to expose noise-sensitive receptors to excessive noise.

***NEPA***

NEPA Build Alternative 2 would result in traffic noise increases in the range of 0.5 to 2.7 dB along project haul routes. During most subphases of construction, there would be fewer daily haul truck or heavy truck trips and the traffic noise increases would be even smaller. Note that there are also no noise-sensitive receptors along the roadway segments that comprise the haul route north of U.S. 101. In conclusion, the maximum modeled noise increase resulting from construction truck would be less than the 3 dB increase threshold established for the project, and haul truck activity would not be expected to expose noise-sensitive receptors to excessive noise.

### Operational Noise

#### Mechanical Equipment

*Heating, Cooling, and Ventilation Equipment*

Project heating, cooling, and ventilation equipment under the CEQA Reduced Density Alternative would essentially be the same as proposed under the CEQA Proposed Project, noting that the overall developed square footage would be reduced under this alternative. This reduction in development could result in slightly fewer individual pieces of heating and cooling equipment needing to be installed per building under this alternative. However, specific details related to a potential reduction in equipment are not currently known. In addition, the analysis of mechanical equipment noise under the CEQA Proposed Project was based on example equipment, using reasonable assumptions of the types of equipment proposed for each project building. Therefore, even with a slight reduction in the number of pieces of equipment required under this alternative, the previously presented analysis of operational mechanical equipment under the CEQA Proposed Project would conservatively apply to the CEQA Reduced Density Alternative and the same results would apply. Refer to the heating, cooling, and ventilation equipment analysis for the CEQA Proposed Project, presented previously, for details.

*Sewer Lift Station*

The same sewer lift station would be installed under the CEQA Reduced Density Alternative as under the CEQA Proposed Project. Therefore, the same analysis would apply and the same results would occur. Refer to the sewer lift station analysis for the CEQA Proposed Project, presented previously, for details.

*BESS Noise*

The same BESS units would be installed under the CEQA Reduced Density Alternative as under the CEQA Proposed Project. Therefore, the same analysis would apply and the same results would occur. Refer to the BESS equipment analysis for the CEQA Proposed Project, presented previously, for details.

***CEQA***

Noise levels from mechanical equipment, including mechanical heating, cooling, and ventilation equipment and the sewer lift station and BESS equipment, would have the potential to exceed the applicable noise standards at the nearest noise-sensitive receptors under the CEQA Reduced Density Alternative. In addition, the analysis provided above is based on reasonable assumptions about the equipment noise levels; the final noise levels would be subject to change, pending final equipment selections and locations. Therefore, the potential exists for actual noise levels to be higher or lower than those presented in this analysis. Accordingly, noise levels from project mechanical equipment, including heating and cooling equipment, sewer lift station equipment, and BESS equipment, may exceed applicable noise limits. Mitigation Measure NOI-3 has been identified to reduce noise levels from mechanical equipment. Although the exact makes and models of project mechanical equipment are not currently known, several noise-reduction options are available to reduce mechanical equipment noise to levels below the significance thresholds used in this assessment. This includes selecting and installing quieter models, upgrading equipment acoustical enclosures, orienting or shielding equipment to protect noise-sensitive receptors to the greatest extent feasible, increasing the distance between the equipment and noise-sensitive receptors, and/or placing noise-attenuating barriers around equipment. With implementation of this mitigation measure, mechanical equipment noise levels would be reduced to below applicable significance thresholds.

***NEPA***

Noise levels from mechanical equipment under NEPA Build Alternative 2 would have the potential to exceed the applicable noise standards at the nearest noise-sensitive receptors under the CEQA Reduced Density Alternative. In addition, the analysis provided above is based on reasonable assumptions about the equipment noise levels; the final noise levels would be subject to change, pending final equipment selections and locations. Therefore, the potential exists for actual noise levels to be higher or lower than those presented in this analysis. Accordingly, noise levels from project mechanical equipment, including heating and cooling equipment, sewer lift station equipment, and BESS equipment, may exceed applicable noise limits. Mitigation Measure NOI-3 has been identified to reduce noise levels from mechanical equipment. With implementation of this mitigation measure, mechanical equipment noise levels would be reduced to below applicable significance thresholds.

## Emergency Generator Noise

The same twelve 500 kW emergency generators that would be installed at the Project Site under the CEQA Proposed Project would be installed under the CEQA Reduced Density Alternative. Therefore, the emergency generator noise analysis presented for the CEQA Proposed Project would also apply to the CEQA Reduced Density Alternative, and the same results would occur. Refer to the emergency generator noise analysis for the CEQA Proposed Project, presented previously, for details.

### *CEQA*

Emergency generator testing would be temporary (lasting 2 to 4 hours) and intermittent (occurring once per month). Nonetheless, estimated emergency generator testing noise would exceed the applicable daytime noise standards at the nearest existing noise-sensitive receptors under the CEQA Reduced Density Alternative. Therefore, Mitigation Measure NOI-4 has been identified to reduce noise levels and ensure that applicable noise exposure limits would not be exceeded during generator testing.

### *NEPA*

Emergency generator testing would be temporary (lasting 2 to 4 hours) and intermittent (occurring once per month). Nonetheless, estimated emergency generator testing noise would exceed the applicable daytime noise standards at the nearest existing noise-sensitive receptors under NEPA Build Alternative 2. Therefore, Mitigation Measure NOI-4 has been identified to reduce noise levels and ensure that applicable noise exposure limits would not be exceeded during generator testing.

## Loading Noise

Under the CEQA Reduced Density Alternative, usage at each project loading dock or loading zone would be similar to the usage under the CEQA Proposed Project, except that total deliveries across the Project Site would be reduced by almost one third (206 per day instead of 302). With this decrease, the analysis and findings for the CEQA Proposed Project, which concluded loading activities associated with the project would not be expected to result in substantial increases in noise in the project area, can conservatively be applied to the CEQA Reduced Density Alternative. Refer to the loading noise analysis for the CEQA Proposed Project, presented previously, for details.

### *CEQA*

The Project Site is in an urban area with elevated existing noise levels. A large portion of project deliveries would take place inside project buildings, most likely resulting in negligible noise levels at the nearest noise-sensitive receptors. Delivery and loading activities would be temporary, intermittent, and primarily during daytime hours. Loading activities for the CEQA Reduced Density Alternative would not be expected to result in substantial increases in noise in the project area.

***NEPA***

The Project Site is in an urban area with elevated existing noise levels. A large portion of project deliveries would take place inside project buildings, most likely resulting in negligible noise levels at the nearest noise-sensitive receptors. Delivery and loading activities would be temporary, intermittent, and primarily during daytime hours. Loading activities for NEPA Build Alternative 2 would not be expected to result in substantial increases in noise in the project area.

**Traffic Noise**

Potential effects related to traffic noise under the CEQA Reduced Density Alternative would be similar to those described for the CEQA Proposed Project but with a slight reduction due to the smaller intensity of development proposed under this alternative. ADT volumes were provided for existing, existing-plus-project, cumulative, and cumulative-plus-project scenarios. Note that the cumulative traffic noise increases are evaluated separately below in Section 5.3.5.2, *Cumulative Assessment*. As was the case for the CEQA Proposed Project, an initial screening evaluation of direct traffic noise increases from the project was conducted by comparing traffic noise modeling results for the existing and the existing-plus-project traffic scenarios. If a 3 dB increase was predicted to occur along segments with sensitive uses (e.g., residential or school land uses), the increase was flagged in the screening analysis and a more detailed assessment was conducted. Table 5-27 includes a summary of the quantitative traffic noise modeling results for existing and existing-plus-project conditions on all evaluated roadway segments.

Two roadway segments were flagged in the screening analysis as having a potential a 3 dB or greater increase in traffic noise as a result of project implementation under the CEQA Reduced Density Alternative. A detailed traffic noise assessment, as described in the traffic noise analysis for the CEQA Proposed Project, was then conducted for the CEQA Reduced Density Alternative. Refer to Table 5-28 for a comparison of the existing (measured ambient) and existing-plus-project (composite ambient-plus-project) noise levels along roadway segments where the screening analysis identified potential substantial increases.

As shown in Table 5-28, a comparison of measured existing ambient noise levels and composite ambient-plus-project traffic noise levels along these two roadway segments demonstrates that project-related traffic would increase existing ambient noise levels by up to 0.8 dB. This increase is below the 3 dB increase threshold for traffic noise.

***CEQA***

No analyzed roadway segments would experience a 3 dB or greater increase in noise at noise-sensitive receptors from project implementation when comparing existing noise levels to existing-plus-project noise levels. Therefore, traffic noise increases associated with the CEQA Reduced Density Alternative would not be considered substantial.

***NEPA***

No analyzed roadway segments would experience a 3 dB or greater increase in noise at noise-sensitive receptors from project implementation when comparing existing noise levels to existing-plus-project noise levels. Therefore, traffic noise increases associated with NEPA Build Alternative 2 would not be considered substantial.

## Table 5-27. Traffic Noise Screening Analysis for the CEQA Reduced Density Alternative (50-Foot Reference Distance)

| Roadway | Segment | Most Sensitive Land Use Type along Segment | Traffic Noise Level ($dBA\ L_{dn}$) Existing | Existing plus Project (CEQA Proposed Project) | Noise Increase Due to Project dB |
|---|---|---|---|---|---|
| **Clark Road** | **Between R T Jones Road and NASA ARC driveway** | **School & Residential** | **57.5** | **61.8** | **4.3** |
| Ellis Street | Between Manila Avenue and NASA ARC driveway | Commercial | 55.4 | 60.8 | 5.4 |
| Ellis Street | Between Middlefield Road and driveway north of Middlefield Road | Commercial | 63.2 | 63.9 | 0.7 |
| Ellis Street | Between National Avenue and Fairchild Drive | Commercial | 63.9 | 64.4 | 0.5 |
| Ellis Street | Between U.S. 101 northbound ramps and Manila Avenue | Commercial | 64.4 | 66.4 | 2.0 |
| Ellis Street | Between U.S. 101 southbound ramps and U.S. 101 northbound ramps | Commercial | 65.1 | 66.2 | 1.1 |
| Manila Avenue | Between Enterprise Way and Ellis Street | Commercial | 64.8 | 66.2 | 1.4 |
| Moffett Boulevard | Between Leong Drive and U.S. 101 southbound ramps | Residential | 67.0 | 68.0 | 1.0 |
| Moffett Boulevard | Between SR-85 northbound off-ramp and Leong Drive | Residential | 67.2 | 68.2 | 1.0 |
| Moffett Boulevard | Between SR-85 southbound on-ramp and SR-85 northbound off-ramp | Residential | 67.3 | 67.9 | 0.6 |
| Moffett Boulevard | Between U.S. 101 northbound ramps and R T Jones Road | Residential | 67.8 | 69.4 | 1.6 |
| Moffett Boulevard | Between U.S. 101 southbound ramps and U.S. 101 northbound ramps | Commercial | 67.3 | 68.7 | 1.4 |
| Moffett Park Drive | Between Innovation way and Enterprise Way | Commercial | 63.2 | 64.6 | 1.4 |
| Moffett Park Drive | Between Mathilda Avenue and Innovation Way | Commercial | 66.3 | 67.0 | 0.7 |
| **Wescoat Road** | **Between Clark Road and the Project Site** | **Residential** | **57.5** | **61.8** | **4.3** |

Refer to Appendix A for the complete traffic noise modeling results.
Note: Screening noise levels at a fixed distance of 50 feet from the roadway centerline.
**Bold** text denotes segments with a 3 dB or greater project-related increase in noise.

**Table 5-28. Detailed Traffic Noise Increase Evaluation for Roadway Segments Flagged in the Screening Analysis – CEQA Reduced Density Alternative**

| Roadway | Segment | Modeled Distance to Centerline (feet) | Measured Ambient Noise Level (dBA $L_{dn}$) | Project-Only Traffic Noise Level (dBA $L_{dn}$) | Composite Ambient-plus-Project Noise Level (dBA $L_{dn}$)[a] | Change Compared to Measured Ambient Noise (dB) | 3 dB or Greater Increase? |
|---|---|---|---|---|---|---|---|
| Clark Road | Between R T Jones Road and NASA ARC driveway | 200 | 63.4[b] | 53.7 | 63.8 | 0.4 | No |
| Wescoat Road | Between Clark Road and the Project Site | 100 | 63.7[c] | 56.8 | 64.5 | 0.8 | No |

Refer to Appendix A for the complete traffic noise modeling results.

[a.] Project-only ADT volumes (i.e., existing-plus-project minus existing volumes) for the segments where a potentially substantial increase was identified during modeling were used to calculate project-only traffic noise levels. Modeled project-only traffic noise levels were then combined with existing measured ambient noise levels to create a composite ambient-plus-project traffic condition.

[b.] The measured ambient noise level representative of this segment is LT-6 (63.4 dBA $L_{dn}$)

[c.] The measured ambient noise level representative of this segment is LT-1 (63.7 dBA $L_{dn}$)

**Parking Garage Noise**

Under the CEQA Reduced Density Alternative, two parking garages would be built and operated on the Project Site. These would be located within Building 6 (Subarea 4) and Building 11 (Subarea 6), the same locations where the parking garages would be constructed under the CEQA Proposed Project. Under the CEQA Reduced Density Alternative, there would be 2,063 total parking spaces (compared to the 3,419 parking spaces that would be developed under the CEQA Proposed Project). These spaces would be roughly evenly split between the two garages, according to the Project Proponent (i.e., 1,031/1,032 spaces). Although the number of vehicles that may use each garage during a peak hour is not currently known, reasonable worst-case noise levels from parking garage activity can be estimated by assuming full capacity of the garages (i.e., 1,031/1,032 vehicles per garage) during a single hour.

Without accounting for any shielding from the parking garage, parking garage activity noise from 1,032 cars operating simultaneously at a reference distance of 50 feet would be approximately 56.6 dBA $L_{eq}$. Modeled parking activity noise levels from each garage are estimated at the nearest noise-sensitive receptors using the acoustical average distance[33] between the garages and the nearest sensitive receptors. These results of this analysis are shown in Table 5-29.

**Table 5-29. Parking Garage Noise Modeling Results – CEQA Reduced Density Alternative**

| Receiving Land Use | Acoustical Average Distance (feet)[a] | Average Daytime Ambient Noise Level (dBA $L_{eq}$) | Modeled Noise Level at Receptor (dBA $L_{eq}$) | Delta dB |
|---|---|---|---|---|
| **Parking Garage in Building 6 (Subarea 4)** | | | | |
| Wescoat Village | 1,710 | 56.4[c] | 25.8 | -30.6 |
| **Parking Garage in Building 11 (Subarea 6)** | | | | |
| Wescoat Village | 345 | 56.4[c] | 39.7 | -16.7 |

a. The acoustical average distance was calculated by multiplying the shortest distance between the nearest receptor and the parking garage by the farthest distance, then taking the square root of the product.
b. Represented by measurement location LT-4.
c. Represented by measurement location LT-1.

The closest sensitive receptors to the parking garages would be the existing Wescoat Village residences. The acoustical average distance between Wescoat Village and the Building 6 (Subarea 4) parking garage is approximately 1,710 feet; the acoustical average distance between Wescoat Village and the Building 11 (Subarea 6) parking garage is approximately 345 feet. At those distances, modeled parking garage noise levels are 25.8 and 39.7 dBA $L_{eq}$, respectively, based on the modeling assumptions described previously. Actual noise levels at Wescoat Village from the Building 6 (Subarea 4) parking garage may be even lower due to shielding from future on-site project structures. Even without accounting for that attenuation, estimated noise levels from the garages in Building 6 (Subarea 4) and Building 11 (Subarea 6) would be approximately 31 dB and 17 dB lower than the existing average daytime ambient noise level at Wescoat Village, respectively. The increase in combined noise levels would be negligible (0.1 dB or less).

33 The acoustical average distance was calculated by multiplying the shortest distance between the nearest receiver and the parking garage by the farthest distance, then taking the square root of the product.

***CEQA***

As shown in Table 5-29, modeled parking garage noise levels under the CEQA Reduced Density Alternative are 17 to 31 dB lower than the existing average daytime noise levels at nearby noise-sensitive receptors (i.e., the Wescoat Village residences). The resulting overall increases in ambient noise levels would be negligible (0.1 dB or less).

***NEPA***

As described for the CEQA evaluation, modeled parking garage noise levels under NEPA Build Alternative 2 are 17 to 31 dB lower than the existing average daytime noise levels at nearby noise-sensitive receptors (i.e., the Wescoat Village residences). The resulting overall increase in ambient noise levels would be negligible (0.1 dB or less).

#### Amplified Music or Speech at Events

Potential effects related to amplified music or speech would be the same under the CEQA Reduced Density Alternative as described for the CEQA Proposed Project. Therefore, the same analysis would apply and the same results would occur. Refer to amplified music or speech analysis for the CEQA Proposed Project, presented previously, for details.

***CEQA***

Noise levels from sound-amplifying equipment at project-related programming or events for the CEQA Reduced Density Alternative would be below the existing average daytime noise levels at the nearest noise-sensitive receptors and would not substantially increase existing ambient noise levels. In addition, events, including outdoor events with amplified sound at the project’s Central Green, would be infrequent (approximately 12 per year).

***NEPA***

Noise levels from sound-amplifying equipment at project-related programming or events for the NEPA Build Alternative 2 would be below the existing average daytime noise levels at the nearest noise-sensitive receptors and would not substantially increase existing ambient noise levels. In addition, events, including outdoor events with amplified sound at the project’s Central Green, would be infrequent (approximately 12 per year).

### Construction Vibration

#### Vibration-Induced Damage

Potential effects related to vibration-induced damage would be the same for the CEQA Reduced Density Alternative as presented for the CEQA Proposed Project because the equipment proposed for use and the general footprint of construction would be the same. Therefore, as was the case for the CEQA Proposed Project, estimated vibration levels from the use of a vibratory roller for in-street utility work within 22 feet of vibration-sensitive structures would be expected to exceed the applicable Caltrans damage criterion for such buildings (i.e., a PPV of 0.25 in/sec) under the CEQA Reduced Density Alternative.

***CEQA***

Vibration from construction of the CEQA Reduced Density Alternative could exceed the applied vibration-related damage criterion at nearby vibration-sensitive structures (i.e., a PPV of 0.25 in/sec). Implementation of Mitigation Measure NOI-5 would avoid or reduce and repair vibration-related damage effects.

***NEPA***

Vibration from construction of NEPA Build Alternative 2 could exceed the applied vibration-related damage criterion at nearby vibration-sensitive structures ( i.e., a PPV of 0.25 in/sec). Implementation of Mitigation Measure NOI-5 would avoid or reduce and repair vibration-related damage effects.

**Vibration-Related Annoyance**

Vibration-related annoyance effects would be the same for the CEQA Reduced Density Alternative as presented previously for the CEQA Proposed Project. Nighttime on-site concrete pours and off-site in-street utility work would both be expected to result in vibration levels below the "strongly perceptible" annoyance threshold at nearby residential land uses.

***CEQA***

Estimated vibration levels from on-site and in-street utility work during nighttime hours would not exceed the applicable "strongly perceptible" criterion at the nearest occupied residential land uses during nighttime hours under CEQA Reduced Density Alternative. In addition, nighttime construction activities in a given area would be short term.

***NEPA***

Estimated vibration levels from on-site and in-street utility work during nighttime hours would not exceedsthe applicable "strongly perceptible" criterion at the nearest occupied residential land uses during nighttime hours under NEPA Build Alternative 2. In addition, nighttime construction activities in a given area would be short term.

**Vibration-Sensitive Equipment**

Potential effects from project construction to nearby vibration-sensitive equipment would be the same under the CEQA Reduced Density Alternative as described for the CEQA Proposed Project.

***CEQA***

Vibration generated by project construction equipment may exceed applied thresholds for nearby sensitive research equipment and may disrupt the use of such equipment during project construction. Mitigation Measure NOI-6 has been identified to reduce impacts on vibration-sensitive equipment. Even with implementation of all feasible mitigation, it may not be possible to fully reduce interference effects on nearby vibration-sensitive laboratory or research equipment.

***NEPA***

As described in the discussion of CEQA-related vibration effects above, vibration generated by project construction equipment may exceed applied thresholds for nearby sensitive research equipment and may disrupt the use of such equipment during project construction. Mitigation

Measure NOI-6 has been identified to reduce impacts on vibration-sensitive equipment. Even with implementation of all feasible mitigation, it may not be possible to fully reduce interference effects on nearby vibration-sensitive laboratory or research equipment.

**<u>Aircraft Noise</u>**

The aircraft noise analysis and findings for the CEQA Reduced Density Alternative are the same as described for the CEQA Proposed Project because the project footprint would be the same, and the exterior noise levels from aircraft at the Project Site would be the same.

***CEQA***

The project land uses potentially located along the edge of the 65 dBA CNEL contour (i.e., office and business uses) under the CEQA Reduced Density Alternative would be considered conditionally compatible with that noise level. In addition, interior noise levels would be expected to be below the maximum acceptable level for such uses. The proposed Student/Faculty Housing and Short-Term Lodging uses would also be exposed to aircraft noise; however, compliance with Title 24 of the California Code of Regulations would ensure that interior noise levels at these uses would be adequately controlled.

***NEPA***

The project land uses potentially located along the edge of the 65 dBA CNEL contour (i.e., office and business uses) under NEPA Build Alternative 2 would be considered conditionally compatible with that noise level. In addition, interior noise levels would be expected to be below the maximum acceptable level for such uses. The proposed Student/Faculty Housing and Short-Term Lodging uses would also be exposed to aircraft noise; however, compliance with Title 24 of the California Code of Regulations would ensure that interior noise levels at these uses would be adequately controlled.

### 5.3.6.2 Cumulative Impacts

**<u>Construction Noise</u>**

Daytime and nighttime construction activities for the CEQA Reduced Density Alternative (NEPA Build Alternative 2) would generally be the same as described for the CEQA Proposed Project because it would include roughly the same demolition and construction activities, footprint of construction, construction equipment, and construction hours. As described for the CEQA Proposed Project (NEPA Build Alternative 1), construction of the cumulative projects is already complete; consequently, cumulative project construction would not occur concurently with project construction activities (beginning in 2027). Cconstruction noise from cumulative proejcts would therefore not be expected to combine with construction noise from the proposed project and expose nearby sensitive receptors to greater overall construction noise levels. However, because project construction noise levels for both daytime and nighttime hours were modeled to exceed applicable thresholds, cumulative construction noise impacts would conservatively be considered substantial. Although Mitigation Measures NOI-1 and NOI-2 would be expected to somewhat reduce project construction noise, it may not be possible to reduce all construction noise to a level below the significance thresholds used in this assessment, even with implementation of all feasible mitigation measures. Therefore, cumulative construction noise effects during daytime and nighttime hours are considered to be substantial, even with implementation of project-specific mitigation.

## Operational Noise

### *Mechanical Equipment*

Operational mechanical equipment for the CEQA Reduced Density Alternative (NEPA Build Alternative 2) would generally be the same as described for the CEQA Proposed Project. As described previously, most operational sources of noise do not generate noise that is perceptible far beyond the edge of a project site. Although project mechanical equipment noise would be localized and associated noise would attenuate rapidly with distance, it is possible that equipment could generate noise in excess of allowable levels at nearby sensitive uses before mitigation is applied, as described previously.

There are no cumulative projects between the nearest noise-sensitive receptors (i.e., the Wescoat Village residences) and the proposed project or within a similar distance. The nearest cumulative project to Wescoat Village is at USGS Building 800, which is more than 1,000 feet from the nearest Wescoat Village residence (with the nearest project building being an estimated 100 feet from the Project Site). However, construction of that project is already completed, and the building is currently operational. Because of the distance between USGS Building 800 and the Wescoat Village residences (i.e., more than 1,000 feet), and because project buildings would be expected to block the line of sight between USGS Building 800 and the Wescoat Village residences once construction is complete, noise-generating uses (e.g., mechanical equipment) at USGS Building 800 would not be expected to combine with noise from project mechanical equipment. However, because project-specific mechanical equipment effects were determined to be potentially substantial, cumulative impacts related to operational equipment noise levels would conservatively be considered substantial. Project Mitigation Measure NOI-3 has been identified to reduce noise levels from project mechanical equipment. With implementation of this mitigation measure, mechanical equipment noise levels would be reduced to below applicable significance thresholds. Therefore, cumulative effects related to mechanical equipment noise would not be considered substantial with implementation of project mitigation.

### *Emergency Generator Testing*

As described under the cumulative analysis for the CEQA Proposed Project (NEPA Build Alternative 1), it is very unlikely that the testing of an emergency generator for the proposed project would occur concurrently with the testing of a generator at a nearby project. Even if testing were to occur simultaneously, which is unlikely, it is not likely that the generators would be close enough to one another for the noise to combine at a given individual receptor. However, because noise from emergency generator testing was determined to potentially exceed applicable standards, cumulative impacts related to noise from emergency generator testing would conservatively be considered substantial. Project Mitigation Measure NOI-4 has been identified to reduce noise levels and ensure that applicable noise exposure limits would not be exceeded during project emergency generator testing. With implementation of this mitigation measure, emergency generator noise would be reduced to levels below applicable significance thresholds. Therefore, cumulative effects related to emergency generator noise would not be considered substantial with implementation of project mitigation.

### *Loading Noise*

As described under the cumulative analysis for the CEQA Proposed Project (NEPA Build Alternative 1), loading activity noise is generally intermittent, and noise levels are often abated by intervening buildings. Even if loading activities for nearby cumulative projects were to occur simultaneously, which is unlikely, it is not likely that the loading docks or zones would be close enough to one another for the noise to combine at a given individual receptor. Cumulative noise impacts related to loading dock activity would not be considered substantial.

#### *Traffic Noise*

Cumulative traffic noise effects would be similar to those described for the CEQA Proposed Project (NEPA Build Alternative 1). According to the screening traffic noise analysis results for the CEQA Reduced Density Alternative (contained in Table 5-30), six roadway segments were flagged in the screening analysis as having a potential 3 dB or greater increase in traffic noise along segments with sensitive land uses when comparing existing and cumulative-plus-project conditions. Three of these segments were also flagged as having the potential to experience a greater than 1 dB increase in noise as a result of project implementation (i.e., when comparing cumulative-no-project conditions to cumulative-plus-project conditions). Modeling results from the screening analysis are included in Table 5-30.

A detailed assessment (as described previously), with consideration given to existing measured noise levels and the actual distances between the roadway centerline and the nearest sensitive use, was conducted for the three segments where both a 3 dB increase from existing and cumulative-plus-project conditions and a 1 dB increase from project implementation were identified. The results of the detailed traffic noise modeling assessment for the CEQA Reduced Density Alternative are included in Table 5-31.

According to the detailed traffic noise assessment for the CEQA Reduced Density Alternative, no evaluated segments would have a 3 dB increase over existing measured noise levels. Although no substantial cumulative traffic noise increases were identified, note that the CEQA Reduced Density Alternative's contribution to the increases is still presented in Table 5-31 for informational purposes. As shown in the table, the project would not result in a 1 dB or greater increase in cumulative-with-project noise levels along any evaluated segment. Cumulative traffic noise impacts under the CEQA Reduced Density Alternative would not be considered substantial.

#### *Parking Garage Noise*

Cumulative parking activity noise effects would be the same as described for the CEQA Proposed Project (NEPA Build Alternative 1). Cumulative noise effects related to parking garage activity would not be considered substantial.

#### *Amplified Music or Speech at Events*

Noise effects from amplified music or speech noise at events would be the same as described for the CEQA Proposed Project (NEPA Build Alternative 1). Cumulative noise effects associated with amplified sound from infrequent events would not be considered substantial.

### Construction Vibration

Daytime and nighttime construction activities for the CEQA Reduced Density Alternative generally be the same as described for the CEQA Proposed Project (NEPA Build Alternative 1) because this option would involve the same demolition and construction activity, footprint of construction, construction equipment, and construction hours.

Because construction of nearby cumulative projects is complete, vibration from multiple pieces of equipment would not be expected to combine and raise the overall peak vibration level experienced at a nearby sensitive use. Consequently, overall vibration levels at nearby structures/receptors would be governed by the nearest and closest ground-disturbing equipment associated with a project. Because project impacts related to annoyance were not considered substantial, cumulative vibration-related annoyance impacts would similarly not considered substantial. However, project-specific vibration effects on vibration-sensitive structures were determined to be potentially substantial. As a result, cumulative vibration-related damage effects would conservatively be considered substantial. Implementation of project Mitigation Measure NOI-5 would avoid or reduce and repair vibration-related damage effects. Therefore, cumulative vibration-related damage effects would not be considered substantial with implementation of project mitigation.

Because the list of cumulative projects does not include construction projects in proximity to the nearby USGS Building 800 (where construction of all nearby cumulative projects is already complete), vibration from project construction would not be expected to combine with vibration from the construction of cumulative projects and result in greater levels of interference with nearby vibration-sensitive research equipment. However, because project-specific effects related to interference with vibration-sensitive research equipment were considered substantial, cumulative effects related to interference with vibration-sensitive research equipment would conservatively be considered substantial. Project-specific Mitigation Measure NOI-6 has been identified to reduce impacts on vibration-sensitive equipment. Even with implementation of all feasible mitigation, it may not be possible to fully reduce interference effects on nearby vibration-sensitive laboratory or research equipment. Cumulative vibration effects related to interference with vibration-sensitive equipment would be conservatively considered substantial, even with implementation of mitigation.

### Aircraft Noise

Noise effects related to aircraft noise would be the same as described for the CEQA Proposed Project (NEPA Build Alternative 1). Consequently, development of the project in conjunction with nearby cumulative projects would not result in a significant cumulative effect related to the exposure of persons residing or working in the project area to excessive aircraft noise levels. There would be no cumulative effects related to aircraft noise.

**Table 5-30. Screening Traffic Noise Levels for Segments for Build Alternative 2 – Cumulative Assessments**

| Roadway | Segment | Most Sensitive Land Use Type along Segment | Traffic Noise Level (dBA $L_{dn}$) | | | Change in Sound Level from Existing to Cumulative plus Project (dB) | Change in Sound Level from Cumulative No Project to Cumulative plus Project (dB) | Potential Significant Cumulative Increase?[b] | Potential Cumulatively Considerable Contribution?[c] |
|---|---|---|---|---|---|---|---|---|---|
| | | | Existing | Cumulative No Project | Cumulative plus Project | | | | |
| **Clark Road** | **Between R T Jones Road and NASA Ames driveway** | **School & Residential** | **57.5** | **62.4** | **65.0** | **7.5** | **2.6** | **Yes** | **Yes** |
| Ellis Street | Between Manila Avenue and NASA Ames driveway | Commercial | 55.4 | 61.5 | 64.3 | 8.9 | 2.8 | No | N/A |
| Ellis Street | Between Middlefield Road and driveway north of Middlefield Road | Commercial | 63.2 | 67.9 | 68.2 | 5.0 | 0.3 | No | N/A |
| Ellis Street | Between National Avenue and Fairchild Drive | Commercial | 63.9 | 67.6 | 67.9 | 4.0 | 0.3 | No | N/A |
| Ellis Street | Between U.S. 101 northbound ramps and Manila Avenue | Commercial | 64.4 | 67.6 | 69.1 | 4.7 | 1.5 | No | N/A |
| Ellis Street | Between U.S. 101 southbound ramps and U.S. 101 northbound ramps | Commercial | 65.1 | 68.3 | 69.1 | 4.0 | 0.8 | No | N/A |
| Manila Avenue | Between Enterprise Way and Ellis Street | Commercial | 63.4 | 66.3 | 67.4 | 4.0 | 1.1 | Yes | N/A |
| Moffett Boulevard | Between Leong Drive and U.S. 101 southbound ramps | Residential | 67.0 | 70.3 | 71.0 | 4.0 | 0.7 | Yes | No |
| Moffett Boulevard | Between SR-85 northbound off-ramp and Leong Drive | Residential | 67.2 | 70.4 | 71.1 | 3.9 | 0.7 | Yes | No |
| Moffett Boulevard | Between SR-85 southbound on-ramp and SR-85 northbound off-ramp | Residential | 67.3 | 70.3 | 70.7 | 3.4 | 0.4 | Yes | No |
| **Moffett Boulevard** | **Between U.S. 101 northbound ramps and R T Jones Road** | **Residential** | **67.8** | **70.0** | **71.5** | **3.7** | **1.5** | **Yes** | **Yes** |
| Moffett Boulevard | Between U.S. 101 southbound ramps and U.S. 101 northbound ramps | Commercial | 67.3 | 70.4 | 71.5 | 4.2 | 1.1 | No | N/A |
| Moffett Park Drive | Between Innovation Way and Enterprise Way | Commercial | 63.2 | 65.8 | 67.0 | 3.8 | 1.2 | No | N/A |
| Moffett Park Drive | Between Mathilda Avenue and Innovation Way | Commercial | 66.3 | 68.2 | 68.9 | 2.6 | 0.7 | No | N/A |
| **Wescoat Road[a]** | **Between Clark Road and the Project Site** | **Residential** | **57.5** | **62.4** | **65.0** | **7.5** | **2.6** | **Yes** | **Yes** |

Refer to Appendix A for the complete traffic noise modeling results.

Note: Screening noise levels at a fixed distance of 50 feet from the roadway centerline.

Underlined text denotes segments with a 3 dB or greater potential significant increase in noise along roadways with sensitive land uses from existing to cumulative-plus-project conditions.

**Bold** text denotes segments with a 3 dB or greater potential significant increase in noise and a 1 dB or more potentially cumulatively considerable contribution.

a. Traffic counts and estimated ADT volumes for roadway segments within the campus (beyond the NASA AMES guard stations) were not available/not provided by the project traffic consultant. To evaluate potential traffic noise effects on existing residential land uses within the campus, it was conservatively assumed that all vehicles that enter at the Clark Road guard station would continue on Clark Road and turn right onto Wescoat Road to access the Project Site.

b. A potential cumulative impact would occur under this screening analysis if the modeled noise increase is greater than 3 dB and land uses along the roadway segment are sensitive to noise (e.g., Residential)

c. No = Project does not result in cumulatively considerable contribution because the land use type along the segment is not a sensitive use. N/A = A cumulatively considerable contribution is not applicable because a significant cumulative impact due to noise level increase would not occur along the roadway segment.

### Table 5-31. Cumulative Traffic Noise Evaluation for Potentially Affected Segments, CEQA Reduced Density Alternative – Detailed Assessment

| Roadway | Segment Location | Modeled Distance to Centerline (feet) | Representative Measurement Location | Measured Ambient Noise Level, Existing (dBA $L_{dn}$) | Ambient with Cumulative-No-Project Traffic Noise Levels (dBA $L_{dn}$) | Ambient with Cumulative-plus-Project Traffic Noise Levels (dBA $L_{dn}$) | Change in Sound Level (dBA $L_{dn}$) from Existing to Ambient with Cumulative plus Project | Significant Cumulative Increase?[a] | Change in Sound Level (dBA $L_{dn}$) between Cumulative Scenarios[b] | Cumulatively Considerable Project Contribution?[b] |
|---|---|---|---|---|---|---|---|---|---|---|
| Clark Road | Between R T Jones Road and NASA Ames driveway | 200 | LT-6 | 63.4 | 63.9 | 64.3 | 0.9 | No | 0.4 | N/A |
| Moffett Boulevard | Between U.S. 101 northbound ramps and R T Jones Road | 400 | LT-6 | 63.4 | 64.2 | 64.6 | 1.2 | No | 0.4 | N/A |
| Wescoat Road | Between Clark Road and Project Site | 100 | LT-1 | 63.7 | 64.7 | 65.3 | 1.6 | No | 0.6 | N/A |

a. A detailed assessment was conducted to determine if the potential cumulative traffic noise increases identified in the screening analysis are actual cumulative traffic noise increases, with consideration given to existing measured noise levels and the actual distances between the roadway centerline and the nearest sensitive use.

b. Although no significant cumulative increases were determined to occur in the detailed assessment, the project contribution to the cumulative increase is still presented here for informational purposes. "N/A" is used to emphasize that the project-related increase is presented for informational purposes only.

# 5.3.7 CEQA Reduced Density Alternative (NEPA Build Alternative 2) with Variant

The Variant/Sub-Alternative would include research and office uses instead of student/faculty housing in Subarea 6, Building 12, as under the CEQA Reduced Density Alternative. The Variant would not change the basic characteristics of the CEQA Reduced Density Alternative. The Variant would occur in the same footprint as the CEQA Reduced Density Alternative.

## 5.3.7.1 Project-Level Impacts

### Construction Noise

**Daytime Construction**

As was the case for the CEQA Reduced Density Alternative, the CEQA Reduced Density Alternative with the Variant would provide less space for Research and Office uses than the CEQA Proposed Project, but the overall footprint of construction, as well as the types of equipment proposed for construction, would be the same. Construction of CEQA Reduced Density Alternative with the Variant would therefore include the same demolition, ground disturbance and excavation, schedule and phasing, construction equipment, and construction hours as the CEQA Proposed Project. For the reasons described above, the potential effects related to daytime construction noise would be the same as described for the CEQA Proposed Project. Refer to the daytime construction noise analysis for the CEQA Proposed Project, presented previously, for an in-depth analysis of worst-case daytime construction noise.

***CEQA***

Worst-case daytime construction noise levels from the CEQA Reduced Density Alternative with the Variant may exceed the applicable criterion for daytime construction noise in the county. A 10 dB increase (or greater) over the existing ambient noise level would be expected to occur at the nearest noise-sensitive receptors. Mitigation Measures NOI-1 and NOI-2, presented previously, have been identified to reduce construction noise levels. However, it may not be possible to reduce all daytime construction noise levels to a level below the significance thresholds, even with implementation of all feasible mitigation measures. Therefore, noise levels from daytime construction are expected to exceed applicable daytime construction noise limits, even with implementation of mitigation.

***NEPA***

Worst-case daytime construction noise levels from off-site construction activities under NEPA Build Alternative 2 with the Sub-Alternative would be expected to exceed the applicable FTA thresholds at one nearby industrial land use. Mitigation Measures NOI-1 and NOI-2, presented previously, have been identified to reduce construction noise levels. However, it may not be possible to reduce all daytime construction noise levels to a level below the significance thresholds, even with implementation of all feasible mitigation measures. For example, locating equipment as far as possible from noise-sensitive receptors and providing mufflers and sound control devices would reduce noise; however, this may not be enough to reduce noise to levels below the significance criteria when in-street work occurs close to a given receptor. In addition, quieter alternative equipment types are generally not available to substitue for the equipment required for this in-street work (i.e., a grader and a concrete saw). Further, the worst-case distance between off-site/in-street construction and the nearest industrial use, Hangar One, is only 15 feet. Because the construction activity itself is required to take place approximately 15 feet from the adjacent industrial use, increasing the separation distance between construction equipment and this nearby receptor is not possible for this construction activity. Finally, Mitigation Measure NOI-2 would not be expected to reduce noise from off-site/in-street work because such work would generally not take place behind the temporary noise barriers described in this measure. For these reasons, noise levels from daytime construction are expected to exceed the applicable daytime construction noise limit at one nearby industrial land use, even with implementation of mitigation.

## Nighttime Construction

Potential effects related to nighttime construction noise for the CEQA Reduced Density Alternative with the Variant would be the same as the effects described for the CEQA Proposed Project. Therefore, the nighttime construction noise analysis presented previously for the CEQA Proposed Project would apply to this Variant. Refer to the nighttime construction noise analysis for the CEQA Proposed Project, presented previously, for an in-depth analysis of worst-case nighttime construction noise.

### *CEQA*

Nighttime construction noise levels from the CEQA Reduced Density Alternative with the Variant would be the same as for the CEQA Proposed Project. Nighttime construction noise exceed the applicable County criterion of 55 dBA $L_{eq}$ for multi-family residential land uses, and a 10 dB increase (or greater) over the existing ambient noise level would be expected to occur at the nearest noise-sensitive receptors. Mitigation Measures NOI-1 and NOI-2 have been identified to reduce construction noise levels. However, it may not be possible to reduce all nighttime construction noise levels to a level below the significance thresholds, even with implementation of all feasible mitigation measures. In addition, Mitigation Measure NOI-2 would not be expected to reduce noise from nighttime off-site/in-street work because such work would generally not take place behind the temporary noise barriers described under this measure. For these reasons, noise levels from nighttime construction are expected to exceed applicable construction noise limits, even with implementation of mitigation.

### *NEPA*

Nighttime construction noise levels from NEPA Build Alternative 2 with the Sub-Alternative may exceed the FTA criteria for nighttime construction. Mitigation Measures NOI-1 and NOI-2, described previously, have been identified to reduce nighttime construction noise levels. However, it may not be possible to reduce all nighttime construction noise levels to a level below the significance thresholds, even with implementation of all feasible mitigation measures. In addition, Mitigation Measure NOI-2 would not be expected to reduce noise from nighttime off-site/in-street work because such work would generally not take place behind the temporary noise barriers described under this measure. For these reasons, noise levels from nighttime construction are expected to exceed applicable construction noise limits, even with implementation of mitigation.

## Haul Truck and Heavy Truck Noise

The haul truck route and the worst-case number of haul trucks and heavy trucks per day along the route would be the same under the CEQA Reduced Density Alternative with the Variant as discussed under the CEQA Proposed Project. The existing noise levels along haul routes would also be the same. Therefore, the heavy truck noise analysis presented for the CEQA Proposed Project would also apply to the CEQA Reduced Density Alternative with the Variant, and the same results would occur. Refer to the haul truck and heavy truck noise analysis for the CEQA Proposed Project, presented previously, for details.

***CEQA***

The CEQA Reduced Density Alternative with the Variant would result in traffic noise increases in the range of 0.5 to 2.7 dB along the project haul routes due to construction truck activity. During most subphases of construction, there would be fewer daily haul truck or heavy truck trips and the traffic noise increases would be even smaller. Note that there are also no noise-sensitive receptors along the roadway segments that comprise the haul route north of U.S. 101. In conclusion, the maximum modeled noise increase resulting from construction truck would be less than the 3 dB increase threshold established for the project, and haul truck activity would not be expected to expose noise-sensitive receptors to excessive noise.

***NEPA***

NEPA Build Alternative 2 with the Sub-Alternative would result in traffic noise increases in the range of 0.5 to 2.7 dB along project haul routes. During most subphases of construction, there would be fewer daily haul truck or heavy truck trips and the traffic noise increases would be even smaller. Note that there are also no noise-sensitive receptors along the roadway segments that comprise the haul route north of U.S.-101. In conclusion, the maximum modeled noise increase resulting from construction truck would be less than the 3 dB increase threshold established for the project, and haul truck activity would not be expected to expose noise-sensitive receptors to excessive noise.

## Operational Noise

### Mechanical Equipment

*Heating, Cooling, and Ventilation Equipment*

Project heating, cooling, and ventilation equipment under the CEQA Reduced Density Alternative with the Variant would be similar to equipment proposed for the CEQA Proposed Project with the Variant, noting that the overall developed square footage would be reduced under the CEQA Reduced Density Alternative compared to the CEQA Proposed Project. This reduction in development could result in slightly fewer individual pieces of heating and cooling equipment needing to be installed per building under this alternative. However, specific details related to a potential reduction in equipment are not currently known. In addition, the analysis of mechanical equipment noise under the CEQA Reduced Density Alternative was based on example equipment, using reasonable assumptions of the types of equipment proposed for each project building. Therefore, even if there is a slight reduction in the number of pieces of equipment required under this alternative, the previously presented analysis of operational mechanical equipment under the CEQA Proposed Project with the Variant would conservatively apply to the CEQA Reduced Density Alternative with the Variant and the same results would apply. Refer to the heating, cooling, and ventilation equipment analysis for the CEQA Proposed Project with the Variant, presented previously, for details.

*Sewer Lift Station*

The same sewer lift station would be installed under the CEQA Reduced Density Alternative with the Variant as under the CEQA Proposed Project. Therefore, the same analysis would apply and the same results would occur. Refer to the sewer lift station analysis for the CEQA Proposed Project, presented previously, for details.

*BESS Equipment*

The same BESS units would be installed under the CEQA Reduced Density Alternative with the Variant as under the CEQA Proposed Project. Therefore, the same analysis would apply and the same results would occur. Refer to the BESS equipment analysis for the CEQA Proposed Project, presented previously, for details.

***CEQA***

Noise levels from mechanical equipment, including mechanical heating, cooling, and ventilation equipment and the sewer lift station and BESS equipment, would have the potential to exceed the applicable noise standards at the nearest noise-sensitive receptors under the CEQA Reduced Density Alternative with the Variant. In addition, the analysis provided above is based on reasonable assumptions about the equipment noise levels; the final noise levels would be subject to change, pending final equipment selections and locations. Therefore, the potential exists for actual noise levels to be higher or lower than those presented in this analysis. Accordingly, noise levels from project mechanical equipment, including heating and cooling equipment, sewer lift station equipment, and BESS equipment, may exceed applicable noise limits. Mitigation Measure NOI-3 has been identified to reduce noise levels from mechanical equipment. With implementation of this mitigation measure, mechanical equipment noise levels would be reduced to below applicable significance thresholds.

***NEPA***

As described for the CEQA evaluation, noise from project-related mechanical equipment would have the potential to exceed the applicable noise standards at Wescoat Village under NEPA Build Alternative 2 with the Sub-Alternative. In addition, the analysis provided above is based on reasonable assumptions about the equipment noise levels; the final noise levels would be subject to change, pending final equipment selections and locations. Therefore, the potential exists for actual noise levels to be higher or lower than those presented in this analysis. Accordingly, noise levels from project mechanical equipment, including heating and cooling equipment, sewer lift station equipment, and BESS equipment, may exceed applicable noise limits. Mitigation Measure NOI-3 has been identified to reduce noise levels from mechanical equipment. With implementation of this mitigation measure, mechanical equipment noise levels would be reduced to below applicable significance thresholds.

**Emergency Generator Noise**

Under the CEQA Reduced Density Alternative with the Variant, thirteen 500 kW emergency generators would be installed at the Project Site compared to the 12 proposed under the CEQA Proposed Project. Specifically, one additional generator would be installed in Subarea 6 of the proposed Project Site, at Building 12, under this Variant because this building would be developed with an office, R&D, and academic building in lieu of a student/faculty housing building. The closest generators to the neighboring existing noise-sensitive receptors would be the same as for the CEQA Proposed Project with the Variant. Therefore, the same analysis and results also apply to the CEQA Reduced Density Alternative with the Variant. The resulting emergency generator noise levels would be approximately 86 dBA $L_{eq}$ at the existing Wescoat Village. Refer to the emergency generator noise analysis for the CEQA Proposed Project with the Variant, presented previously, for details.

***CEQA***

Emergency generator testing under the CEQA Reduced Density Alternative with the Variant was modeled to exceed the daytime noise exposure limit of 55 dBA $L_{eq}$ at Wescoat Village by approximately 31 dB. Generator testing would be temporary (lasting 2 to 4 hours) and intermittent (occurring once per month). Nonetheless, estimated noise levels would exceed the applicable noise standards at the nearest noise-sensitive receptors. Mitigation Measure NOI-4, presented previously, has been identified to reduce noise levels and ensure that applicable noise exposure limits would not be exceeded during generator testing.

***NEPA***

Emergency generator testing under NEPA Build Alternative 2 with the Sub-Alternative was modeled to exceed the daytime noise exposure limit of 55 dBA $L_{eq}$ at Wescoat Village by approximately 31 dB. Generator testing would be temporary (lasting 2 to 4 hours) and intermittent (occurring once per month). Nonetheless, estimated noise levels would exceed the applicable noise standards at the nearest noise-sensitive receptors. Mitigation Measure NOI-4, presented previously, has been identified to reduce noise levels and ensure that applicable noise exposure limits would not be exceeded during generator testing.

**Loading Noise**

Under the CEQA Reduced Density Alternative, usage at each project loading dock or loading zone would be similar to the usage under the CEQA Proposed Project, except that total deliveries across the Project Site would be reduced by almost one third (217 per day instead of 302). With this decrease, the analysis and findings for the CEQA Proposed Project, which concluded loading activities associated with the project would not be expected to result in substantial increases in noise in the project area, can conservatively be applied to the CEQA Reduced Density Alternative. Refer to the loading noise analysis for the CEQA Proposed Project, presented previously, for details.

***CEQA***

The Project Site is in an urban area with elevated existing noise levels. A large portion of project deliveries would take place inside project buildings, most likely resulting in negligible noise levels at the nearest noise-sensitive receptors. Delivery and loading activities would be temporary, intermittent, and primarily during daytime hours. Loading activities for the CEQA Reduced Density Alternative with the Variant would not be expected to result in substantial increases in noise in the project area.

***NEPA***

The Project Site is in an urban area with elevated existing noise levels. A large portion of project deliveries would take place inside project buildings, most likely resulting in negligible noise levels at the nearest noise-sensitive receptors. Delivery and loading activities would be temporary, intermittent, and primarily during daytime hours. Loading activities for NEPA Build Alternative 2 with the Sub-Alternative would not be expected to result in substantial increases in noise in the project area.

**Traffic Noise**

Potential effects related to traffic noise under the CEQA Reduced Density Alternative with the Variant would be similar to those described for the CEQA Reduced Density Alternative, with a slight increase in overall traffic volumes under this Variant due to an expected slight increase in the need for students and faculty to commute to the site if no on-site housing is developed. ADT volumes under the CEQA Reduced Density Alternative with the Variant were provided for existing, existing-plus-project, cumulative, and cumulative-plus-project scenarios. The cumulative traffic noise increases are evaluated separately below in Section 5.3.5.2, *Cumulative Assessment*. As was the case for the CEQA Proposed Project, an initial screening evaluation of direct traffic noise increases from the project was conducted by comparing predicted traffic noise for the existing and the existing-plus-project traffic scenarios. If a potential for a 3 dB increase was predicted to occur along segments with sensitive uses (e.g., residential or school land uses), the increase was flagged in the screening analysis and a more detailed assessment was then conducted. Table 5-32 includes a summary of the quantitative traffic noise modeling results for existing and existing-plus-project conditions on all evaluated roadway segments for the CEQA Reduced Density Alternative with the Variant.

Two roadway segments were flagged in the initial screening analysis as having a potential 3 dB or greater increase in traffic noise as a result of project implementation. A detailed traffic noise assessment, as described in the traffic noise analysis for the CEQA Proposed Project, was then conducted for the CEQA Reduced Density Alternative with the Variant. Refer to Table 5-33 for a comparison of the existing (measured ambient) and existing-plus-project (composite ambient-plus-project) noise levels along roadway segments where the screening analysis identified potential substantial increases.

As shown in Table 5-33, the detailed traffic noise evaluation for the CEQA Reduced Density Alternative, which includes a comparison of measured ambient noise levels and composite ambient-plus-project traffic noise levels along these two roadway segments, demonstrates that project-related traffic noise would increase existing ambient noise levels by up to a maximum of 0.8 dB under this Variant. This increase is below the 3 dB (or greater) increase threshold for traffic noise.

***CEQA***

Based on the detailed traffic noise evaluation, which includes a comparison of measured ambient noise levels and composite ambient-plus-project traffic noise levels for the CEQA Reduced Density Alternative with the Variant, project-related traffic noise increases would be up to 0.8 dB. This increase is below the 3 dB (or greater) increase threshold for traffic noise.

***NEPA***

As described for the CEQA evaluation, project-related traffic noise associated with NEPA Build Alternative 2 with the Sub-Alternative would increase existing ambient noise levels by up to a maximum of 0.8 dB along the evaluated roadway segments. This increase is below the 3 dB (or greater) increase threshold for transportation noise sources.

**Parking Garage Noise**

Parking garage spaces and assumed usage for the CEQA Reduced Density Alternative with the Variant would be the same as what was used for the analysis of the CEQA Reduced Density Alternative. Consequently, the same analysis and results would apply. Modeled parking garage noise levels are 17 to 31 dB lower than the existing (measured) average daytime noise levels at nearby noise-sensitive receptors (i.e., the Wescoat Village residences). Refer to the parking garage analysis for the CEQA Reduced Density Alternative, presented previously, for details.

## Table 5-32. Traffic Noise Screening Analysis for the CEQA Reduced Density Alternative with the Variant (50-Foot Reference Distance)

| Roadway | Segment | Most Sensitive Land Use Type along Segment | Traffic Noise Level ($dBA\ L_{dn}$) Existing | Traffic Noise Level ($dBA\ L_{dn}$) Existing plus Project (CEQA Proposed Project) | Noise Increase Due to Project dB |
|---|---|---|---|---|---|
| **Clark Road** | **Between R T Jones Road and NASA ARC driveway** | **School & Residential** | **57.5** | **61.9** | **4.4** |
| Ellis Street | Between Manila Avenue and NASA ARC driveway | Commercial | 55.4 | 60.9 | 5.5 |
| Ellis Street | Between Middlefield Road and driveway north of Middlefield Road | Commercial | 63.2 | 63.9 | 0.7 |
| Ellis Street | Between National Avenue and Fairchild Drive | Commercial | 63.9 | 64.5 | 0.6 |
| Ellis Street | Between U.S. 101 northbound ramps and Manila Avenue | Commercial | 64.4 | 66.5 | 2.1 |
| Ellis Street | Between U.S. 101 southbound ramps and U.S. 101 northbound ramps | Commercial | 65.1 | 66.2 | 1.1 |
| Manila Avenue | Between Enterprise Way and Ellis Street | Commercial | 64.8 | 64.8 | 1.4 |
| Moffett Boulevard | Between Leong Drive and U.S. 101 southbound ramps | Residential | 67.0 | 68.0 | 1.0 |
| Moffett Boulevard | Between SR-85 northbound off-ramp and Leong Drive | Residential | 67.2 | 68.2 | 1.0 |
| Moffett Boulevard | Between SR-85 southbound on-ramp and SR-85 northbound off-ramp | Residential | 67.3 | 67.9 | 0.6 |
| Moffett Boulevard | Between U.S. 101 northbound ramps and R T Jones Road | Residential | 67.8 | 69.4 | 1.6 |
| Moffett Boulevard | Between U.S. 101 southbound ramps and U.S. 101 northbound ramps | Commercial | 67.3 | 68.7 | 1.4 |
| Moffett Park Drive | Between Innovation Way and Enterprise Way | Commercial | 63.2 | 64.7 | 1.5 |
| Moffett Park Drive | Between Mathilda Avenue and Innovation Way | Commercial | 66.3 | 67.0 | 0.7 |
| **Wescoat Road** | **Between Clark Road and the Project Site** | **Residential** | **57.5** | **61.9** | **4.4** |

Refer to Appendix A for the complete traffic noise modeling results.

Note: Screening noise levels at a fixed distance of 50 feet from the roadway centerline.

**Bold** text denotes segments with a 3 dB or greater project-related increase in noise.

**Table 5-33. Detailed Traffic Noise Increase Evaluation for Roadway Segments Flagged in the Screening Analysis – CEQA Reduced Density Alternative with Variant**

| Roadway | Segment | Modeled Distance to Centerline (feet) | Measured Ambient Noise Level (dBA $L_{dn}$) | Project-Only Traffic Noise Level (dBA $L_{dn}$) | Composite Ambient-plus-Project Noise Level (dBA $L_{dn}$)[a] | Change Compared to Measured Ambient Noise (dB) | 3 dB or Greater Increase? |
|---|---|---|---|---|---|---|---|
| Clark Road | Between R T Jones Road and NASA ARC driveway | 200 | 63.4[b] | 53.9 | 63.9 | 0.5 | No |
| Wescoat Road | Between Clark Road and the Project Site | 100 | 63.7[c] | 56.9 | 64.5 | 0.8 | No |

Refer to Appendix A for the complete traffic noise modeling results.

a. Project-only ADT volumes (i.e., existing-plus-project minus existing volumes) for the segments where a potentially substantial increase was identified during Modeling were used to calculate project-only traffic noise levels. Modeled project-only traffic noise levels were then combined with existing measured ambient noise levels to create a composite ambient-plus-project traffic condition.

b. The measured ambient noise level representative of this segment is LT-6 (63.4 dBA $L_{dn}$)

c. The measured ambient noise level representative of this segment is LT-1 (63.7 dBA $L_{dn}$)

***CEQA***

Modeled parking garage noise levels for the CEQA Reduced Density Alternative with the Variant are 17 to 31 dB lower than the existing average daytime noise levels at nearby noise-sensitive receptors (i.e., the Wescoat Village residences). The resulting overall increases in ambient noise levels would be negligible (0.1 dB or less).

***NEPA***

Modeled parking garage noise levels for NEPA Build Alternative 2 with the Sub-Alternative are 17 to 31 dB lower than the existing average daytime noise levels at nearby noise-sensitive receptors (i.e., Wescoat Village). The resulting overall increase in ambient noise levels would be negligible (0.1 dB or less).

#### Amplified Music or Speech at Events

Potential effects related to amplified music or speech would be the same for the CEQA Reduced Density Alternative with the Variant as presented for the CEQA Proposed Project because the number and types of programming and events at the Central Green would be the same. Therefore, the same analysis would apply and the same results would occur. Refer to amplified music or speech analysis for the CEQA Proposed Project, presented previously, for details.

***CEQA***

Noise levels from sound-amplifying equipment at project-related programming or events under the CEQA Reduced Density Alternative with the Variant would be below the existing average daytime noise levels at the nearest noise-sensitive receptors and would not substantially increase existing ambient noise levels. In addition, events, including outdoor events with amplified sound at the project's Central Green, would be infrequent (approximately 12 per year).

***NEPA***

Noise levels from sound-amplifying equipment at project-related programming or events under NEPA Build Alternative 2 with the Sub-Alternative would be below the existing average daytime noise levels at the nearest noise-sensitive receptors and would not substantially increase existing ambient noise levels. In addition, events, including outdoor events with amplified sound at the project's Central Green, would be infrequent (approximately 12 per year).

### Construction Vibration

#### Vibration-Induced Damage

Potential effects related to vibration-induced damage would be the same for the CEQA Reduced Density Alternative with the Variant as those presented for the CEQA Proposed Project because the equipment proposed for use and the general footprint of construction would be the same. Therefore, as was the case for the CEQA Proposed Project, estimated vibration levels from the use of a vibratory roller for in-street utility work within 22 feet of vibration-sensitive structures would be expected to exceed the applicable Caltrans damage criterion for such buildings (i.e., a PPV of 0.25 in/sec) under the CEQA Reduced Density Alternative with the Variant.

#### *CEQA*

Vibration from construction of the CEQA Reduced Density Alternative with the Variant could exceed the applied vibration-related damage criterion at nearby vibration-sensitive structures (i.e., a PPV of 0.25 in/sec). Implementation of Mitigation Measure NOI-5 would avoid or reduce and repair vibration-related damage effects.

#### *NEPA*

Vibration from construction of NEPA Build Alternative 2 with the Sub-Alternative could exceed the applied vibration-related damage criterion at nearby vibration-sensitive structures (i.e., a PPV of 0.25 in/sec). Implementation of Mitigation Measure NOI-5 would avoid or reduce and repair vibration-related damage effects.

### Vibration-Related Annoyance

Vibration-related annoyance effects would be the same for the CEQA Reduced Density Alternative with the Variant as presented for the CEQA Proposed Project. Nighttime on-site concrete pours and off-site in-street utility work would both be expected to result in vibration levels below the "strongly perceptible" annoyance threshold at nearby residential land uses.

#### *CEQA*

Estimated vibration levels from on-site and in-street utility work during nighttime hours would not exceed the applicable "strongly perceptible" criterion at the nearest occupied residential land uses during nighttime hours under the CEQA Reduced Density Alternative with the Variant. In addition, nighttime construction activities in a given area would be short term.

#### *NEPA*

Estimated vibration levels from on-site and in-street utility work during nighttime hours would not exceed the applicable "strongly perceptible" criterion at the nearest occupied residential land uses during nighttime hours under NEPA Build Alternative 2 with the Sub-Alternative. In addition, nighttime construction activities in a given area would be short term.

### Vibration-Sensitive Equipment

Potential effects from project construction to nearby vibration-sensitive equipment would be the same under the CEQA Reduced Density Alternative with the Variant as described for the CEQA Proposed Project.

#### *CEQA*

Vibration generated by project construction equipment may exceed applied thresholds for nearby sensitive research equipment and may disrupt the use of such equipment during project construction. Mitigation Measure NOI-6 has been identified to reduce impacts on vibration-sensitive equipment. Even with implementation of all feasible mitigation, it may not be possible to fully reduce interference effects on nearby vibration-sensitive laboratory or research equipment.

#### *NEPA*

As described in the discussion of CEQA-related vibration effects above, vibration generated by project construction equipment may exceed applied thresholds for nearby sensitive research equipment and may disrupt the use of such equipment during project construction. Mitigation Measure NOI-6 has been identified to reduce impacts on vibration-sensitive equipment. Even with implementation of all feasible mitigation, it may not be possible to fully reduce interference effects on nearby vibration-sensitive laboratory or research equipment.

### Aircraft Noise

The aircraft noise analysis and findings for the CEQA Reduced Density Alternative with the Variant are the same as described for the CEQA Proposed Project because the project footprint would be the same, and the exterior noise levels from aircraft at the Project Site would be the same.

#### *CEQA*

The proposed land uses potentially located along the edge of the 65 dBA CNEL contour (i.e., office and business uses) would be considered conditionally compatible with that noise level. In addition, interior noise levels would be expected to be below the maximum acceptable level for such uses.

#### *NEPA*

The proposed land uses potentially located along the edge of the 65 dBA CNEL contour (i.e., office and business uses) would be considered conditionally compatible with that noise level. In addition, interior noise levels would be expected to be below the maximum acceptable level for such uses.

## 5.3.7.2 Cumulative Impacts

### Construction Noise

Daytime and nighttime construction activities for the CEQA Reduced Density Alternative with the Variant would generally be the same as described for the CEQA Proposed Project because it would include roughly the same demolition and construction activities, footprint of construction, construction equipment, and construction hours. As described for the CEQA Proposed Project, construction of the cumulative projects is already complete; consequently, cumulative project construction would not occur concurrently with project construction activities (beginning in 2027). Construction noise from cumulative projects would therefore not be expected to combine with construction noise from the proposed project and expose nearby sensitive receptors to greater overall construction noise levels. However, because project construction noise levels for both daytime and nighttime hours were modeled to exceed applicable thresholds, cumulative construction noise effects would conservatively be considered substantial. Although Mitigation Measures NOI-1 and NOI-2 would be expected to somewhat reduce project construction noise, it may not be possible to reduce all construction noise to a level below the significance thresholds used in this assessment, even with implementation of all feasible mitigation measures. Therefore, cumulative construction noise effects during daytime and nighttime hours are considered to be substantial, even with implementation of project-specific mitigation.

## Operational Noise

### *Mechanical Equipment*

Operational Mechanical Equipment for the CEQA Reduced Density Alternative with the Variant would generally be the same as described for the CEQA Proposed Project.

As described previously, most operational sources of noise do not generate noise that is perceptible far beyond the edge of a project site. Project mechanical equipment noise would be localized and associated noise would attenuate rapidly with distance.

There are no cumulative projects between the nearest noise-sensitive receptors (i.e., the Wescoat Village residences) and the proposed project or within a similar distance. The nearest cumulative project to Wescoat Village is at USGS Building 800, which is more than 1,000 feet from the nearest Wescoat Village residence (with the nearest project building being an estimated 100 feet from the Project Site). However, construction of that project is already completed, and the building is currently operational. Because of the distance between USGS Building 800 and the Wescoat Village residences (i.e., more than 1,000 feet), and because project buildings would be expected to block the line of sight between USGS Building 800 and the Wescoat Village residences once construction is complete, noise-generating uses (e.g., mechanical equipment) at USGS Building 800 would not be expected to combine with noise from project mechanical equipment. However, because project-specific mechanical equipment effects were determined to be potentially substantial, cumulative effects related to operational equipment noise levels would conservatively be considered substantial. Mitigation Measure NOI-3 has been identified to reduce noise levels from project mechanical equipment. With implementation of this mitigation measure, mechanical equipment noise would be reduced to levels below applicable significance thresholds. Therefore, cumulative effects related to mechanical equipment noise would not be considered substantial with implementation of project mitigation.

### *Emergency Generator Testing*

As described under the cumulative analysis for the CEQA Proposed Project, it is very unlikely that the testing of an emergency generator for the proposed project would occur concurrently with the testing of a generator at a nearby project. Even if testing were to occur simultaneously, which is unlikely, it is not likely that the generators would be close enough to one another for the noise to combine at a given individual receptor. However, because noise from emergency generator noise testing was determined to potentially exceed applicable standards, cumulative effects related to noise from emergency generator testing would conservatively be considered substantial. Mitigation Measure NOI-4 has been identified to reduce noise levels and ensure that applicable noise exposure limits would not be exceeded during project emergency generator testing. With implementation of this mitigation measure, emergency generator noise would be reduced to levels below applicable significance thresholds. Therefore, cumulative effects related to emergency generator noise would not be considered substantial with implementation of project mitigation.

### *Loading Noise*

As described under the cumulative analysis for the CEQA Proposed Project, loading activity noise is generally intermittent, and noise levels are often abated by intervening buildings. Even if loading activities for nearby cumulative projects were to occur simultaneously, which is unlikely, it is not likely that the loading docks or zones would be close enough to one another for the noise to combine at a given individual receptor. Cumulative noise effects related to loading dock activity would not be considered substantial.

#### *Traffic Noise*

Cumulative traffic noise effects under the Reduced Density Alternative with the Variant would be similar to those described for the CEQA Proposed Project. According to the results of the screening analysis of traffic noise for the CEQA Reduced Density Alternative with the Variant (contained in Table 5-34), six roadway segments were flagged as having a potential 3 dB or greater increase in traffic noise along segments with sensitive land uses when comparing existing and cumulative-plus-project conditions. Three of these segments were flagged as having the potential to experience a greater than 1 dB increase in noise as a result of project implementation (i.e., when comparing cumulative-no-project conditions to cumulative-plus-project conditions). Results from the screening analysis are included in Table 5-34.

A detailed assessment (as described previously), with consideration given to existing measured noise levels and the actual distances between the roadway centerline and the nearest sensitive use), was conducted for these three segments. The results of the detailed traffic noise modeling assessment for the CEQA Reduced Density Alternative with the Variant are included in Table 5-35.

According to the detailed traffic noise assessment for the CEQA Reduced Density Alternative with the Variant, no evaluated segments would have a 3 dB increase over existing measured noise levels. As shown in this table, the project would also not result in a 1 dB or greater increase in cumulative with project noise levels along any segment evaluated in the detailed assessment. Cumulative traffic noise impacts under the CEQA Reduced Density Alternative with the Variant would not be considered substantial.

#### *Parking Garage Noise*

Cumulative parking activity noise effects would be the same as described for the CEQA Proposed Project. Cumulative noise effects related to parking garage activity would not be considered substantial.

#### *Amplified Music or Speech at Events*

Noise effects from amplified music or speech noise at events would be the same as described for the CEQA Proposed Project. Cumulative noise effects associated with amplified sound from infrequent events would not be considered substantial.

### Construction Vibration

Daytime and nighttime construction activities for the CEQA Reduced Density Alternative with the Variant generally be the same because this option would involve the same demolition and construction activity, footprint of construction, construction equipment, and construction hours.

Because construction for nearby cumulative projects is complete, vibration from multiple pieces of equipment would not be expected to combine and raise the overall peak vibration level experienced at a nearby sensitive use. Consequently, overall vibration levels at nearby structures/receptors would be governed by the nearest and closest ground-disturbing equipment associated with a project. Because project effects related to annoyance were not to be considered substantial, cumulative vibration-related annoyance effects would similarly not be considered substantial. However, project-specific vibration effects on vibration-sensitive structures were determined to be potentially substantial. As a result, cumulative vibration-related damage effects would conservatively be considered substantial. Implementation of project Mitigation Measure NOI-5 would avoid or reduce and repair vibration-related damage effects. Therefore, cumulative vibration-related damage effects would not be considered substantial with implementation of project mitigation.

Because the list of cumulative projects does not include construction projects in proximity to the nearby USGS Building 800 (where construction of all nearby cumulative projects is already complete), vibration from project construction would not be expected to combine with vibration from the construction of cumulative projects and result in greater levels of interference with nearby vibration-sensitive research equipment. However, because project-specific effects related to interference with vibration-sensitive research equipment were considered substantial, cumulative effects related to interference with vibration-sensitive research equipment would conservatively be considered substantial. Project-specific Mitigation Measure NOI-6 has been identified to reduce effects on vibration-sensitive equipment. Even with implementation of all feasible mitigation, it may not be possible to fully reduce interference effects on nearby vibration-sensitive laboratory or research equipment. Cumulative vibration effects related to interference with vibration-sensitive equipment would be conservatively considered substantial, even with implementation of mitigation.

## Aircraft Noise

Noise effects related to aircraft noise would be the same as described for the CEQA Proposed Project. Consequently, development of the project in conjunction with nearby cumulative projects would not result in a significant cumulative effect related to the exposure of persons residing or working in the project area to excessive aircraft noise levels. There would be no cumulative effects related to aircraft noises.

**Table 5-34. Screening Traffic Noise Levels for Segments for Reduced Density Alternative with the No Student/Faculty Housing Variant/Sub-Alternative – Cumulative Assessment Screening Analysis**

| Roadway | Segment | Most Sensitive Land Use Type along Segment | Traffic Noise Level ($dBA\ L_{dn}$) | | | Change in Sound Level from Existing to Cumulative plus Project (dB) | Change in Sound Level from Cumulative No Project to Cumulative plus Project (dB) | Potential Significant Cumulative Increase?[b] | Potential Cumulatively Considerable Contribution?[c] |
|---|---|---|---|---|---|---|---|---|---|
| | | | Existing | Cumulative No Project | Cumulative plus Project | | | | |
| **Clark Road** | **Between R T Jones Road and NASA Ames driveway** | **School & Residential** | **57.5** | **62.4** | **64.2** | **6.7** | **1.8** | **Yes** | **Yes** |
| Ellis Street | Between Manila Avenue and NASA Ames driveway | Commercial | 55.4 | 61.5 | 63.4 | 8.0 | 1.9 | No | N/A |
| Ellis Street | Between Middlefield Road and driveway north of Middlefield Road | Commercial | 63.2 | 67.9 | 68.1 | 4.9 | 0.2 | No | N/A |
| Ellis Street | Between National Avenue and Fairchild Drive | Commercial | 63.9 | 67.6 | 67.8 | 3.9 | 0.2 | No | N/A |
| Ellis Street | Between U.S. 101 northbound ramps and Manila Avenue | Commercial | 64.4 | 67.6 | 68.6 | 4.2 | 1.0 | No | N/A |
| Ellis Street | Between U.S. 101 southbound ramps and U.S. 101 northbound ramps | Commercial | 65.1 | 68.3 | 68.8 | 3.7 | 0.5 | No | N/A |
| Manila Avenue | Between Enterprise Way and Ellis Street | Commercial | 63.4 | 66.3 | 67.0 | 3.6 | 0.7 | No | N/A |
| Moffett Boulevard | Between Leong Drive and U.S. 101 southbound ramps | Residential | 67.0 | 70.3 | 70.8 | 3.8 | 0.5 | Yes | No |
| Moffett Boulevard | Between SR-85 northbound off-ramp and Leong Drive | Residential | 67.2 | 70.4 | 70.8 | 3.6 | 0.4 | Yes | No |
| Moffett Boulevard | Between SR-85 southbound on-ramp and SR-85 northbound off-ramp | Residential | 67.3 | 70.3 | 70.5 | 3.2 | 0.2 | Yes | No |
| **Moffett Boulevard** | **Between U.S. 101 northbound ramps and R T Jones Road** | **Residential** | **67.8** | **70.0** | **71.0** | **3.2** | **1.0** | **Yes** | **Yes** |
| Moffett Boulevard | Between U.S. 101 southbound ramps and U.S. 101 northbound ramps | Commercial | 67.3 | 70.4 | 71.1 | 3.8 | 0.7 | No | N/A |
| Moffett Park Drive | Between Innovation Way and Enterprise Way | Commercial | 63.2 | 65.8 | 66.6 | 3.4 | 0.8 | No | N/A |
| Moffett Park Drive | Between Mathilda Avenue and Innovation Way | Commercial | 66.3 | 68.2 | 68.6 | 2.3 | 0.4 | No | N/A |
| **Wescoat Road[a]** | **Between Clark Road and the Project Site** | **Residential** | **57.5** | **62.4** | **64.2** | **6.7** | **1.8** | **Yes** | **Yes** |

Refer to Appendix A for the complete traffic noise modeling results.

Note: Screening noise levels at a fixed distance of 50 feet from the roadway centerline.

Underlined text denotes segments with a 3 dB or greater potential significant increase in noise along roadways with sensitive land uses from existing to cumulative-plus-project conditions.

**Bold** text denotes segments with a 3 dB or greater potential significant increase in noise and a 1 dB or more potentially cumulatively considerable contribution.

[a] Traffic counts and estimated ADT volumes for roadway segments within the campus (beyond the NASA AMES guard station) were not available/not provided by the project traffic consultant. To evaluate potential traffic noise effects on existing residential land uses within the campus, it was conservatively assumed that all vehicles that enter at the Clark Road guard station would continue on Clark Road and turn right onto Wescoat Road to access the Project Site.

[b] A potential cumulative impact would occur under this screening analysis if the modeled noise increase is greater than 3 dB and land uses along the roadway segment are sensitive to noise (e.g., residential).

[c] No = Project would not result in cumulatively considerable contribution because the land use type along the segment is not a sensitive use. N/A = A cumulatively considerable contribution is not applicable because a significant cumulative impact due to noise level increase would not occur along the roadway segment.

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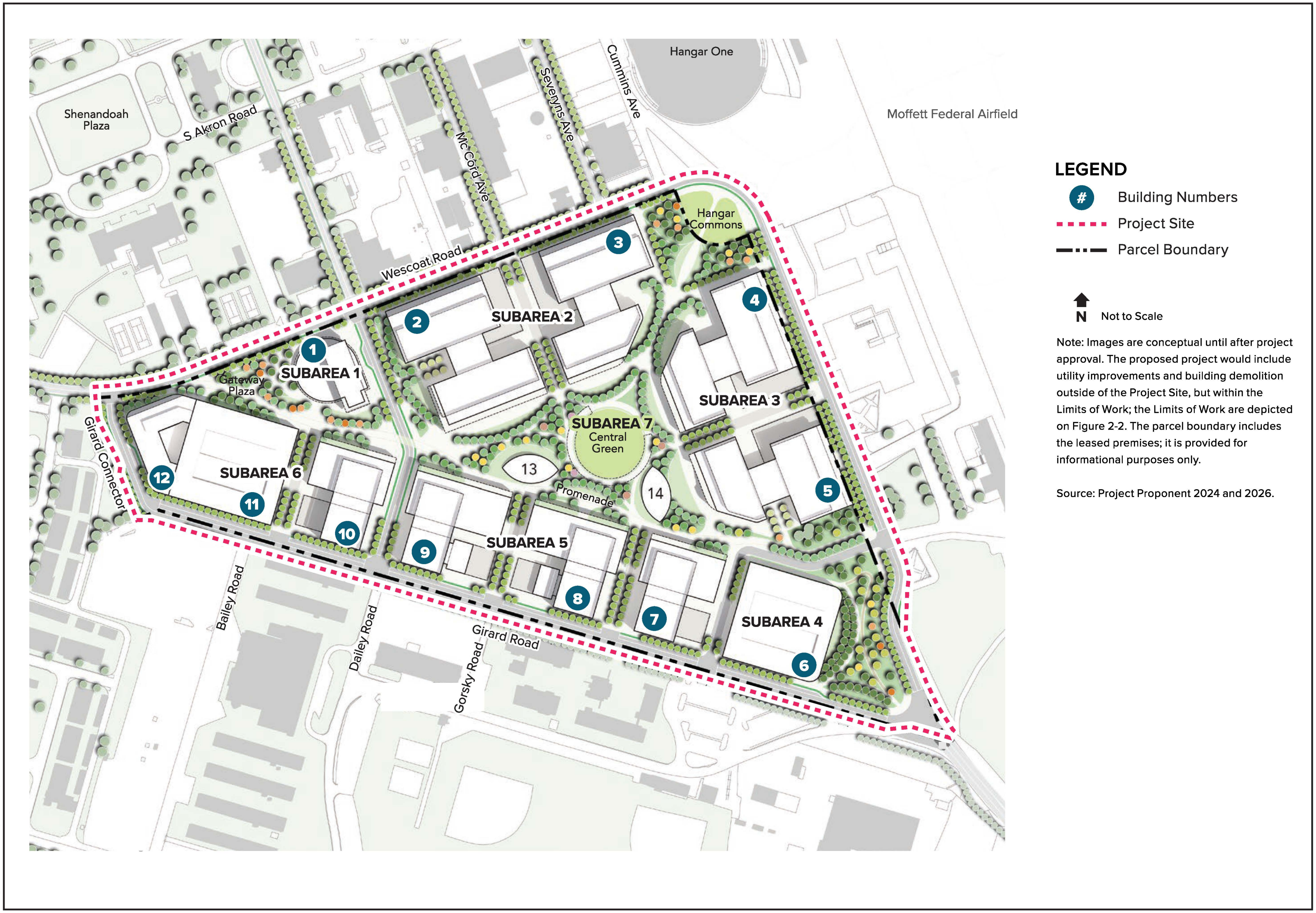
**Table 5-35. Cumulative Traffic Noise Evaluation for Potentially Affected Segments, CEQA Reduced Density Alternative with Variant – Detailed Assessment**

| Roadway | Segment Location | Modeled Distance to Centerline (feet) | Representative Measurement Location | Measured Ambient Noise Level, Existing (dBA $L_{dn}$) | Ambient with Cumulative-No-Project Traffic Noise Levels (dBA $L_{dn}$) | Ambient with Cumulative-plus-Project Traffic Noise Levels (dBA $L_{dn}$) | Change in Sound Level (dBA $L_{dn}$) from Existing to Ambient with Cumulative plus Project | Significant Cumulative Increase?[a] | Change in Sound Level (dBA $L_{dn}$) between Cumulative Scenarios[b] | Cumulatively Considerable Project Contribution?[b] |
|---|---|---|---|---|---|---|---|---|---|---|
| Clark Road | Between R T Jones Road and NASA Ames driveway | 200 | LT-6 | 63.4 | 63.9 | 64.2 | 0.8 | No | 0.2 | N/A |
| Moffett Boulevard | Between U.S. 101 northbound ramps and R T Jones Road | 400 | LT-6 | 63.4 | 64.2 | 64.6 | 1.2 | No | 0.4 | N/A |
| Wescoat Road | Between Clark Road and Project Site | 100 | LT-1 | 63.7 | 64.7 | 65.0 | 1.3 | No | 0.3 | N/A |

a. A detailed assessment was conducted to determine if the potential cumulative traffic noise increases identified in the screening analysis are actual cumulative traffic noise increases, with consideration given to existing measured noise levels and the actual distances between the roadway centerline and the nearest sensitive use.

b. Although no significant cumulative increases were determined to occur in the detailed assessment, the project contribution to the cumulative increase is still presented here for informational purposes. "N/A" is used to emphasize that the project-related increase is presented for informational purposes only.

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ICF

**Figure 5-1**

**Conceptual Building Locations for the CEQA Proposed Project and CEQA Reduced Density Alternative**

Berkeley Space Center at NASA Research Park

# Chapter 6
# **References**


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## Personal Communication

Rusch, J., Project Architectural Historian and Preservation Planner. June 16, 2025—email regarding the appropriate Caltrans vibration criteria to apply to buildings near project construction areas.

Rusch, J., Project Architectural Historian and Preservation Planner. March 23, 2026—email regarding the historic status of buildings within 22 feet of project construction areas.

Chapter 7
# Preparers

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Appendix A

# Noise and Vibration Appendix

# UC Berkeley Space Center

Noise Measurement Survey Data

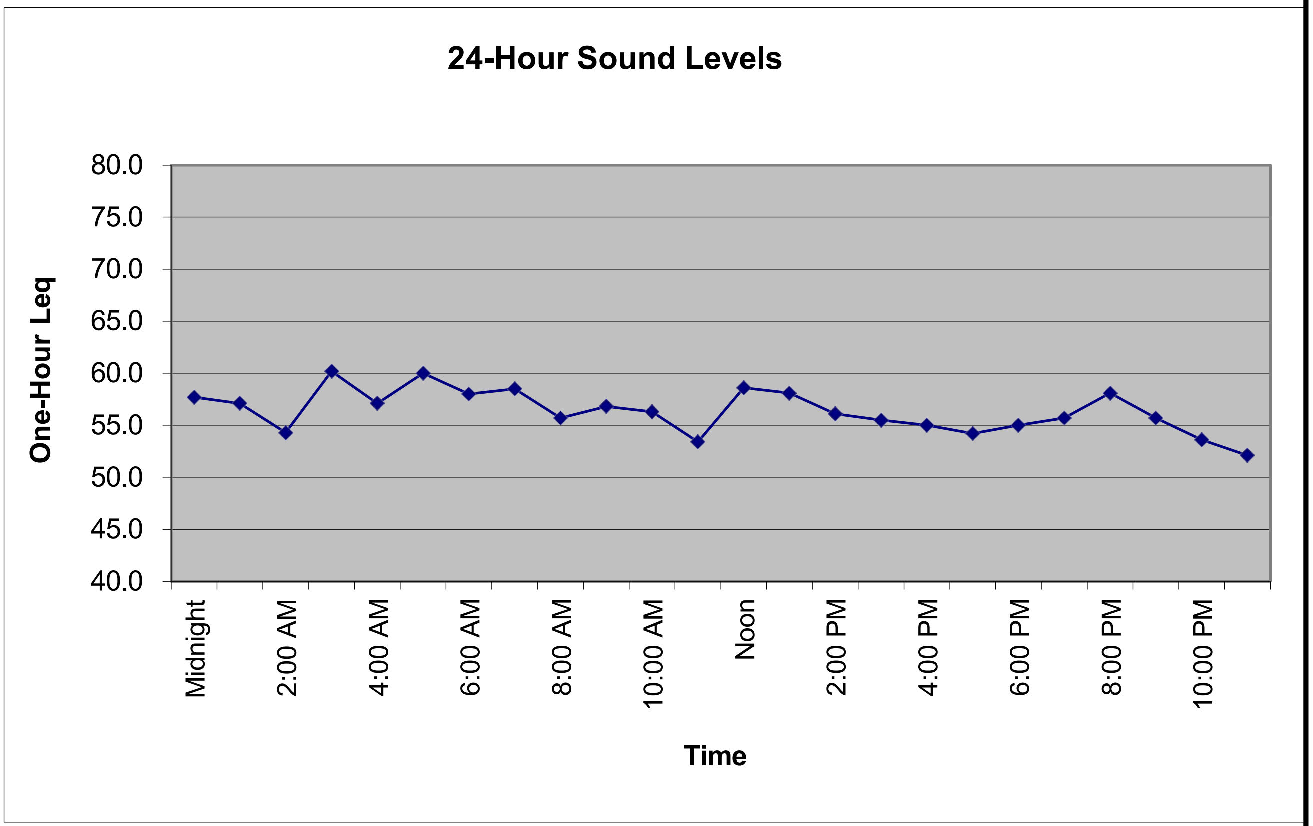
# Noise Appendix

## Long Term Measurement Data

# Ldn/CNEL Calculation Spreadsheet

Project: UC Berkeley Moffett Space Center Date: 4/23/2025 Analyst: Schumaker, N
Location: LT-1

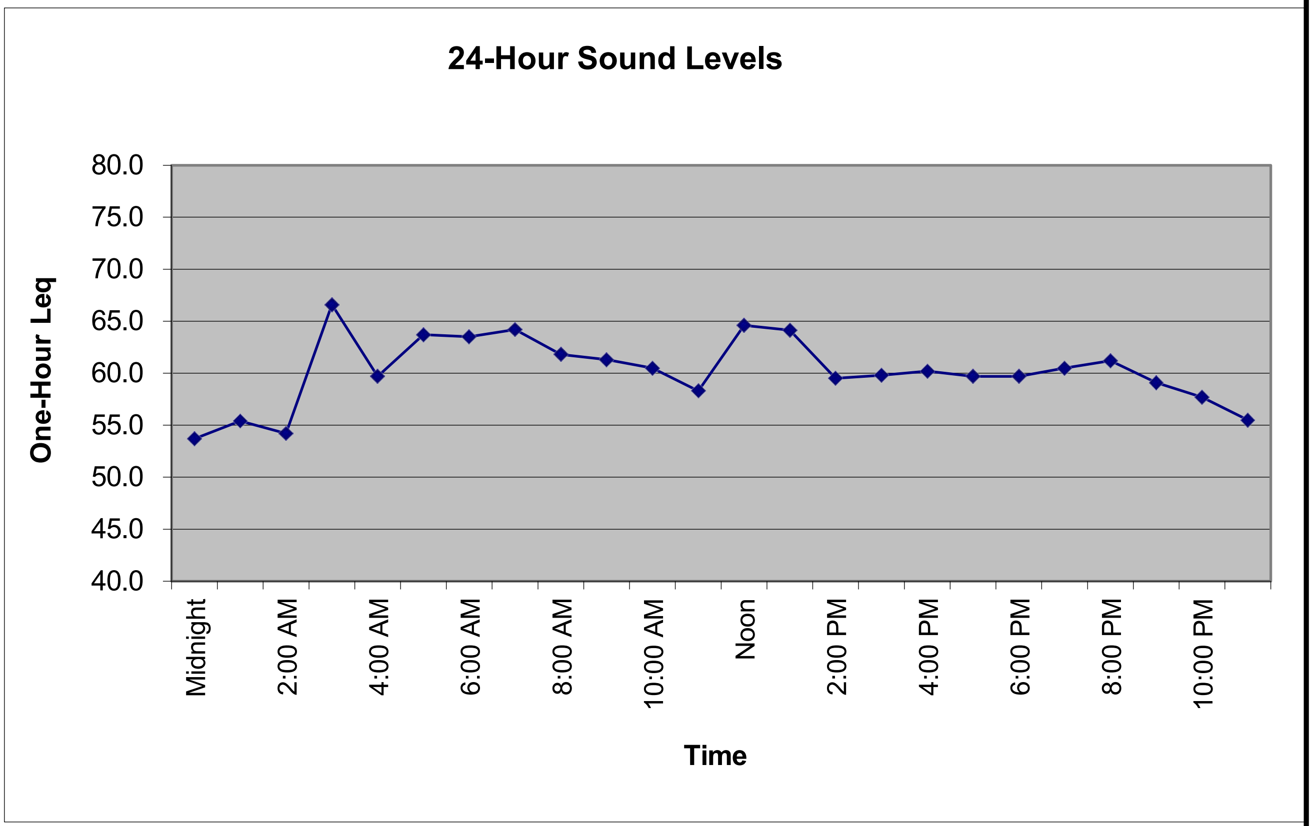
| Time | Wednesday 4/23/2025 | Leq(24) | Ldn | CNEL | Worst Hour Leq | Ldn minus Worst Hour Leq | CNEL minus Ldn | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Day |
| Midnight | 57.7 | 56.8 | 63.7 | 63.9 | 60.2 | 3.5 | 0.2 | Evening |
| 1:00 AM | 57.1 | | 5.2 | 5.4 | | | | Night |
| 2:00 AM | 54.3 | | | | | | | |
| 3:00 AM | 60.2 | | | | | | | |
| 4:00 AM | 57.1 | | | | | | | |
| 5:00 AM | 60.0 | | | | | | | |
| 6:00 AM | 58.0 | | | | | | | |
| 7:00 AM | 58.5 | | | | | | | |
| 8:00 AM | 55.7 | | | | | | | |
| 9:00 AM | 56.8 | | | | | | | |
| 10:00 AM | 56.3 | | | | | | | |
| 11:00 AM | 53.4 | | | | | | | |
| Noon | 58.6 | | | | | | | |
| 1:00 PM | 58.1 | | | | | | | |
| 2:00 PM | 56.1 | | | | | | | |
| 3:00 PM | 55.5 | | | | | | | |
| 4:00 PM | 55.0 | | | | | | | |
| 5:00 PM | 54.2 | | | | | | | |
| 6:00 PM | 55.0 | | | | | | | |
| 7:00 PM | 55.7 | | | | | | | |
| 8:00 PM | 58.1 | | | | | | | |
| 9:00 PM | 55.7 | | | | | | | |
| 10:00 PM | 53.6 | | | | | | | |
| 11:00 PM | 52.1 | | | | | | | |



# Ldn/CNEL Calculation Spreadsheet

Project: UC Berkeley Moffett Space Center  Date: 4/23/2025  Analyst: Schumaker, N
Location: LT-2

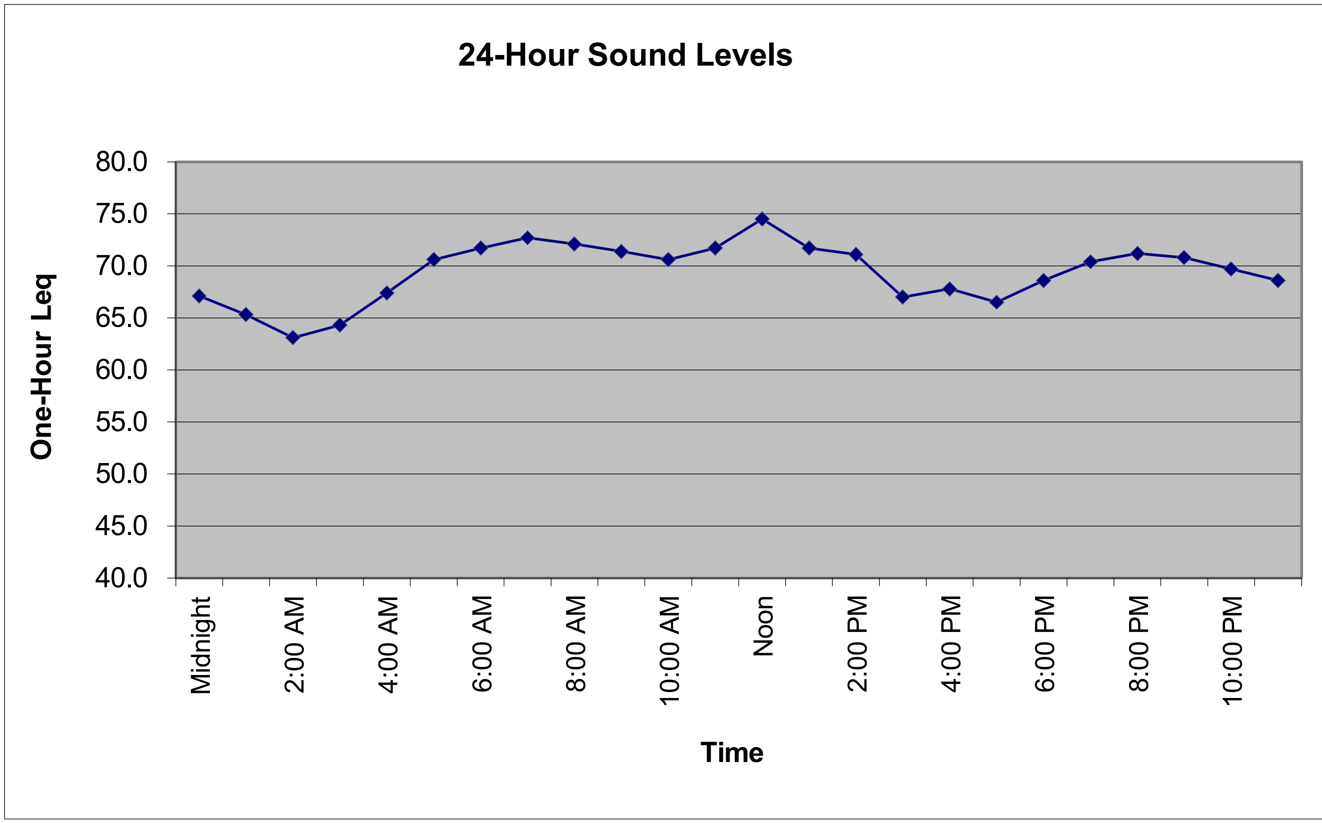
| Time | Wednesday 4/23/2025 | Leq(24) | Ldn | CNEL | Worst Hour Leq | Ldn minus Worst Hour Leq | CNEL minus Ldn | Day |
|---|---|---|---|---|---|---|---|---|
| Midnight | 53.7 | 61.3 | 67.6 | 67.9 | 66.6 | 1.0 | 0.2 | Evening |
| 1:00 AM | 55.4 | | 3.4 | 3.7 | | | | Night |
| 2:00 AM | 54.2 | | | | | | | |
| 3:00 AM | 66.6 | | | | | | | |
| 4:00 AM | 59.7 | | | | | | | |
| 5:00 AM | 63.7 | | | | | | | |
| 6:00 AM | 63.5 | | | | | | | |
| 7:00 AM | 64.2 | | | | | | | |
| 8:00 AM | 61.8 | | | | | | | |
| 9:00 AM | 61.3 | | | | | | | |
| 10:00 AM | 60.5 | | | | | | | |
| 11:00 AM | 58.3 | | | | | | | |
| Noon | 64.6 | | | | | | | |
| 1:00 PM | 64.1 | | | | | | | |
| 2:00 PM | 59.5 | | | | | | | |
| 3:00 PM | 59.8 | | | | | | | |
| 4:00 PM | 60.2 | | | | | | | |
| 5:00 PM | 59.7 | | | | | | | |
| 6:00 PM | 59.7 | | | | | | | |
| 7:00 PM | 60.5 | | | | | | | |
| 8:00 PM | 61.2 | | | | | | | |
| 9:00 PM | 59.1 | | | | | | | |
| 10:00 PM | 57.7 | | | | | | | |
| 11:00 PM | 55.5 | | | | | | | |




Noise levels during the 1:00 p.m. and 2:00 p.m. hours were substantially greater than the preceeding and following hours, and from tuesday. The average 1-hour noise values for these time periods were recalculated by removing contaminated 1-minute data and reaveraging.

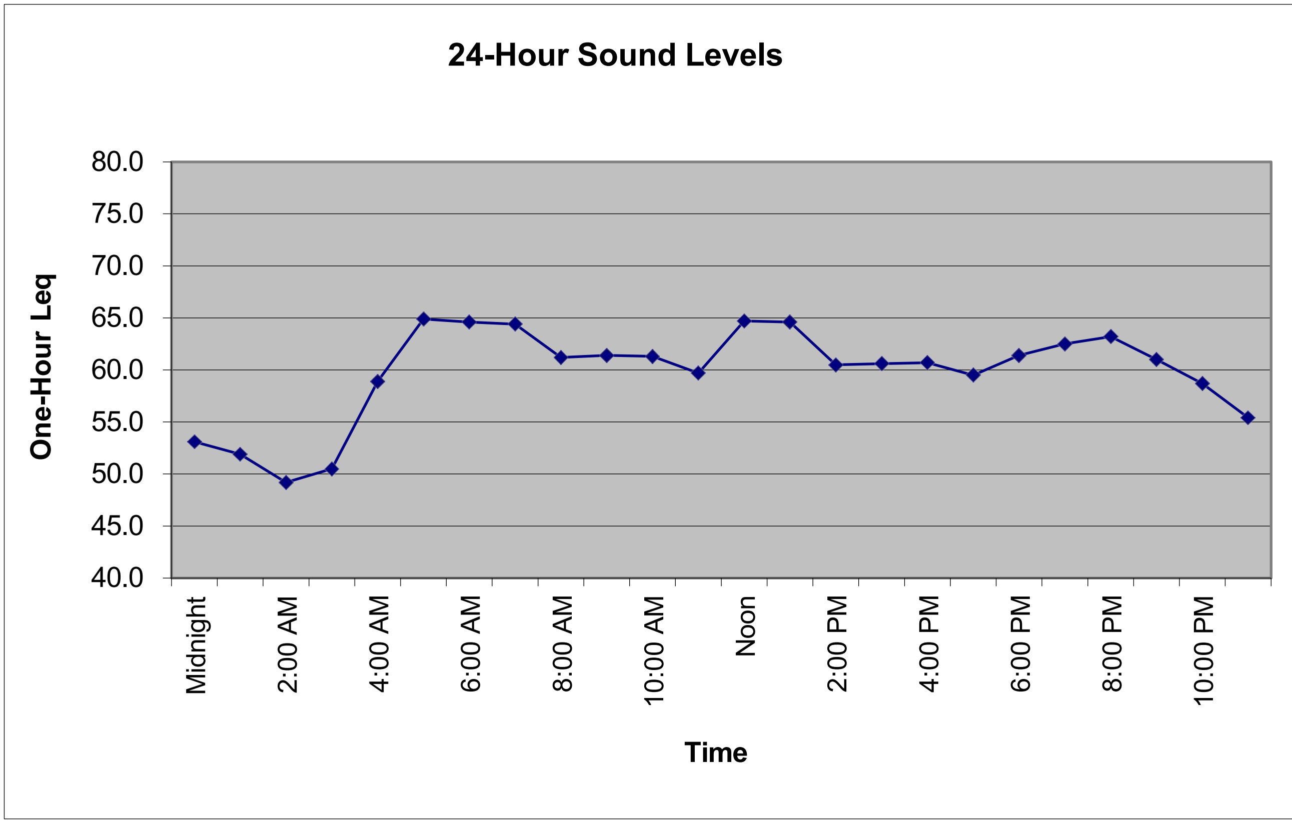
# Ldn/CNEL Calculation Spreadsheet

| Project: | UC Berkeley Moffett Space Center | | Date: | 4/23/2025 | Analyst: | Schumaker, N | | |
|---|---|---|---|---|---|---|---|---|
| Location: | LT-3 | | | | | | | |
| Time | Wednesday 4/23/2025 | Leq(24) | Ldn | CNEL | Worst Hour Leq | Ldn minus Worst Hour Leq | CNEL minus Ldn | Day |
| Midnight | 67.1 | 70.2 | 75.3 | 75.7 | 74.5 | 0.8 | 0.4 | Evening |
| 1:00 AM | 65.3 | | 2.6 | 3.0 | | | | Night |
| 2:00 AM | 63.1 | | | | | | | |
| 3:00 AM | 64.3 | | | | | | | |
| 4:00 AM | 67.4 | | | | | | | |
| 5:00 AM | 70.6 | | | | | | | |
| 6:00 AM | 71.7 | | | | | | | |
| 7:00 AM | 72.7 | | | | | | | |
| 8:00 AM | 72.1 | | | | | | | |
| 9:00 AM | 71.4 | | | | | | | |
| 10:00 AM | 70.6 | | | | | | | |
| 11:00 AM | 71.7 | | | | | | | |
| Noon | 74.5 | | | | | | | |
| 1:00 PM | 71.7 | | | | | | | |
| 2:00 PM | 71.1 | | | | | | | |
| 3:00 PM | 67.0 | | | | | | | |
| 4:00 PM | 67.8 | | | | | | | |
| 5:00 PM | 66.5 | | | | | | | |
| 6:00 PM | 68.6 | | | | | | | |
| 7:00 PM | 70.4 | | | | | | | |
| 8:00 PM | 71.2 | | | | | | | |
| 9:00 PM | 70.8 | | | | | | | |
| 10:00 PM | 69.7 | | | | | | | |
| 11:00 PM | 68.6 | | | | | | | |



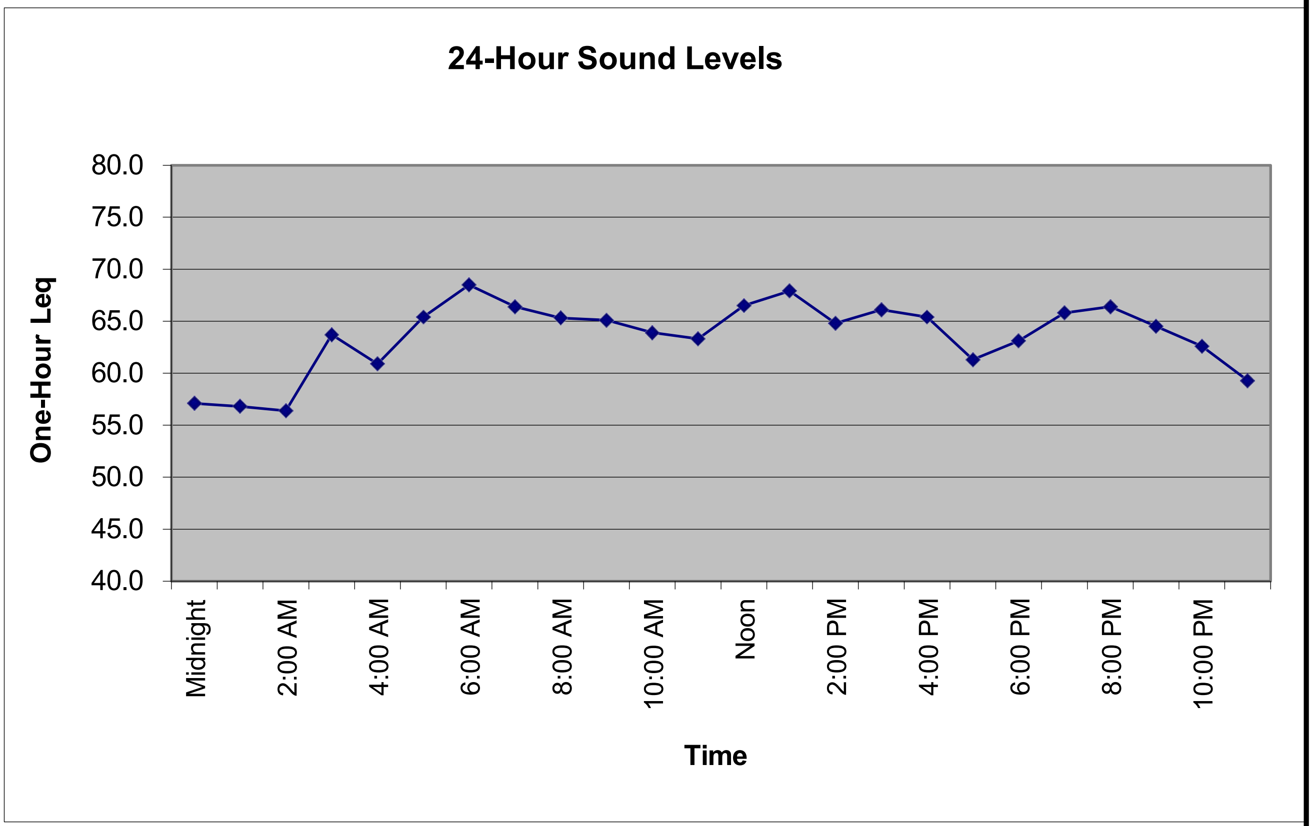
# Ldn/CNEL Calculation Spreadsheet

| Project: | UC Berkeley Moffett Space Center | | Date: | 4/23/2025 | Analyst: | Schumaker, N | | |
|---|---|---|---|---|---|---|---|---|
| Location: | LT-4 | | | | | | | |
| Time | Wednesday 4/23/2025 | Leq(24) | Ldn | CNEL | Worst Hour Leq | Ldn minus Worst Hour Leq | CNEL minus Ldn | Day |
| Midnight | 53.1 | 61.4 | 66.5 | 67.0 | 64.9 | 1.6 | 0.4 | Evening |
| 1:00 AM | 51.9 | | 2.1 | 2.6 | | | | Night |
| 2:00 AM | 49.2 | | | | | | | |
| 3:00 AM | 50.5 | | | | | | | |
| 4:00 AM | 58.9 | | | | | | | |
| 5:00 AM | 64.9 | | | | | | | |
| 6:00 AM | 64.6 | | | | | | | |
| 7:00 AM | 64.4 | | | | | | | |
| 8:00 AM | 61.2 | | | | | | | |
| 9:00 AM | 61.4 | | | | | | | |
| 10:00 AM | 61.3 | | | | | | | |
| 11:00 AM | 59.7 | | | | | | | |
| Noon | 64.7 | | | | | | | |
| 1:00 PM | 64.6 | | | | | | | |
| 2:00 PM | 60.5 | | | | | | | |
| 3:00 PM | 60.6 | | | | | | | |
| 4:00 PM | 60.7 | | | | | | | |
| 5:00 PM | 59.5 | | | | | | | |
| 6:00 PM | 61.4 | | | | | | | |
| 7:00 PM | 62.5 | | | | | | | |
| 8:00 PM | 63.2 | | | | | | | |
| 9:00 PM | 61.0 | | | | | | | |
| 10:00 PM | 58.7 | | | | | | | |
| 11:00 PM | 55.4 | | | | | | | |



# Ldn/CNEL Calculation Spreadsheet

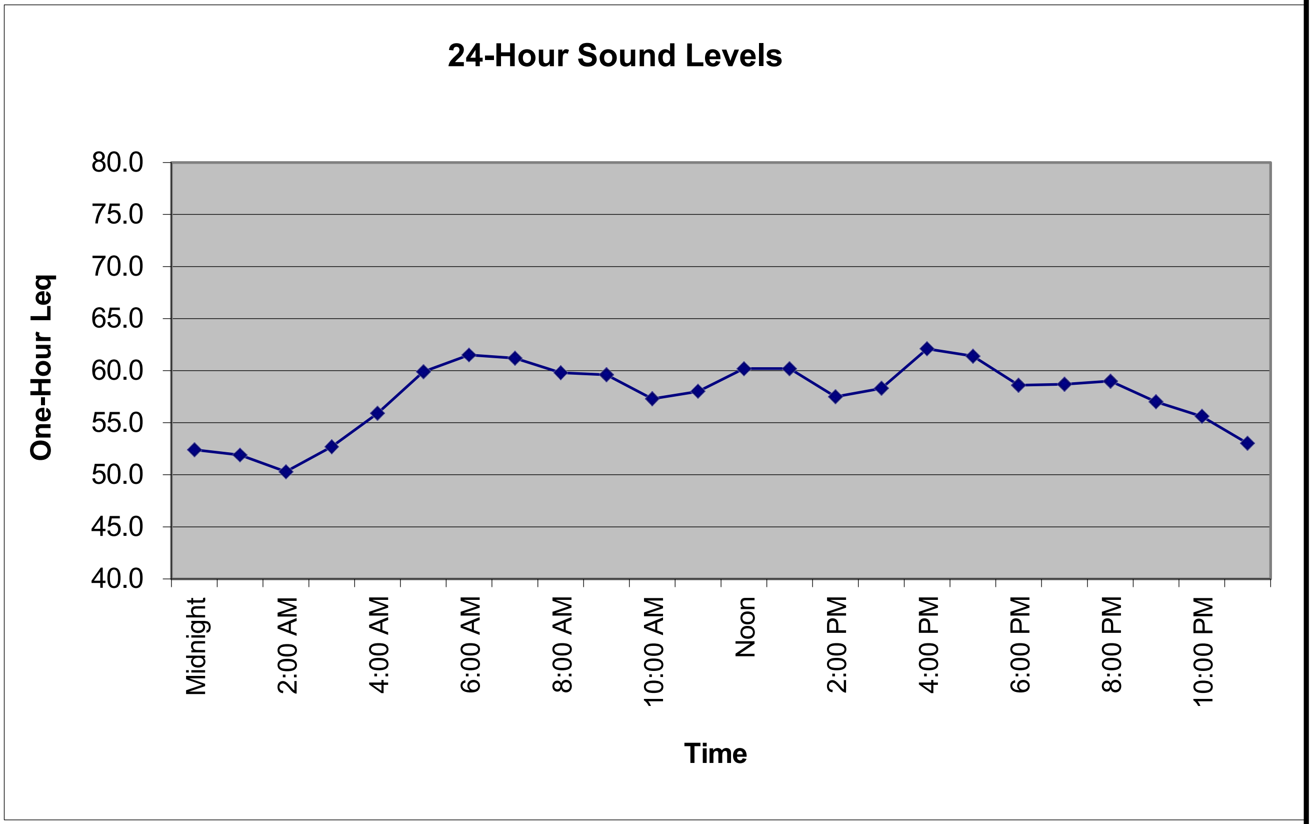
| Project: | UC Berkeley Moffett Space Center | | Date: | 4/23/2025 | Analyst: | Schumaker, N | | |
|---|---|---|---|---|---|---|---|---|
| Location: | LT-5 | | | | | | | |
| Time | Wednesday 4/23/2025 | Leq(24) | Ldn | CNEL | Worst Hour Leq | Ldn minus Worst Hour Leq | CNEL minus Ldn | Day |
| Midnight | 57.1 | 64.6 | 69.9 | 70.3 | 68.5 | 1.4 | 0.4 | Evening |
| 1:00 AM | 56.8 | | 3.5 | 3.9 | | | | Night |
| 2:00 AM | 56.4 | | | | | | | |
| 3:00 AM | 63.7 | | | | | | | |
| 4:00 AM | 60.9 | | | | | | | |
| 5:00 AM | 65.4 | | | | | | | |
| 6:00 AM | 68.5 | | | | | | | |
| 7:00 AM | 66.4 | | | | | | | |
| 8:00 AM | 65.3 | | | | | | | |
| 9:00 AM | 65.1 | | | | | | | |
| 10:00 AM | 63.9 | | | | | | | |
| 11:00 AM | 63.3 | | | | | | | |
| Noon | 66.5 | | | | | | | |
| 1:00 PM | 67.9 | | | | | | | |
| 2:00 PM | 64.8 | | | | | | | |
| 3:00 PM | 66.1 | | | | | | | |
| 4:00 PM | 65.4 | | | | | | | |
| 5:00 PM | 61.3 | | | | | | | |
| 6:00 PM | 63.1 | | | | | | | |
| 7:00 PM | 65.8 | | | | | | | |
| 8:00 PM | 66.4 | | | | | | | |
| 9:00 PM | 64.5 | | | | | | | |
| 10:00 PM | 62.6 | | | | | | | |
| 11:00 PM | 59.3 | | | | | | | |



# Ldn/CNEL Calculation Spreadsheet

Project: UC Berkeley Moffett Space Center Date: 4/23/2025 Analyst: Schumaker, N
Location: LT-6

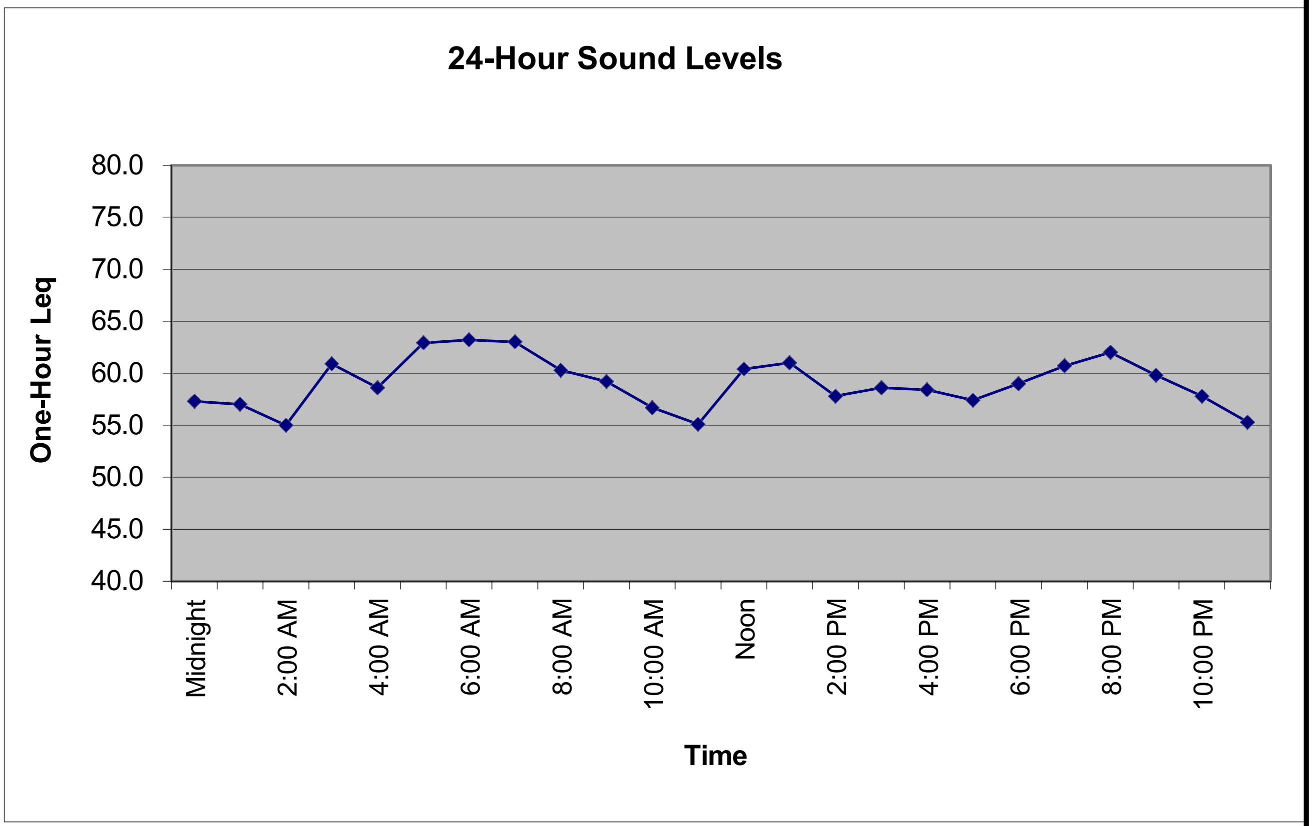
| Time | Wednesday 4/23/2025 | Leq(24) | Ldn | CNEL | Worst Hour Leq | Ldn minus Worst Hour Leq | CNEL minus Ldn | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Day |
| Midnight | 52.4 | 58.6 | 63.4 | 63.8 | 62.1 | 1.3 | 0.3 | Evening |
| 1:00 AM | 51.9 | | 2.2 | 2.6 | | | | Night |
| 2:00 AM | 50.3 | | | | | | | |
| 3:00 AM | 52.7 | | | | | | | |
| 4:00 AM | 55.9 | | | | | | | |
| 5:00 AM | 59.9 | | | | | | | |
| 6:00 AM | 61.5 | | | | | | | |
| 7:00 AM | 61.2 | | | | | | | |
| 8:00 AM | 59.8 | | | | | | | |
| 9:00 AM | 59.6 | | | | | | | |
| 10:00 AM | 57.3 | | | | | | | |
| 11:00 AM | 58.0 | | | | | | | |
| Noon | 60.2 | | | | | | | |
| 1:00 PM | 60.2 | | | | | | | |
| 2:00 PM | 57.5 | | | | | | | |
| 3:00 PM | 58.3 | | | | | | | |
| 4:00 PM | 62.1 | | | | | | | |
| 5:00 PM | 61.4 | | | | | | | |
| 6:00 PM | 58.6 | | | | | | | |
| 7:00 PM | 58.7 | | | | | | | |
| 8:00 PM | 59.0 | | | | | | | |
| 9:00 PM | 57.0 | | | | | | | |
| 10:00 PM | 55.6 | | | | | | | |
| 11:00 PM | 53.0 | | | | | | | |



# Ldn/CNEL Calculation Spreadsheet

Project: UC Berkeley Moffett Space Center Date: 4/23/2025 Analyst: Schumaker, N
Location: LT-7

| Time | Wednesday 4/23/2025 | Leq(24) | Ldn | CNEL | Worst Hour Leq | Ldn minus Worst Hour Leq | CNEL minus Ldn | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Day |
| Midnight | 57.3 | 59.7 | 66.1 | 66.4 | 63.2 | 2.9 | 0.3 | Evening |
| 1:00 AM | 57.0 | | 3.1 | 3.4 | | | | Night |
| 2:00 AM | 55.0 | | | | | | | |
| 3:00 AM | 60.9 | | | | | | | |
| 4:00 AM | 58.6 | | | | | | | |
| 5:00 AM | 62.9 | | | | | | | |
| 6:00 AM | 63.2 | | | | | | | |
| 7:00 AM | 63.0 | | | | | | | |
| 8:00 AM | 60.3 | | | | | | | |
| 9:00 AM | 59.2 | | | | | | | |
| 10:00 AM | 56.7 | | | | | | | |
| 11:00 AM | 55.1 | | | | | | | |
| Noon | 60.4 | | | | | | | |
| 1:00 PM | 61.0 | | | | | | | |
| 2:00 PM | 57.8 | | | | | | | |
| 3:00 PM | 58.6 | | | | | | | |
| 4:00 PM | 58.4 | | | | | | | |
| 5:00 PM | 57.4 | | | | | | | |
| 6:00 PM | 59.0 | | | | | | | |
| 7:00 PM | 60.7 | | | | | | | |
| 8:00 PM | 62.0 | | | | | | | |
| 9:00 PM | 59.8 | | | | | | | |
| 10:00 PM | 57.8 | | | | | | | |
| 11:00 PM | 55.3 | | | | | | | |



# Noise Appendix

## Short Term Measurement Data

## Summary

| | |
|---|---|
| **File Name on Meter** | LxT_Data.133.s |
| **File Name on PC** | LxT_0004004-20250422 103400-LxT_Data.133.ldbin |
| **Serial Number** | 0004004 |
| **Model** | SoundTrack LxT® |
| **Firmware Version** | 2.404 |
| **User** | |
| **Location** | |
| **Job Description** | |
| **Note** | |

## Measurement

| | |
|---|---|
| **Description** | |
| **Start** | 2025-04-22 10:34:00 |
| **Stop** | 2025-04-22 10:49:05 |
| **Duration** | 00:15:05.4 |
| **Run Time** | 00:15:05.4 |
| **Pause** | 00:00:00.0 |
| | |
| **Pre-Calibration** | 2025-04-22 10:21:30 |
| **Post-Calibration** | None |
| **Calibration Deviation** | --- |

## Overall Settings

| | | | |
|---|---|---|---|
| **RMS Weight** | A Weighting | | |
| **Peak Weight** | A Weighting | | |
| **Detector** | Slow | | |
| **Preamplifier** | PRMLxT1L | | |
| **Microphone Correction** | Off | | |
| **Integration Method** | Linear | | |
| **Overload** | 122.8 dB | | |
| | **A** | **C** | **Z** |
| **Under Range Peak** | **79.4** | 76.4 | 81.4 dB |
| **Under Range Limit** | **24.3** | 25.5 | 31.7 dB |
| **Noise Floor** | 15.2 | 16.3 | 22.5 dB |
| | **First** | **Second** | **Third** |
| **Instrument Identification** | | | |

## Results

| | |
|---|---|
| **$L_{Aeq}$** | 51.4 dB |
| **LAE** | 81.0 dB |
| **EA** | 13.887 µPa²h |
| **EA8** | 441.723 µPa²h |

| | | |
|---|---|---|
| **EA40** | 2.209 mPa²h | |
| **LApk (max)** | 2025-04-22 10:48:26 | 82.4 dB |
| **LASmax** | 2025-04-22 10:48:26 | 64.2 dB |
| **LASmin** | 2025-04-22 10:34:49 | 45.7 dB |
| **SEA** | -99.94 dB | |

| | Exceedance Counts | Duration |
|---|---|---|
| **LAS > 85.0 dB** | 0 | 0.0 s |
| **LAS > 90.0 dB** | 0 | 0.0 s |
| **LApk > 135.0 dB** | 0 | 0.0 s |
| **LApk > 137.0 dB** | 0 | 0.0 s |
| **LApk > 140.0 dB** | 0 | 0.0 s |

| **Community Noise** | **LDN** | **LDay 07:00-22:00** | **LNight 22:00-07:00** | **LDEN** | **LDay 07:00-19:00** | **LEvening 19:00-22:00** |
|---|---|---|---|---|---|---|
| | 51.4 | 51.4 | -99.94 | 51.4 | 51.4 | -99.94 |

| | |
|---|---|
| **LCeq** | 62.0 dB |
| **LAeq** | 51.4 dB |
| **LCeq - LAeq** | 10.6 dB |
| **LAIeq** | 53.3 dB |
| **LAeq** | 51.4 dB |
| **LAIeq - LAeq** | 1.9 dB |

| | A | | C | | Z | |
|---|---|---|---|---|---|---|
| | dB | Time Stamp | dB | Time Stamp | dB | Time Stamp |
| **Leq** | 51.4 | | 62.0 | | | |
| **Ls(max)** | 64.2 | 2025/04/22 10:48:26 | | | | |
| **Ls(min)** | 45.7 | 2025/04/22 10:34:49 | | | | |
| **Lpk(max)** | 82.4 | 2025/04/22 10:48:26 | | | | |

| | |
|---|---|
| **Overload Count** | 0 |
| **Overload Duration** | 0.0 s |

## Dose Settings

| | | |
|---|---|---|
| **Dose Name** | OSHA-1 | OSHA-2 |
| **Exchange Rate** | 5 | 5 dB |
| **Threshold** | 90 | 80 dB |
| **Criterion Level** | 90 | 90 dB |
| **Criterion Duration** | 8 | 8 h |

## Results

| | | |
|---|---|---|
| **Dose** | -99.94 | -99.94 % |
| **Projected Dose** | -99.94 | -99.94 % |
| **TWA (Projected)** | -99.94 | -99.94 dB |
| **TWA (t)** | -99.94 | -99.94 dB |
| **Lep (t)** | 36.4 | 36.4 dB |

## Ln Percentiles

| | |
|---|---|
| **LA 1.00** | 61.5 dB |
| **LA 10.00** | 53.4 dB |
| **LA 25.00** | 50.7 dB |
| **LA 50.00** | 48.8 dB |
| **LA 90.00** | 46.9 dB |
| **LA 99.00** | 46.2 dB |

## Calibration History

| Preamp | Date | dB re 1V/Pa | mV/Pa |
|---|---|---|---|
| **PRMLxT1L** | 2025-04-22 10:21:29 | -29.06 | 35.22 |
| **PRMLxT1L** | 2025-04-22 04:43:29 | -29.02 | 35.39 |
| **PRMLxT1L** | 2024-12-04 11:37:32 | -29.12 | 34.98 |
| **PRMLxT1L** | 2024-12-04 11:14:35 | -29.08 | 35.16 |
| **PRMLxT1L** | 2024-12-04 10:47:29 | -29.14 | 34.90 |
| **PRMLxT1L** | 2024-12-04 10:25:53 | -29.11 | 35.03 |
| **PRMLxT1L** | 2024-12-04 09:53:48 | -29.04 | 35.32 |
| **PRMLxT1L** | 2024-12-04 09:29:05 | -29.00 | 35.47 |
| **PRMLxT1L** | 2024-12-04 09:23:57 | -29.01 | 35.43 |
| **PRMLxT1L** | 2024-11-13 15:09:50 | -28.83 | 36.19 |
| **PRMLxT1L** | 2024-11-13 14:49:06 | -28.74 | 36.56 |

## Summary

| | |
|---|---|
| **File Name on Meter** | LxT_Data.137.s |
| **File Name on PC** | LxT_0004004-20250424 105300-LxT_Data.137.ldbin |
| **Serial Number** | 0004004 |
| **Model** | SoundTrack LxT® |
| **Firmware Version** | 2.404 |
| **User** | |
| **Location** | |
| **Job Description** | |
| **Note** | |

## Measurement

| | |
|---|---|
| **Description** | |
| **Start** | 2025-04-24 10:53:00 |
| **Stop** | 2025-04-24 11:08:00 |
| **Duration** | 00:15:00.5 |
| **Run Time** | 00:15:00.5 |
| **Pause** | 00:00:00.0 |
| | |
| **Pre-Calibration** | 2025-04-24 10:50:20 |
| **Post-Calibration** | 2025-04-24 11:08:59 |
| **Calibration Deviation** | -0.07 dB |

## Overall Settings

| | | | |
|---|---|---|---|
| **RMS Weight** | A Weighting | | |
| **Peak Weight** | A Weighting | | |
| **Detector** | Slow | | |
| **Preamplifier** | PRMLxT1L | | |
| **Microphone Correction** | Off | | |
| **Integration Method** | Linear | | |
| **Overload** | 122.9 dB | | |
| | **A** | **C** | **Z** |
| **Under Range Peak** | **79.4** | 76.4 | 81.4 dB |
| **Under Range Limit** | **24.4** | 25.5 | 31.7 dB |
| **Noise Floor** | 15.2 | 16.4 | 22.6 dB |
| | | | |
| | **First** | **Second** | **Third** |
| **Instrument Identification** | | | |

## Results

| | |
|---|---|
| **$LA_{eq}$** | 52.4 dB |
| **LAE** | 81.9 dB |
| **EA** | 17.388 µPa²h |
| **EA8** | 556.096 µPa²h |

| | | |
|---|---|---|
| **EA40** | 2.780 mPa²h | |
| **LApk (max)** | 2025-04-24 10:54:55 | 76.9 dB |
| **LASmax** | 2025-04-24 11:04:43 | 60.6 dB |
| **LASmin** | 2025-04-24 10:53:29 | 49.7 dB |
| **SEA** | -99.94 dB | |

| | Exceedance Counts | Duration |
|---|---|---|
| **LAS > 85.0 dB** | 0 | 0.0 s |
| **LAS > 90.0 dB** | 0 | 0.0 s |
| **LApk > 135.0 dB** | 0 | 0.0 s |
| **LApk > 137.0 dB** | 0 | 0.0 s |
| **LApk > 140.0 dB** | 0 | 0.0 s |

| **Community Noise** | LDN | LDay 07:00-22:00 | LNight 22:00-07:00 | LDEN | LDay 07:00-19:00 | LEvening 19:00-22:00 |
|---|---|---|---|---|---|---|
| | 52.4 | 52.4 | -99.94 | 52.4 | 52.4 | -99.94 |

| | |
|---|---|
| **LCeq** | 60.2 dB |
| **LAeq** | 52.4 dB |
| **LCeq - LAeq** | 7.8 dB |
| **LAIeq** | 53.4 dB |
| **LAeq** | 52.4 dB |
| **LAIeq - LAeq** | 1.0 dB |

| | A | | C | | Z | |
|---|---|---|---|---|---|---|
| | dB | Time Stamp | dB | Time Stamp | dB | Time Stamp |
| **Leq** | 52.4 | | 60.2 | | | |
| **Ls(max)** | 60.6 | 2025/04/24 11:04:43 | | | | |
| **Ls(min)** | 49.7 | 2025/04/24 10:53:29 | | | | |
| **Lpk(max)** | 76.9 | 2025/04/24 10:54:55 | | | | |

| | |
|---|---|
| **Overload Count** | 0 |
| **Overload Duration** | 0.0 s |

## Dose Settings

| | | |
|---|---|---|
| **Dose Name** | OSHA-1 | OSHA-2 |
| **Exchange Rate** | 5 | 5 dB |
| **Threshold** | 90 | 80 dB |
| **Criterion Level** | 90 | 90 dB |
| **Criterion Duration** | 8 | 8 h |

## Results

| | | |
|---|---|---|
| **Dose** | -99.94 | -99.94 % |
| **Projected Dose** | -99.94 | -99.94 % |
| **TWA (Projected)** | -99.94 | -99.94 dB |
| **TWA (t)** | -99.94 | -99.94 dB |
| **Lep (t)** | 37.4 | 37.4 dB |

## Ln Percentiles

| | |
|---|---|
| **LA 1.00** | 55.2 dB |
| **LA 10.00** | 53.7 dB |
| **LA 25.00** | 52.9 dB |
| **LA 50.00** | 52.2 dB |
| **LA 90.00** | 51.1 dB |
| **LA 99.00** | 50.4 dB |

## Calibration History

| **Preamp** | **Date** | **dB re 1V/Pa** | **mV/Pa** |
|---|---|---|---|
| **PRMLxT1L** | 2025-04-24 11:08:32 | -29.13 | 34.95 |
| **PRMLxT1L** | 2025-04-24 10:50:17 | -29.05 | 35.26 |
| **PRMLxT1L** | 2025-04-22 12:15:30 | -29.03 | 35.38 |
| **PRMLxT1L** | 2025-04-22 11:55:09 | -29.08 | 35.14 |
| **PRMLxT1L** | 2025-04-22 11:44:46 | -29.06 | 35.22 |
| **PRMLxT1L** | 2025-04-22 11:26:46 | -29.09 | 35.12 |
| **PRMLxT1L** | 2025-04-22 11:16:34 | -29.04 | 35.32 |
| **PRMLxT1L** | 2025-04-22 10:21:29 | -29.06 | 35.22 |
| **PRMLxT1L** | 2025-04-22 04:43:29 | -29.02 | 35.39 |
| **PRMLxT1L** | 2024-12-04 11:37:32 | -29.12 | 34.98 |
| **PRMLxT1L** | 2024-12-04 11:14:35 | -29.08 | 35.16 |

## Summary

| | |
|---|---|
| **File Name on Meter** | LxT_Data.135.s |
| **File Name on PC** | LxT_0004004-20250422 112900-LxT_Data.135.ldbin |
| **Serial Number** | 0004004 |
| **Model** | SoundTrack LxT® |
| **Firmware Version** | 2.404 |
| **User** | |
| **Location** | |
| **Job Description** | |
| **Note** | |

## Measurement

| | |
|---|---|
| **Description** | |
| **Start** | 2025-04-22 11:29:00 |
| **Stop** | 2025-04-22 11:44:00 |
| **Duration** | 00:15:00.5 |
| **Run Time** | 00:15:00.5 |
| **Pause** | 00:00:00.0 |
| | |
| **Pre-Calibration** | 2025-04-22 11:26:57 |
| **Post-Calibration** | 2025-04-22 11:45:18 |
| **Calibration Deviation** | 0.02 dB |

## Overall Settings

| | | | |
|---|---|---|---|
| **RMS Weight** | A Weighting | | |
| **Peak Weight** | A Weighting | | |
| **Detector** | Slow | | |
| **Preamplifier** | PRMLxT1L | | |
| **Microphone Correction** | Off | | |
| **Integration Method** | Linear | | |
| **Overload** | 122.8 dB | | |
| | **A** | **C** | **Z** |
| **Under Range Peak** | **79.4** | 76.4 | 81.4 dB |
| **Under Range Limit** | **24.3** | 25.5 | 31.7 dB |
| **Noise Floor** | 15.2 | 16.3 | 22.5 dB |
| | | | |
| | **First** | **Second** | **Third** |
| **Instrument Identification** | | | |

## Results

| | |
|---|---|
| **$LA_{eq}$** | 53.7 dB |
| **LAE** | 83.2 dB |
| **EA** | 23.455 µPa²h |
| **EA8** | 750.153 µPa²h |
| **EA40** | 3.751 mPa²h |

| | | |
|---|---|---|
| **LApk (max)** | 2025-04-22 11:29:04 | 84.1 dB |
| **LASmax** | 2025-04-22 11:37:18 | 67.0 dB |
| **LASmin** | 2025-04-22 11:43:30 | 48.1 dB |
| **SEA** | -99.94 dB | |

| | Exceedance Counts | Duration |
|---|---|---|
| **LAS > 85.0 dB** | 0 | 0.0 s |
| **LAS > 90.0 dB** | 0 | 0.0 s |
| **LApk > 135.0 dB** | 0 | 0.0 s |
| **LApk > 137.0 dB** | 0 | 0.0 s |
| **LApk > 140.0 dB** | 0 | 0.0 s |

| **Community Noise** | LDN | LDay 07:00-22:00 | LNight 22:00-07:00 | LDEN | LDay 07:00-19:00 | LEvening 19:00-22:00 |
|---|---|---|---|---|---|---|
| | 53.7 | 53.7 | -99.94 | 53.7 | 53.7 | -99.94 |

| | |
|---|---|
| **LCeq** | 63.4 dB |
| **LAeq** | 53.7 dB |
| **LCeq - LAeq** | 9.7 dB |
| **LAIeq** | 55.0 dB |
| **LAeq** | 53.7 dB |
| **LAIeq - LAeq** | 1.3 dB |

| | A | | C | | Z | |
|---|---|---|---|---|---|---|
| | dB | Time Stamp | dB | Time Stamp | dB | Time Stamp |
| **Leq** | 53.7 | | 63.4 | | | |
| **Ls(max)** | 67.0 | 2025/04/22 11:37:18 | | | | |
| **Ls(min)** | 48.1 | 2025/04/22 11:43:30 | | | | |
| **Lpk(max)** | 84.1 | 2025/04/22 11:29:04 | | | | |

| | |
|---|---|
| **Overload Count** | 0 |
| **Overload Duration** | 0.0 s |

## Dose Settings

| | | |
|---|---|---|
| **Dose Name** | OSHA-1 | OSHA-2 |
| **Exchange Rate** | 5 | 5 dB |
| **Threshold** | 90 | 80 dB |
| **Criterion Level** | 90 | 90 dB |
| **Criterion Duration** | 8 | 8 h |

## Results

| | | |
|---|---|---|
| **Dose** | -99.94 | -99.94 % |
| **Projected Dose** | -99.94 | -99.94 % |
| **TWA (Projected)** | -99.94 | -99.94 dB |
| **TWA (t)** | -99.94 | -99.94 dB |
| **Lep (t)** | 38.7 | 38.7 dB |

## Ln Percentiles

| | |
|---|---|
| **LA 1.00** | 64.2 dB |
| **LA 10.00** | 55.6 dB |
| **LA 25.00** | 51.8 dB |
| **LA 50.00** | 50.4 dB |
| **LA 90.00** | 48.9 dB |
| **LA 99.00** | 48.5 dB |

## Calibration History

| Preamp | Date | dB re 1V/Pa | mV/Pa |
|---|---|---|---|
| **PRMLxT1L** | 2025-04-22 11:44:46 | -29.06 | 35.22 |
| **PRMLxT1L** | 2025-04-22 11:26:46 | -29.09 | 35.12 |
| **PRMLxT1L** | 2025-04-22 11:16:34 | -29.04 | 35.32 |
| **PRMLxT1L** | 2025-04-22 10:21:29 | -29.06 | 35.22 |
| **PRMLxT1L** | 2025-04-22 04:43:29 | -29.02 | 35.39 |
| **PRMLxT1L** | 2024-12-04 11:37:32 | -29.12 | 34.98 |
| **PRMLxT1L** | 2024-12-04 11:14:35 | -29.08 | 35.16 |
| **PRMLxT1L** | 2024-12-04 10:47:29 | -29.14 | 34.90 |
| **PRMLxT1L** | 2024-12-04 10:25:53 | -29.11 | 35.03 |
| **PRMLxT1L** | 2024-12-04 09:53:48 | -29.04 | 35.32 |
| **PRMLxT1L** | 2024-12-04 09:29:05 | -29.00 | 35.47 |

# Noise Appendix

## Field Sheets

# FIELD NOISE MEASUREMENT DATA

PROJECT: UCB Moffett PROJ. #

**SITE IDENTIFICATION:** ST 1
ADDRESS:
START DATE / TIME: 4/22/25
OBSERVER(S): SCHUMAKER / HARTFELDER
END DATE / TIME: 4/22/25

**METEROLOGICAL CONDITIONS:**
TEMP: 70 °F HUMIDITY: 57.9 %R.H. WIND: **CALM LIGHT MODERATE VARIABLE**
WINDSPEED: 1.1 MPH DIR: **N NE E SE S SW W NW** **STEADY GUSTY**
SKY: **SUNNY CLEAR OVRCST PRTLY CLOUDY FOG RAIN** OTHER:

**ACOUSTIC MEASUREMENTS:**
INSTRUMENT: LXT 4004 TYPE: 1 2 SERIAL #: 4004
CALIBRATOR: CAL 200 4593 SERIAL #: 4593
CALIBRATION CHECK: PRE-TEST 114.0 dBA SPL POST-TEST dBA SPL WINDSCREEN ✓
SETTINGS: **A-WEIGHTED SLOW FAST FRONTAL RANDOM ANSI** OTHER:

| REC # | START | END | $L_{eq}$ | $L_{max}$ | $L_1$ | $L_{10}$ | $L_{25}$ | $L_{50}$ | $L_{90}$ | $L_{99}$ | $L_{min}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 133 | 10:34 | 10:49 | 51.4 | 64.2 | 61.5 | 53.4 | 50.7 | 48.8 | 46.9 | 46.2 | 45.7 |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

COMMENTS:

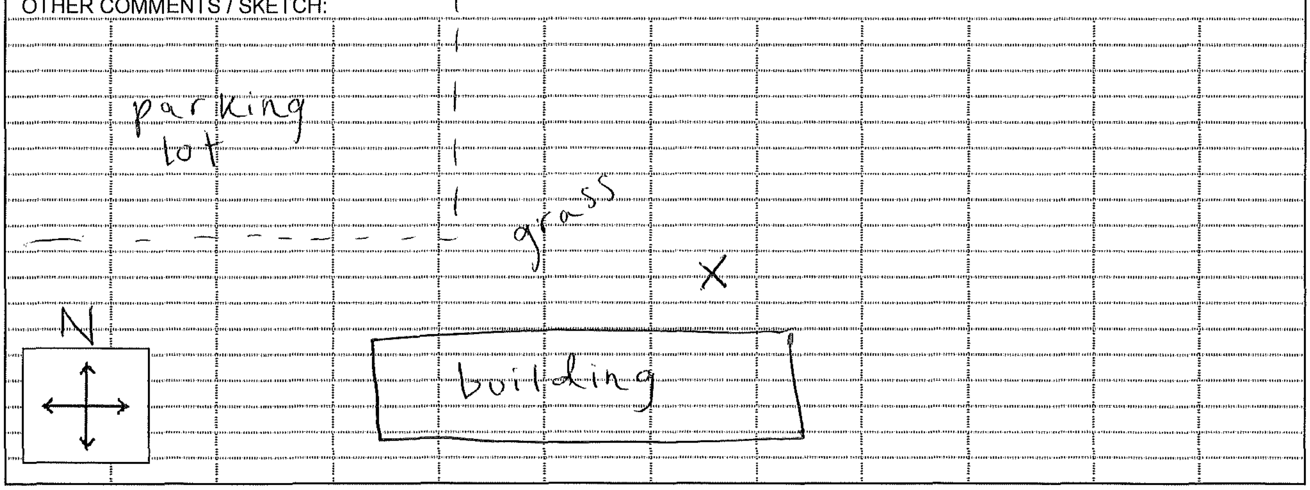
**SOURCE INFO AND TRAFFIC COUNTS:**
PRIMARY NOISE SOURCE: **TRAFFIC AIRCRAFT RAIL INDUSTRIAL AMBIENT OTHER:** distant construction
ROADWAY TYPE:
TRAFFIC COUNT DURATION: ___-MIN SPEED #2 COUNT SPEED

| | NB / EB | SB / WB | NB / EB | SB / WB | NB / EB | SB / WB | NB / EB | SB / WB |
|---|---|---|---|---|---|---|---|---|
| AUTOS: | | | | | | | | |
| MED. TRUCKS: | | | | | | | | |
| HVY TRUCKS: | | | | | | | | |
| BUSES: | | | | | | | | |
| MOTORCYCLES: | | | | | | | | |

SPEED ESTIMATED BY: RADAR / DRIVING / OBSERVER

OTHER SOURCES: **DIST. AIRCRAFT / RUSTLING LEAVES / DIST. BARKING DOGS / BIRDS / DIST. INDUSTRIAL DIST. CHILDREN PLAYING / DIST. TRAFFIC / DIST. LANDSCAPING ACTIVITIES / OTHER:**

**DESCRIPTION / SKETCH:**
TERRAIN: **HARD SOFT MIXED FLAT OTHER:**
PHOTOS:
OTHER COMMENTS / SKETCH:



# NOISE MEASUREMENT LOG SHEET (20)

Jones & Stokes

PROJECT NAME: UCB Moffett

PROJECT #:

SITE NUMBER: ST 1

DATE/TIME:

LOCATION/ADDRESS:

ENGINEERS:

| # | Minute Starting | Measured Leq (dBA) | O or X | Autos | Medium Trucks | Heavy Trucks | Other Noise Sources/Comments (include SLM equipment, Calibration Data) | |
|---|---|---|---|---|---|---|---|---|
| 1 | 10:34 | | | | | | | |
| 2 | 10:35 | | | | | | | |
| 3 | 10:36 | | | | | | | |
| 4 | 10:37 | | | | | | | |
| 5 | 10:38 | | | | | | | |
| 6 | 10:39 | | | | | | plane flying over | |
| 7 | 10:40 | | | | | | | |
| 8 | 10:41 | | | | | | | |
| 9 | 10:42 | | | | | | | |
| 10 | 10:43 | | | | | | | |
| 11 | 10:44 | | | | | | | |
| 12 | 10:45 | | | | | | | |
| 13 | 10:46 | | | | | | | |
| 14 | 10:47 | | | | | | | Leq |
| 15 | 10:48 | | | | | | plane flying over | Lmax |
| 16 | | | | | | | | Lmin |
| 17 | | | | | | | | L10 |
| 18 | | | | | | | | L33 |
| 19 | | | | | | | | L50 |
| 20 | | | | | | | | L90 |

Overall Leq (Include "O" minutes, Exclude "X" minutes) = dBA

Subset Leq (Exclude "O" and "X" minutes) = dBA

*"O" = other characteristic sources that contributed to the Leq*

*"X" = exclude from Leq calculation; a non-typical source contaminated the measurement*

# FIELD NOISE MEASUREMENT DATA

PROJECT: UCB Moffett PROJ. #

**SITE IDENTIFICATION:** ST-2 OBSERVER(S): Schumaker N
ADDRESS: Carnegie Mellon University, Silicon Valley
START DATE / TIME: 20250424 10:52 END DATE / TIME:

**METEROLOGICAL CONDITIONS:**
TEMP: 54.9 °F HUMIDITY: 70.9 %R.H. WIND: **(CALM)** **LIGHT** **MODERATE** **VARIABLE**
WINDSPEED: 1.4 MPH DIR: **N** **NE** **E** **SE** **S** **SW** **(W)** **NW** **STEADY** **GUSTY**
SKY: **SUNNY** **CLEAR** **(OVRCST)** **PRTLY CLOUDY** **FOG** **RAIN** **OTHER:**

**ACOUSTIC MEASUREMENTS:**
INSTRUMENT: LD LxT TYPE: (1) **2** SERIAL #: 4004
CALIBRATOR: LD CAL200 SERIAL #: 4593
CALIBRATION CHECK, BEFORE: 114.0 AFTER 113.92 WINDSCREEN ✓

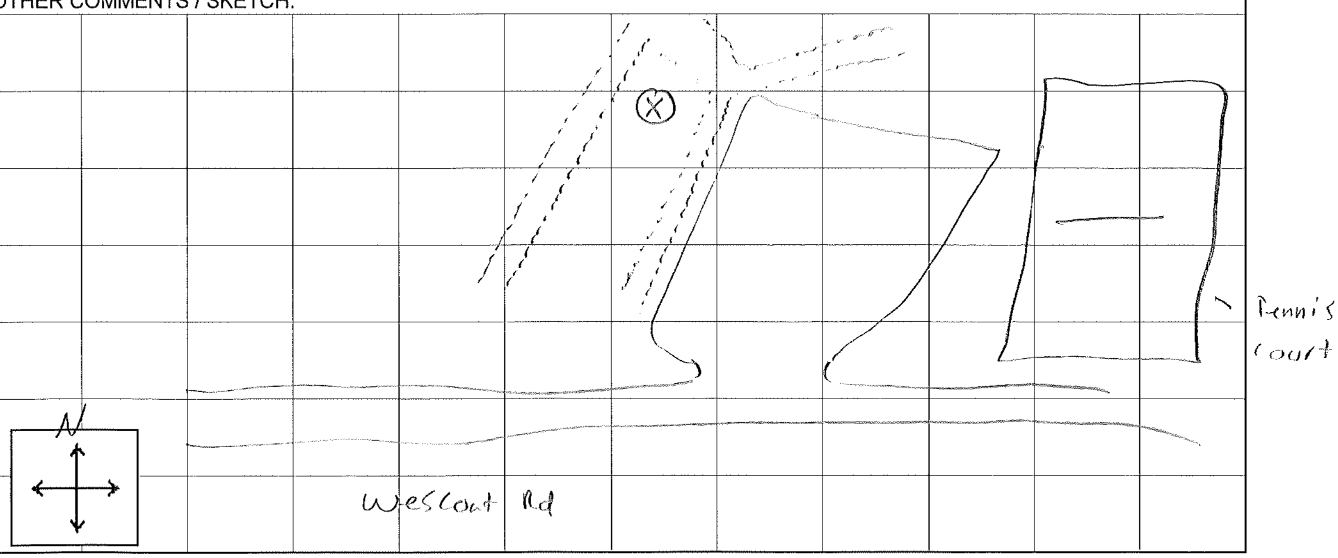
SETTINGS: **A-WEIGHTED** **SLOW** **FAST** **FRONTAL** **RANDOM** **ANSI** **OTHER:**

| FILE / MEAS # | START TIME | END TIME | $L_{eq}$ | max | L 1 (~~1.67~~) | L 10 (~~8.33~~) | L 25 | L 50 | L 90 | L 99 | min |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lx1_data. 137 | 10:52 | 11:08 | 52.4 | 60.6 | 55.2 | 53.7 | 52.9 | 52.2 | 51.1 | 50.4 | 49.7 |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

COMMENTS:

**NOISE SOURCE INFO:**
PRIMARY NOISE SOURCE: **(TRAFFIC)** **AIRCRAFT** **RAIL** **INDUSTRIAL** **(AMBIENT)** **OTHER:**
ROADWAY TYPE:
OTHER SOURCES: **DIST. AIRCRAFT / RUSTLING LEAVES / DIST. BARKING DOGS / (BIRDS) / DIST. INDUSTRIAL**
**DIST. CHILDREN PLAYING / DIST. TRAFFIC / DIST. LANDSCAPING ACTIVITIES / OTHER:**

**DESCRIPTION / SKETCH:**
TERRAIN: **HARD** **SOFT** **(MIXED)** **(FLAT)** **OTHER:**
PHOTOS:
OTHER COMMENTS / SKETCH:




Run #2

# FIELD NOISE MEASUREMENT DATA

PROJECT: ______ PROJ. # ______

| | | | |
|---|---|---|---|
| **SITE IDENTIFICATION:** | ST-2 | OBSERVER(S): | Schumaker |
| ADDRESS: | Carnegie Melon | | |
| START DATE / TIME: | 20250424 10:53 | END DATE / TIME: | 11:08 |

**Short-Term Observations** Minute by Minute

| # | Starting Minute | Noise Sources/Comments (pauses, stops, significant events) |
|---|---|---|
| 0 | 10:53 | |
| 1 | 10:54 | car door close and car lock Beep |
| 2 | 10:55 | |
| 3 | 10:56 | |
| 4 | 10:57 | Spray/compressed air [illegible] for tennis courts |
| 5 | 10:58 | |
| 6 | 10:59 | distant hammers -> tennis courts? |
| 7 | 11:00 | |
| 8 | 1101 | |
| 9 | 11:02 | |
| 10 | 11:03 | |
| 11 | 11:04 | Crows 3 instances |
| 12 | 11:05 | |
| 13 | 11:06 | |
| 14 | 11:07 | |
| 15 | | |
| 16 | | |
| 17 | | * Sources throughout : highway, traffic, birds |
| 18 | | |
| 19 | | |

**Simplified Caltrans Traffic Counts:** For use with clickable traffic counters

| # | ROADWAY SEGMENT | TRAFFIC DIRECTION (NB, SB, etc) | AUTO | MT | HT | BUS | MC |
|---|---|---|---|---|---|---|---|
| 1 | | | | | | | |
| | | | | | | | |
| 2 | | | | | | | |
| | | | | | | | |
| 3 | | | | | | | |
| | | | | | | | |
| 4 | | | | | | | |
| | | | | | | | |

run #2

# FIELD NOISE MEASUREMENT DATA

PROJECT: UCB Moffett    PROJ. #

**SITE IDENTIFICATION:** ST 3    OBSERVER(S): SCHUMAKER/HARTFELDER
ADDRESS:
START DATE / TIME:    END DATE / TIME:

**METEROLOGICAL CONDITIONS:**
TEMP: 69.4 °F    HUMIDITY: 61.0 %R.H.    WIND: CALM (LIGHT) MODERATE VARIABLE
WINDSPEED: 1.9 MPH    DIR: N NE (E) SE S SW W NW    STEADY GUSTY
SKY: (SUNNY) (CLEAR) OVRCST PRTLY CLOUDY FOG RAIN OTHER:

**ACOUSTIC MEASUREMENTS:**
INSTRUMENT: LXT    TYPE: (1) 2    SERIAL #: 4004
CALIBRATOR: Cal 200    SERIAL #: 4593
CALIBRATION CHECK, BEFORE: 114.0 AFTER 114.02 WINDSCREEN ✓

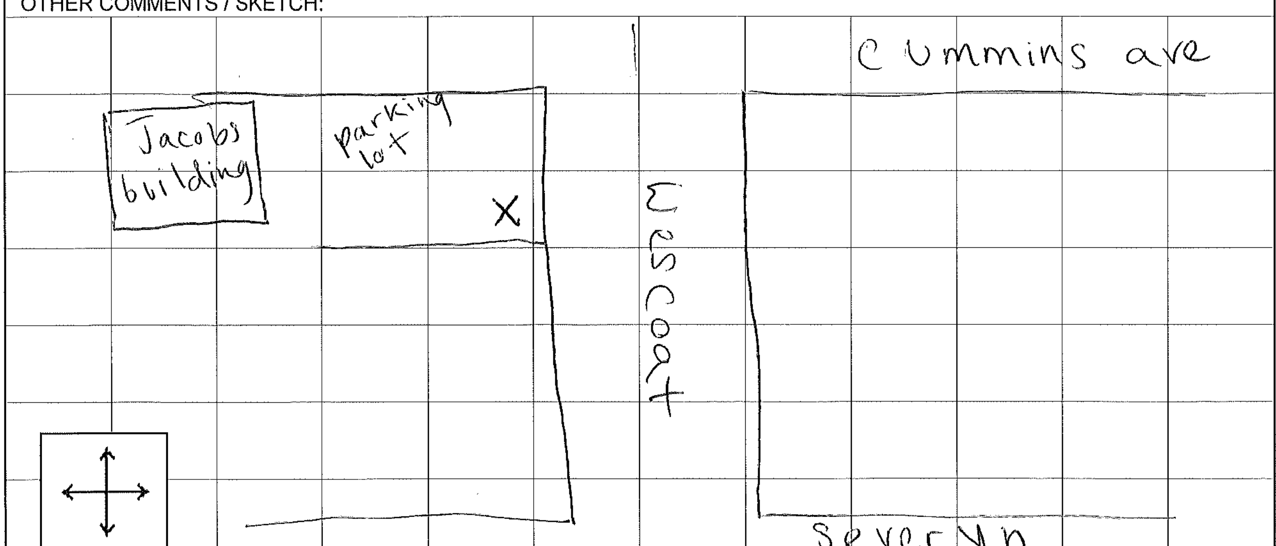
SETTINGS: (A-WEIGHTED) (SLOW) FAST FRONTAL RANDOM ANSI OTHER:

| FILE / MEAS # | START TIME | END TIME | $L_{eq}$ | max | L 1 (~~1.67~~) | L 10 (~~8.33~~) | L 25 | L 50 | L 90 | L 99 | min |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 135 | 11:29 | 11:45 | 53.7 | 67.0 | 64.2 | 55.6 | 51.8 | 50.4 | 48.9 | ~~48.8~~ 48.5 | 48.1 |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

COMMENTS:

**NOISE SOURCE INFO:**
PRIMARY NOISE SOURCE: (TRAFFIC) (AIRCRAFT) RAIL INDUSTRIAL (AMBIENT) (OTHER): mech. equipment → HVAC, exhaust fans
ROADWAY TYPE:
OTHER SOURCES: DIST. AIRCRAFT / RUSTLING LEAVES / DIST. BARKING DOGS / BIRDS / DIST. INDUSTRIAL
DIST. CHILDREN PLAYING / DIST. TRAFFIC / DIST. LANDSCAPING ACTIVITIES / OTHER:

**DESCRIPTION / SKETCH:**
TERRAIN: (HARD) SOFT MIXED (FLAT) OTHER:
PHOTOS:
OTHER COMMENTS / SKETCH:



FIELD NOISE MEASUREMENT DATA

PROJECT: UCB Moffett PROJ. #

| | | | |
|---|---|---|---|
| **SITE IDENTIFICATION:** | ST 3 | OBSERVER(S): | SCHUMAKER / HARTFELDER |
| ADDRESS: | | | |
| START DATE / TIME: | 4/22/25 11:29 AM | END DATE / TIME: | 4/22/25 11:45AM |

**Short-Term Observations** — Minute by Minute

| # | Starting Minute | Noise Sources/Comments (pauses, stops, significant events) |
|---|---|---|
| 0 | 11:29 | |
| 1 | 11:30 | truck passes by |
| 2 | 11:31 | car passes by / some engine running (AC) |
| 3 | 11:32 | |
| 4 | 11:33 | car passes by |
| 5 | 11:34 | |
| 6 | 11:35 | car passes by / pedestrians |
| 7 | 11:36 | car passes by + aircraft overhead |
| 8 | 11:37 | cars |
| 9 | 11:38 | cars / trucks |
| 10 | 11:39 | |
| 11 | 11:40 | |
| 12 | 11:41 | cars |
| 13 | 11:42 | |
| 14 | 11:43 | |
| 15 | 11:44 | car starting nearby |
| 16 | | |
| 17 | | |
| 18 | | |
| 19 | | |

**Simplified Caltrans Traffic Counts:** For use with clickable traffic counters

| # | ROADWAY SEGMENT | TRAFFIC DIRECTION (NB, SB, etc) | AUTO | MT | HT | BUS | MC |
|---|---|---|---|---|---|---|---|
| 1 | | | | | | | |
| 2 | | | | | | | |
| 3 | | | | | | | |
| 4 | | | | | | | |

# Noise Appendix

# Field Photographs

## Noise Measurement Photographs

| | |
|---|---|
| <br>LT-1 Looking South | <br>LT-1 Looking West |

**Noise Measurement Photographs**

| | |
|---|---|
| <br>LT-2 Looking South | <br>LT-2 Looking West |

## Noise Measurement Photographs

LT-3 Looking North (off campus)


LT-3 Looking West (off campus)

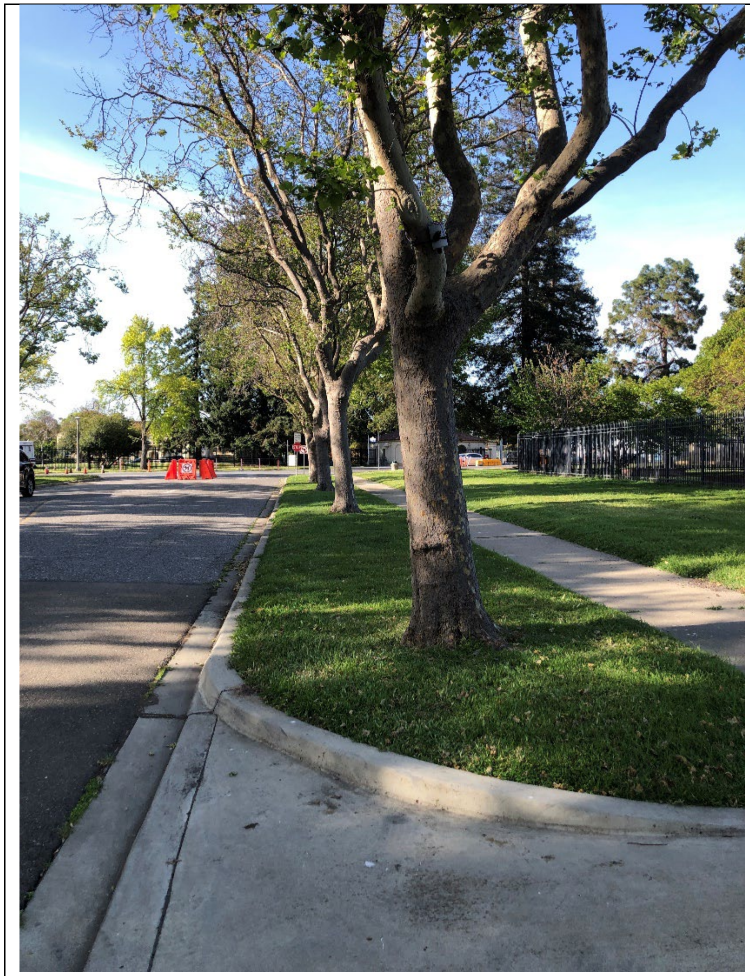
## Noise Measurement Photographs

| | |
|---|---|
|  LT-4 Looking South |  LT-4 Looking West |

**Noise Measurement Photographs**

| | |
|---|---|
| <br>LT-5 Looking South | <br><br>LT-5 Looking West |

**Noise Measurement Photographs**

| | |
|---|---|
| <br>LT-6 Looking South | <br>LT-6 Looking West |

**Noise Measurement Photographs**


LT-7 Looking South


LT-7 Looking West

## Noise Measurement Photographs

| | |
|---|---|
| <br>ST-1 Looking South | <br>ST-1 Looking West |

## Noise Measurement Photographs

ST-2 Looking South

ST-2 Looking West

# Noise Measurement Photographs

| | |
|---|---|
|  ST-3 Looking South |  ST-3 Looking West |

# UC Berkeley Space Center

Modeling Files

# Construction Noise Modeling

**Table 1. Detailed Construction Noise Analysis, Build Alternative 1, Phase 1 Construction Noise Level Summary, by Sub-Phase**

| | | Noise Level (dBA Leq) at Various Distances (feet) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Phase Description 1** | **Distance (ft)** | **15** | **25** | **50** | **100** | **200** | **300** | **400** | **500** | **600** | **700** | **800** | **900** | **1000** |
| Phase 1-A : Buildings (All) - Site Preparation | Noise Level By Phase, at Various Distance | -- | -- | 87 | 81 | 75 | 71 | 69 | 67 | 65 | 64 | 63 | 62 | 61 |
| Phase 1-B : Buildings (All) - Grading | | -- | -- | 87 | 81 | 75 | 71 | 69 | 67 | 65 | 64 | 63 | 62 | 61 |
| Phase 1-C : Buildings (All) - Demolition | | -- | -- | 93 | 87 | 81 | 77 | 75 | 73 | 71 | 70 | 69 | 68 | 67 |
| Phase1-D-1-A : Buildings Vertical Construction - Research Building #3 Foundations | | -- | -- | 83 | 77 | 71 | 68 | 65 | 63 | 62 | 60 | 59 | 58 | 57 |
| Phase 1-D-1-B : Buildings Vertical Construction - Research Building #3 Trenching | | -- | -- | 86 | 80 | 74 | 70 | 68 | 66 | 64 | 63 | 62 | 61 | 60 |
| Phase 1-D-1-C : Buildings Vertical Construction - Research Building #3 Core and Shell | | -- | -- | 84 | 78 | 72 | 68 | 66 | 64 | 62 | 61 | 60 | 59 | 58 |
| Phase 1-D-2-A : Buildings Vertical Construction - Research Building #4 Foundations | | -- | -- | 83 | 77 | 71 | 68 | 65 | 63 | 62 | 60 | 59 | 58 | 57 |
| Phase 1-D-2-B : Buildings Vertical Construction - Research Building #4 Trenching | | -- | -- | 86 | 80 | 74 | 70 | 68 | 66 | 64 | 63 | 62 | 61 | 60 |
| Phase 1-D-2-C : Buildings Vertical Construction - Research Building #4 Core and Shell | | -- | -- | 84 | 78 | 72 | 68 | 66 | 64 | 62 | 61 | 60 | 59 | 58 |
| Phase 1-E-1 : Buildings Architectural Coating - Research Building #3 | | -- | -- | 81 | 75 | 69 | 65 | 63 | 61 | 59 | 58 | 57 | 56 | 55 |
| Phase 1-E-2 : Buildings Architectural Coating - Research Building #4 | | -- | -- | 81 | 75 | 69 | 65 | 63 | 61 | 59 | 58 | 57 | 56 | 55 |
| Phase 1-F : Utilities/Roads - Grubbing and Land Clearing | | 98 | 94 | 88 | 82 | 76 | 72 | 70 | 68 | 66 | 65 | 64 | 63 | 62 |
| Phase 1-G : Utilities/Roads - Excavation | | 102 | 97 | 91 | 85 | 79 | 76 | 73 | 71 | 70 | 68 | 67 | 66 | 65 |
| Phase 1-H : Utilities/Roads - Drainage and Subgrade | | 102 | 97 | 91 | 85 | 79 | 76 | 73 | 71 | 70 | 68 | 67 | 66 | 65 |
| Phase 1-I : Utilities/Roads - Paving | | 98 | 94 | 88 | 82 | 76 | 72 | 70 | 68 | 66 | 65 | 64 | 63 | 62 |
| Phase 1-J : Surface Parking - Grading | | -- | -- | 88 | 82 | 76 | 72 | 70 | 68 | 66 | 65 | 64 | 63 | 62 |
| Phase 1-K : Surface Parking - Site Preparation | | -- | -- | 88 | 82 | 76 | 72 | 70 | 68 | 66 | 65 | 64 | 63 | 62 |
| Phase 1-L : Surface Parking - Paving | | -- | -- | 88 | 82 | 76 | 72 | 70 | 68 | 66 | 65 | 64 | 63 | 62 |

Construction Data for Build Alternative 2 is Identical to construction data for Design Alternative 1.

**Table 2. Detailed Construction Noise Analysis, Build Alternative 1, Phase 2 Construction Noise Level Summary, by Sub-Phase**

| | | Noise Level (dBA Leq) at Various Distances (feet) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Phase Description** | **Distance (ft)** | **15** | **25** | **50** | **100** | **200** | **300** | **400** | **500** | **600** | **700** | **800** | **900** | **1000** |
| Phase 2-A : Buildings (All) - Site Preparation | Noise Level By Phase, at Various Distance | -- | -- | 87 | 81 | 75 | 71 | 69 | 67 | 65 | 64 | 63 | 62 | 61 |
| Phase 2-B : Buildings (All) - Grading | | -- | -- | 87 | 81 | 75 | 71 | 69 | 67 | 65 | 64 | 63 | 62 | 61 |
| Phase 2-C : Buildings (All) - Demolition | | -- | -- | 93 | 87 | 81 | 77 | 75 | 73 | 71 | 70 | 69 | 68 | 67 |
| Phase 2-D-1-A : Buildings Vertical Construction - Research Building #1 Foundations | | -- | -- | 83 | 77 | 71 | 68 | 65 | 63 | 62 | 60 | 59 | 58 | 57 |
| Phase 2-D-1-B : Buildings Vertical Construction - Research Building #1 Trenching | | -- | -- | 86 | 80 | 74 | 70 | 68 | 66 | 64 | 63 | 62 | 61 | 60 |
| Phase 2-D-1-C : Buildings Vertical Construction - Research Building #1 Core and Shell | | -- | -- | 84 | 78 | 72 | 68 | 66 | 64 | 62 | 61 | 60 | 59 | 58 |
| Phase 2-D-2-A : Buildings Vertical Construction - Research Building #5 Foundations | | -- | -- | 83 | 77 | 71 | 68 | 65 | 63 | 62 | 60 | 59 | 58 | 57 |
| Phase 2-D-2-B : Buildings Vertical Construction - Research Building #5 Trenching | | -- | -- | 86 | 80 | 74 | 70 | 68 | 66 | 64 | 63 | 62 | 61 | 60 |
| Phase 2-D-2-C : Buildings Vertical Construction - Research Building #5 Core and Shell | | -- | -- | 84 | 78 | 72 | 68 | 66 | 64 | 62 | 61 | 60 | 59 | 58 |
| Phase 2-E-1 : Buildings Architectural Coating - Research Building #1 | | -- | -- | 81 | 75 | 69 | 65 | 63 | 61 | 59 | 58 | 57 | 56 | 55 |
| Phase 2-E-2 : Buildings Architectural Coating - Research Building #5 | | -- | -- | 81 | 75 | 69 | 65 | 63 | 61 | 59 | 58 | 57 | 56 | 55 |
| Phase 2-F-1-A : Buildings Vertical Construction - Conference/Hotel Foundations | | -- | -- | 83 | 77 | 71 | 68 | 65 | 63 | 62 | 60 | 59 | 58 | 57 |
| Phase 2-F-1-B : Buildings Vertical Construction - Conference/Hotel Trenching | | -- | -- | 86 | 80 | 74 | 70 | 68 | 66 | 64 | 63 | 62 | 61 | 60 |
| Phase 2-F-1-C : Buildings Vertical Construction - Conference/Hotel Core and Shell | | -- | -- | 84 | 78 | 72 | 68 | 66 | 64 | 62 | 61 | 60 | 59 | 58 |
| Phase 2-G : Buildings Architectural Coating - Conference/Hotel | | -- | -- | 81 | 75 | 69 | 65 | 63 | 61 | 59 | 58 | 57 | 56 | 55 |
| Phase 2-H-1-A : Buildings Vertical Construction - Active Use #13 Foundations | | -- | -- | 83 | 77 | 71 | 68 | 65 | 63 | 62 | 60 | 59 | 58 | 57 |
| Phase 2-H-1-B : Buildings Vertical Construction - Active Use #13 Trenching | | -- | -- | 86 | 80 | 74 | 70 | 68 | 66 | 64 | 63 | 62 | 61 | 60 |
| Phase 2-H-1-C : Buildings Vertical Construction - Active Use #13 Core and Shell | | -- | -- | 84 | 78 | 72 | 68 | 66 | 64 | 62 | 61 | 60 | 59 | 58 |
| Phase 2-H-2-A : Buildings Vertical Construction - Active Use #14 Foundations | | -- | -- | 83 | 77 | 71 | 68 | 65 | 63 | 62 | 60 | 59 | 58 | 57 |
| Phase 2-H-2-B : Buildings Vertical Construction - Active Use #14 Trenching | | -- | -- | 86 | 80 | 74 | 70 | 68 | 66 | 64 | 63 | 62 | 61 | 60 |
| Phase 2-H-2-C : Buildings Vertical Construction - Active Use #14 Core and Shell | | -- | -- | 84 | 78 | 72 | 68 | 66 | 64 | 62 | 61 | 60 | 59 | 58 |
| Phase 2-I :Buildings Architectual Coating - Active Use | | -- | -- | 81 | 75 | 69 | 65 | 63 | 61 | 59 | 58 | 57 | 56 | 55 |
| Phase 2-J : Utilities/Roads - Grubbing and Land Clearing | | 98 | 94 | 88 | 82 | 76 | 72 | 70 | 68 | 66 | 65 | 64 | 63 | 62 |
| Phase 2-K : Utilities/Roads - Excavation | | 102 | 97 | 91 | 85 | 79 | 76 | 73 | 71 | 70 | 68 | 67 | 66 | 65 |
| Phase 2-L : Utilities/Roads - Drainage and Subgrade | | 102 | 97 | 91 | 85 | 79 | 76 | 73 | 71 | 70 | 68 | 67 | 66 | 65 |
| Phase 2-M : Utilities/Roads - Paving | | 98 | 94 | 88 | 82 | 76 | 72 | 70 | 68 | 66 | 65 | 64 | 63 | 62 |
| Phase 2-N : Surface Parking - Grading | | -- | -- | 88 | 82 | 76 | 72 | 70 | 68 | 66 | 65 | 64 | 63 | 62 |
| Phase 2-O : Surface Parking - Site Preparation | | -- | -- | 88 | 82 | 76 | 72 | 70 | 68 | 66 | 65 | 64 | 63 | 62 |
| Phase 2-P : Surface Parking - Paving | | -- | -- | 88 | 82 | 76 | 72 | 70 | 68 | 66 | 65 | 64 | 63 | 62 |

Construction Data for Build Alternative 2 is Identical to construction data for Design Alternative 1.

**Table 3. Detailed Construction Noise Analysis, Build Alternative 1, Phase 3 Construction Noise Level Summary, by Sub-Phase**

| | | Noise Level (dBA Leq) at Various Distances (feet) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Phase Description** | **Distance (ft)** | **15** | **25** | **50** | **100** | **200** | **300** | **400** | **500** | **600** | **700** | **800** | **900** | **1000** |
| Phase 3-A : Buildings (All) - Site Preparation | Noise Level By Phase, at Various Distance | -- | -- | 87 | 81 | 75 | 71 | 69 | 67 | 65 | 64 | 63 | 62 | 61 |
| Phase 3-B : Buildings (All) - Grading | | -- | -- | 87 | 81 | 75 | 71 | 69 | 67 | 65 | 64 | 63 | 62 | 61 |
| Phase 3-C : Buildings (All) - Demolition | | -- | -- | 93 | 87 | 81 | 77 | 75 | 73 | 71 | 70 | 69 | 68 | 67 |
| Phase 3-D-1-A : Buildings Vertical Construction - Research Building #7 Foundations | | -- | -- | 83 | 77 | 71 | 68 | 65 | 63 | 62 | 60 | 59 | 58 | 57 |
| Phase 3-D-1-B : Buildings Vertical Construction - Research Building #7 Trenching | | -- | -- | 86 | 80 | 74 | 70 | 68 | 66 | 64 | 63 | 62 | 61 | 60 |
| Phase 3-D-1-C : Buildings Vertical Construction - Research Building #7 Core and Shell | | -- | -- | 84 | 78 | 72 | 68 | 66 | 64 | 62 | 61 | 60 | 59 | 58 |
| Phase 3-D-2-A : Buildings Vertical Construction - Research Building #8 Foundations | | -- | -- | 83 | 77 | 71 | 68 | 65 | 63 | 62 | 60 | 59 | 58 | 57 |
| Phase 3-D-2-B : Buildings Vertical Construction - Research Building #8 Trenching | | -- | -- | 86 | 80 | 74 | 70 | 68 | 66 | 64 | 63 | 62 | 61 | 60 |
| Phase 3-D-2-C : Buildings Vertical Construction - Research Building #8 Core and Shell | | -- | -- | 84 | 78 | 72 | 68 | 66 | 64 | 62 | 61 | 60 | 59 | 58 |
| Phase 3-E-1 : Buildings Architectural Coating - Research Building #7 | | -- | -- | 81 | 75 | 69 | 65 | 63 | 61 | 59 | 58 | 57 | 56 | 55 |
| Phase 3-E-2 : Buildings Architectural Coating - Research Building #8 | | -- | -- | 81 | 75 | 69 | 65 | 63 | 61 | 59 | 58 | 57 | 56 | 55 |
| Phase 3-F : Utilities/Roads - Grubbing and Land Clearing | | 98 | 94 | 88 | 82 | 76 | 72 | 70 | 68 | 66 | 65 | 64 | 63 | 62 |
| Phase 3-G : Utilities/Roads - Excavation | | 102 | 97 | 91 | 85 | 79 | 76 | 73 | 71 | 70 | 68 | 67 | 66 | 65 |
| Phase 3-H : Utilities/Roads - Drainage and Subgrade | | 102 | 97 | 91 | 85 | 79 | 76 | 73 | 71 | 70 | 68 | 67 | 66 | 65 |
| Phase 3-I : Utilities/Roads - Paving | | 98 | 94 | 88 | 82 | 76 | 72 | 70 | 68 | 66 | 65 | 64 | 63 | 62 |
| Phase 3-J : Parking Structure - Grading | | -- | -- | 87 | 81 | 75 | 71 | 69 | 67 | 65 | 64 | 63 | 62 | 61 |
| Phase 3-K : Parking Structure - Site Preparation | | -- | -- | 87 | 81 | 75 | 71 | 69 | 67 | 65 | 64 | 63 | 62 | 61 |
| Phase 3-L : Parking Structure - Building Construction | | -- | -- | 84 | 78 | 72 | 68 | 66 | 64 | 62 | 61 | 60 | 59 | 58 |
| Phase 3-M : Parking Structure - Building Coatings | | -- | -- | 78 | 72 | 66 | 62 | 60 | 58 | 56 | 55 | 54 | 53 | 52 |
| Phase 3-N : Parking Structure - Paving | | -- | -- | 83 | 77 | 70 | 67 | 64 | 63 | 61 | 60 | 58 | 57 | 57 |
| Phase 3-O : Surface Parking - Grading | | -- | -- | 88 | 82 | 76 | 72 | 70 | 68 | 66 | 65 | 64 | 63 | 62 |
| Phase 3-P : Surface Parking - Site Preparation | | -- | -- | 88 | 82 | 76 | 72 | 70 | 68 | 66 | 65 | 64 | 63 | 62 |
| Phase 3-Q : Surface Parking - Paving | | -- | -- | 88 | 82 | 76 | 72 | 70 | 68 | 66 | 65 | 64 | 63 | 62 |

Construction Data for Build Alternative 2 is Identical to construction data for Design Alternative 1.

**Table 4. Detailed Construction Noise Analysis, Build Alternative 1, Phase 4 Construction Noise Level Summary, by Sub-Phase**

| | | Noise Level (dBA Leq) at Various Distances (feet) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Phase Description** | **Distance (ft)** | **15** | **25** | **50** | **100** | **200** | **300** | **400** | **500** | **600** | **700** | **800** | **900** | **1000** |
| Phase 4-A : Buildings (All) - Site Preparation | Noise Level By Phase, at Various Distance | -- | -- | 87 | 81 | 75 | 71 | 69 | 67 | 65 | 64 | 63 | 62 | 61 |
| Phase 4-B : Buildings (All) - Grading | | -- | -- | 87 | 81 | 75 | 71 | 69 | 67 | 65 | 64 | 63 | 62 | 61 |
| Phase 4-C : Buildings (All) - Demolition | | -- | -- | 93 | 87 | 81 | 77 | 75 | 73 | 71 | 70 | 69 | 68 | 67 |
| Phase 4-D-1-A : Buildings Vertical Construction - Research Building #9 Foundations | | -- | -- | 83 | 77 | 71 | 68 | 65 | 63 | 62 | 60 | 59 | 58 | 57 |
| Phase 4-D-1-B : Buildings Vertical Construction - Research Building #9 Trenching | | -- | -- | 86 | 80 | 74 | 70 | 68 | 66 | 64 | 63 | 62 | 61 | 60 |
| Phase 4-D-1-C : Buildings Vertical Construction - Research Building #9 Core and Shell | | -- | -- | 84 | 78 | 72 | 68 | 66 | 64 | 62 | 61 | 60 | 59 | 58 |
| Phase 4-D-2-A : Buildings Vertical Construction - Research Building #10 Foundations | | -- | -- | 83 | 77 | 71 | 68 | 65 | 63 | 62 | 60 | 59 | 58 | 57 |
| Phase 4-D-2-B : Buildings Vertical Construction - Research Building #10 Trenching | | -- | -- | 86 | 80 | 74 | 70 | 68 | 66 | 64 | 63 | 62 | 61 | 60 |
| Phase 4-D-2-C : Buildings Vertical Construction - Research Building #10 Core and Shell | | -- | -- | 84 | 78 | 72 | 68 | 66 | 64 | 62 | 61 | 60 | 59 | 58 |
| Phase 4-E-1 : Buildings Architectural Coatings, Research Building #9 | | -- | -- | 81 | 75 | 69 | 65 | 63 | 61 | 59 | 58 | 57 | 56 | 55 |
| Phase 4-E-2 : Buildings Architectural Coatings, Research Building #10 | | -- | -- | 81 | 75 | 69 | 65 | 63 | 61 | 59 | 58 | 57 | 56 | 55 |
| Phase 4-F-1-A : Buildings Vertical Construction, Residential Foundations | | -- | -- | 83 | 77 | 71 | 68 | 65 | 63 | 62 | 60 | 59 | 58 | 57 |
| Phase 4-F-1-B : Buildings Vertical Construction, Residential Trenching | | -- | -- | 86 | 80 | 74 | 70 | 68 | 66 | 64 | 63 | 62 | 61 | 60 |
| Phase 4-F-1-C : Buildings Vertical Construction, Residential Core and Shell | | -- | -- | 84 | 78 | 72 | 68 | 66 | 64 | 62 | 61 | 60 | 59 | 58 |
| Phase 4-G : Buildings Architectural Coatings - Residential | | -- | -- | 81 | 75 | 69 | 65 | 63 | 61 | 59 | 58 | 57 | 56 | 55 |
| Phase 4-H : Utilities/Roads - Grubbing and Land Clearing | | 98 | 94 | 88 | 82 | 76 | 72 | 70 | 68 | 66 | 65 | 64 | 63 | 62 |
| Phase 4-I : Utilities/Roads - Excavation | | 102 | 97 | 91 | 85 | 79 | 76 | 73 | 71 | 70 | 68 | 67 | 66 | 65 |
| Phase 4-J : Utilities/Roads - Drainage and Subgrade | | 102 | 97 | 91 | 85 | 79 | 76 | 73 | 71 | 70 | 68 | 67 | 66 | 65 |
| Phase 4-K : Utilities/Roads - Paving | | 98 | 94 | 88 | 82 | 76 | 72 | 70 | 68 | 66 | 65 | 64 | 63 | 62 |
| Phase 4-L : Parking Structure - Grading | | -- | -- | 87 | 81 | 75 | 71 | 69 | 67 | 65 | 64 | 63 | 62 | 61 |
| Phase 4-M : Parking Structure - Site Preparation | | -- | -- | 87 | 81 | 75 | 71 | 69 | 67 | 65 | 64 | 63 | 62 | 61 |
| Phase 4-N : Parking Structure - Building Construction | | -- | -- | 84 | 78 | 72 | 68 | 66 | 64 | 62 | 61 | 60 | 59 | 58 |
| Phase 4-O : Parking Structure - Building Coatings | | -- | -- | 78 | 72 | 66 | 62 | 60 | 58 | 56 | 55 | 54 | 53 | 52 |
| Phase 4-P : Parking Structure - Paving | | -- | -- | 83 | 77 | 70 | 67 | 64 | 63 | 61 | 60 | 58 | 57 | 57 |

Construction Data for Build Alternative 2 provided by the Applicant is identical to data used for Design Alternative 1.
Construction Data for Build Alternative 1 - No Student/Faculty Housing Variant is the same as Alterantive 1, except for a slight reduction in ROG emissions during Phase 4. Construction equipment data would not change.
Construction Data for Build Alternative 2 - No Student/Faculty Housing Variant is the same as Alterantive 1, except for a slight reduction in ROG emissions during Phase 4. Construction equipment data would not change.

**Table 5. Detailed Construction Noise Analysis, Build Alternative 1, Water Reuse Facility Option Construction Noise Level Summary, by Sub-Phase**

| Phase Description | Distance (ft) | 15 | 25 | 50 | 100 | 200 | 300 | 400 | 500 | 600 | 700 | 800 | 900 | 1000 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Noise Level (dBA Leq) at Various Distances (feet) | | | | | | | | | | | | |
| Phase WRF-A : Site Preparation | Noise Level By | -- | -- | 87 | 81 | 75 | 71 | 69 | 67 | 65 | 64 | 63 | 62 | 61 |
| Phase WRF-B : Grading | | -- | -- | 87 | 81 | 75 | 71 | 69 | 67 | 65 | 64 | 63 | 62 | 61 |
| Phase WRF-C : Vertical Construction | | -- | -- | 82 | 76 | 70 | 66 | 64 | 62 | 60 | 59 | 58 | 57 | 56 |

Construction noise results for the Water Resuse Facility Option would be in additional to the full Build Alternative 1 build out.

**Table 6. Detailed Construction Noise Analysis, Build Alternative 1, Central Utility Plant Option Construction Noise Level Summary, by Sub-Phase**

| Phase Description | Distance (ft) | 15 | 25 | 50 | 100 | 200 | 300 | 400 | 500 | 600 | 700 | 800 | 900 | 1000 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Noise Level (dBA Leq) at Various Distances (feet) | | | | | | | | | | | | |
| Phase CUP-A : Site Preparation | Noise Level By | -- | -- | 87 | 81 | 75 | 71 | 69 | 67 | 65 | 64 | 63 | 62 | 61 |
| Phase CUP-B : Grading | | -- | -- | 87 | 81 | 75 | 71 | 69 | 67 | 65 | 64 | 63 | 62 | 61 |
| Phase CUP-C : Vertical Construction | | -- | -- | 82 | 76 | 70 | 66 | 64 | 62 | 60 | 59 | 58 | 57 | 56 |

Construction noise results for the Central Utility Plant Option would be in additional to the full Build Alternative 1 build out.

**Table 7. Detailed Construction Noise Analysis, Phase 1-A : Buildings (All) - Site Preparation**

| Source Data: | Maximum Sound Level (dBA) | Utilization Factor | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Tractor - Sound level (dBA) at 50 feet = | 84 | 100% | 84.0 |
| Source 2: Tractor - Sound level (dBA) at 50 feet = | 84 | 100% | 84.0 |
| Calculated Data: | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 87 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 87 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 50 | 0 | 0.0 | 87 | 87 |
| 100 | -6 | 0.0 | 81 | 81 |
| 200 | -12 | 0.0 | 75 | 75 |
| 300 | -16 | 0.0 | 71 | 71 |
| 400 | -18 | 0.0 | 69 | 69 |
| 500 | -20 | 0.0 | 67 | 67 |
| 600 | -22 | 0.0 | 65 | 65 |
| 700 | -23 | 0.0 | 64 | 64 |
| 800 | -24 | 0.0 | 63 | 63 |
| 900 | -25 | 0.0 | 62 | 62 |
| 1000 | -26 | 0.0 | 61 | 61 |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or "Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

Geometric attenuation based on 6 dB per doubling of distance.

Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

**Table 8. Detailed Construction Noise Analysis, Phase 1-B : Buildings (All) - Grading**

| Source Data: | Maximum Sound Level (dBA) | Utilization Factor | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Tractor - Sound level (dBA) at 50 feet = | 84 | 100% | 84.0 |
| Source 2: Tractor - Sound level (dBA) at 50 feet = | 84 | 100% | 84.0 |
| Calculated Data: | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 87 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 87 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 50 | 0 | 0.0 | 87 | 87 |
| 100 | -6 | 0.0 | 81 | 81 |
| 200 | -12 | 0.0 | 75 | 75 |
| 300 | -16 | 0.0 | 71 | 71 |
| 400 | -18 | 0.0 | 69 | 69 |
| 500 | -20 | 0.0 | 67 | 67 |
| 600 | -22 | 0.0 | 65 | 65 |
| 700 | -23 | 0.0 | 64 | 64 |
| 800 | -24 | 0.0 | 63 | 63 |
| 900 | -25 | 0.0 | 62 | 62 |
| 1000 | -26 | 0.0 | 61 | 61 |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or "Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

Geometric attenuation based on 6 dB per doubling of distance.

Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

**Table 9. Detailed Construction Noise Analysis, Phase 1-C : Buildings (All) - Demolition**

| Source Data: | Maximum Sound Level (dBA) | Utilization Factor | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Concrete Saw - Sound level (dBA) at 50 feet = | 90 | 100% | 90.0 |
| Source 2: Concrete Saw - Sound level (dBA) at 50 feet = | 90 | 100% | 90.0 |
| Calculated Data: | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 93 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 93 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 50 | 0 | 0.0 | 93 | 93 |
| 100 | -6 | 0.0 | 87 | 87 |
| 200 | -12 | 0.0 | 81 | 81 |
| 300 | -16 | 0.0 | 77 | 77 |
| 400 | -18 | 0.0 | 75 | 75 |
| 500 | -20 | 0.0 | 73 | 73 |
| 600 | -22 | 0.0 | 71 | 71 |
| 700 | -23 | 0.0 | 70 | 70 |
| 800 | -24 | 0.0 | 69 | 69 |
| 900 | -25 | 0.0 | 68 | 68 |
| 1000 | -26 | 0.0 | 67 | 67 |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or "Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

Geometric attenuation based on 6 dB per doubling of distance.

Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

**Table 10. Detailed Construction Noise Analysis, Phase1-D-1-A : Buildings Vertical Construction - Research Building #3 Foundations**

| Source Data [a]: | Maximum Sound Level (dBA) | Utilization Factor | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Concrete Pump Truck - Sound level (dBA) at 50 feet = | 81 | 100% | 81.0 |
| Source 2: Concrete Mixer Truck - Sound level (dBA) at 50 feet = | 79 | 100% | 79.0 |
| Calculated Data: | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 83 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 83 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 50 | 0 | 0.0 | 83 | 83 |
| 100 | -6 | 0.0 | 77 | 77 |
| 200 | -12 | 0.0 | 71 | 71 |
| 300 | -16 | 0.0 | 68 | 68 |
| 400 | -18 | 0.0 | 65 | 65 |
| 500 | -20 | 0.0 | 63 | 63 |
| 600 | -22 | 0.0 | 62 | 62 |
| 700 | -23 | 0.0 | 60 | 60 |
| 800 | -24 | 0.0 | 59 | 59 |
| 900 | -25 | 0.0 | 58 | 58 |
| 1000 | -26 | 0.0 | 57 | 57 |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or "Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971

2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

[a] Although no off-road equipment is included in the foundations sub-phase, concrete pump trucks and concrete mixer trucks would be used to pour mat foundations and would contribute to on-site construction noise.

Geometric attenuation based on 6 dB per doubling of distance.

Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

**Table 11. Detailed Construction Noise Analysis, Phase 1-D-1-B : Buildings Vertical Construction - Research Building #3 Trenching**

| Source Data: | Maximum Sound Level (dBA) | Utilization Factor | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Compactor (ground) - Sound level (dBA) at 50 feet = | 83 | 100% | 83.0 |
| Source 2: Compactor (ground) - Sound level (dBA) at 50 feet = | 83 | 100% | 83.0 |
| Calculated Data: | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 86 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 86 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 50 | 0 | 0.0 | 86 | 86 |
| 100 | -6 | 0.0 | 80 | 80 |
| 200 | -12 | 0.0 | 74 | 74 |
| 300 | -16 | 0.0 | 70 | 70 |
| 400 | -18 | 0.0 | 68 | 68 |
| 500 | -20 | 0.0 | 66 | 66 |
| 600 | -22 | 0.0 | 64 | 64 |
| 700 | -23 | 0.0 | 63 | 63 |
| 800 | -24 | 0.0 | 62 | 62 |
| 900 | -25 | 0.0 | 61 | 61 |
| 1000 | -26 | 0.0 | 60 | 60 |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or "Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

Geometric attenuation based on 6 dB per doubling of distance.

Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

**Table 12. Detailed Construction Noise Analysis, Phase 1-D-1-C : Buildings Vertical Construction - Research Building #3 Core and Shell**

| Source Data: | Maximum Sound Level (dBA) | Utilization Factor | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Crane - Sound level (dBA) at 50 feet = | 81 | 100% | 81.0 |
| Source 2: Crane - Sound level (dBA) at 50 feet = | 81 | 100% | 81.0 |
| Calculated Data: | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 84 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 84 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 50 | 0 | 0.0 | 84 | 84 |
| 100 | -6 | 0.0 | 78 | 78 |
| 200 | -12 | 0.0 | 72 | 72 |
| 300 | -16 | 0.0 | 68 | 68 |
| 400 | -18 | 0.0 | 66 | 66 |
| 500 | -20 | 0.0 | 64 | 64 |
| 600 | -22 | 0.0 | 62 | 62 |
| 700 | -23 | 0.0 | 61 | 61 |
| 800 | -24 | 0.0 | 60 | 60 |
| 900 | -25 | 0.0 | 59 | 59 |
| 1000 | -26 | 0.0 | 58 | 58 |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or "Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

Geometric attenuation based on 6 dB per doubling of distance.

Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

**Table 13. Detailed Construction Noise Analysis, Phase 1-D-2-A : Buildings Vertical Construction - Research Building #4 Foundations**

| Source Data [a]: | Maximum Sound Level (dBA) | Utilization Factor | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Concrete Pump Truck - Sound level (dBA) at 50 feet = | 81 | 100% | 81.0 |
| Source 2: Concrete Mixer Truck - Sound level (dBA) at 50 feet = | 79 | 100% | 79.0 |
| Calculated Data: | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 83 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 83 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 50 | 0 | 0.0 | 83 | 83 |
| 100 | -6 | 0.0 | 77 | 77 |
| 200 | -12 | 0.0 | 71 | 71 |
| 300 | -16 | 0.0 | 68 | 68 |
| 400 | -18 | 0.0 | 65 | 65 |
| 500 | -20 | 0.0 | 63 | 63 |
| 600 | -22 | 0.0 | 62 | 62 |
| 700 | -23 | 0.0 | 60 | 60 |
| 800 | -24 | 0.0 | 59 | 59 |
| 900 | -25 | 0.0 | 58 | 58 |
| 1000 | -26 | 0.0 | 57 | 57 |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or
"Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

[a] Although no off-road equipment is included in the foundations sub-phase, concrete pump trucks and concrete mixer trucks would be used to pour mat foundations and would contribute to on-site construction noise.

Geometric attenuation based on 6 dB per doubling of distance.

Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

**Table 14. Detailed Construction Noise Analysis, Phase 1-D-2-B : Buildings Vertical Construction - Research Building #4 Trenching**

| Source Data: | Maximum Sound Level (dBA) | Utilization Factor | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Compactor (ground) - Sound level (dBA) at 50 feet = | 83 | 100% | 83.0 |
| Source 2: Compactor (ground) - Sound level (dBA) at 50 feet = | 83 | 100% | 83.0 |
| Calculated Data: | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 86 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 86 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 50 | 0 | 0.0 | 86 | 86 |
| 100 | -6 | 0.0 | 80 | 80 |
| 200 | -12 | 0.0 | 74 | 74 |
| 300 | -16 | 0.0 | 70 | 70 |
| 400 | -18 | 0.0 | 68 | 68 |
| 500 | -20 | 0.0 | 66 | 66 |
| 600 | -22 | 0.0 | 64 | 64 |
| 700 | -23 | 0.0 | 63 | 63 |
| 800 | -24 | 0.0 | 62 | 62 |
| 900 | -25 | 0.0 | 61 | 61 |
| 1000 | -26 | 0.0 | 60 | 60 |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or "Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

Geometric attenuation based on 6 dB per doubling of distance.
Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

**Table 15. Detailed Construction Noise Analysis, Phase 1-D-2-C : Buildings Vertical Construction - Research Building #4 Core and Shell**

| Source Data: | Maximum Sound Level (dBA) | Utilization Factor | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Crane - Sound level (dBA) at 50 feet = | 81 | 100% | 81.0 |
| Source 2: Crane - Sound level (dBA) at 50 feet = | 81 | 100% | 81.0 |
| Calculated Data: | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 84 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 84 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 50 | 0 | 0.0 | 84 | 84 |
| 100 | -6 | 0.0 | 78 | 78 |
| 200 | -12 | 0.0 | 72 | 72 |
| 300 | -16 | 0.0 | 68 | 68 |
| 400 | -18 | 0.0 | 66 | 66 |
| 500 | -20 | 0.0 | 64 | 64 |
| 600 | -22 | 0.0 | 62 | 62 |
| 700 | -23 | 0.0 | 61 | 61 |
| 800 | -24 | 0.0 | 60 | 60 |
| 900 | -25 | 0.0 | 59 | 59 |
| 1000 | -26 | 0.0 | 58 | 58 |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or "Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

Geometric attenuation based on 6 dB per doubling of distance.

Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

**Table 16. Detailed Construction Noise Analysis, Phase 1-E-1 : Buildings Architectural Coating - Research Building #3**

| Source Data: | Maximum Sound Level (dBA) | Utilization Factor | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Compressor (air) - Sound level (dBA) at 50 feet = | 78 | 100% | 78.0 |
| Source 2: Compressor (air) - Sound level (dBA) at 50 feet = | 78 | 100% | 78.0 |
| Calculated Data: | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 81 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 81 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 50 | 0 | 0.0 | 81 | 81 |
| 100 | -6 | 0.0 | 75 | 75 |
| 200 | -12 | 0.0 | 69 | 69 |
| 300 | -16 | 0.0 | 65 | 65 |
| 400 | -18 | 0.0 | 63 | 63 |
| 500 | -20 | 0.0 | 61 | 61 |
| 600 | -22 | 0.0 | 59 | 59 |
| 700 | -23 | 0.0 | 58 | 58 |
| 800 | -24 | 0.0 | 57 | 57 |
| 900 | -25 | 0.0 | 56 | 56 |
| 1000 | -26 | 0.0 | 55 | 55 |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or
"Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

Geometric attenuation based on 6 dB per doubling of distance.

Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

**Table 17. Detailed Construction Noise Analysis, Phase 1-E-2 : Buildings Architectural Coating - Research Building #4**

| Source Data: | Maximum Sound Level (dBA) | Utilization Factor | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Compressor (air) - Sound level (dBA) at 50 feet = | 78 | 100% | 78.0 |
| Source 2: Compressor (air) - Sound level (dBA) at 50 feet = | 78 | 100% | 78.0 |
| Calculated Data: | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 81 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 81 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 50 | 0 | 0.0 | 81 | 81 |
| 100 | -6 | 0.0 | 75 | 75 |
| 200 | -12 | 0.0 | 69 | 69 |
| 300 | -16 | 0.0 | 65 | 65 |
| 400 | -18 | 0.0 | 63 | 63 |
| 500 | -20 | 0.0 | 61 | 61 |
| 600 | -22 | 0.0 | 59 | 59 |
| 700 | -23 | 0.0 | 58 | 58 |
| 800 | -24 | 0.0 | 57 | 57 |
| 900 | -25 | 0.0 | 56 | 56 |
| 1000 | -26 | 0.0 | 55 | 55 |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or "Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

Geometric attenuation based on 6 dB per doubling of distance.

Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

**Table 18. Detailed Construction Noise Analysis, Phase 1-F : Utilities/Roads - Grubbing and Land Clearing**

| Source Data: | Maximum Sound Level (dBA) | Utilization Factor | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Grader - Sound level (dBA) at 50 feet = | 85 | 100% | 85.0 |
| Source 2: Grader - Sound level (dBA) at 50 feet = | 85 | 100% | 85.0 |
| Calculated Data: | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 88 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 88 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 15 | 10 | 0.0 | 98 | 98 |
| 25 | 6 | 0.0 | 94 | 94 |
| 50 | 0 | 0.0 | 88 | 88 |
| 100 | -6 | 0.0 | 82 | 82 |
| 200 | -12 | 0.0 | 76 | 76 |
| 300 | -16 | 0.0 | 72 | 72 |
| 400 | -18 | 0.0 | 70 | 70 |
| 500 | -20 | 0.0 | 68 | 68 |
| 600 | -22 | 0.0 | 66 | 66 |
| 700 | -23 | 0.0 | 65 | 65 |
| 800 | -24 | 0.0 | 64 | 64 |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or "Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

Geometric attenuation based on 6 dB per doubling of distance.

Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

**Table 19. Detailed Construction Noise Analysis, Phase 1-G : Utilities/Roads - Excavation**

| Source Data: | Maximum Sound Level (dBA) | Utilization Factor | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Grader - Sound level (dBA) at 50 feet = | 85 | 100% | 85.0 |
| Source 2: Concrete Saw - Sound level (dBA) at 50 feet = | 90 | 100% | 90.0 |
| Calculated Data: | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 91 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 91 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 15 | 10 | 0.0 | 102 | 102 |
| 25 | 6 | 0.0 | 97 | 97 |
| 50 | 0 | 0.0 | 91 | 91 |
| 100 | -6 | 0.0 | 85 | 85 |
| 200 | -12 | 0.0 | 79 | 79 |
| 300 | -16 | 0.0 | 76 | 76 |
| 400 | -18 | 0.0 | 73 | 73 |
| 500 | -20 | 0.0 | 71 | 71 |
| 600 | -22 | 0.0 | 70 | 70 |
| 700 | -23 | 0.0 | 68 | 68 |
| 800 | -24 | 0.0 | 67 | 67 |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or "Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

Geometric attenuation based on 6 dB per doubling of distance.
Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

**Table 20. Detailed Construction Noise Analysis, Phase 1-H : Utilities/Roads - Drainage and Subgrade**

| Source Data: | Maximum Sound Level (dBA) | Utilization Factor | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Grader - Sound level (dBA) at 50 feet = | 85 | 100% | 85.0 |
| Source 2: Concrete Saw - Sound level (dBA) at 50 feet = | 90 | 100% | 90.0 |
| Calculated Data: | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 91 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 91 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 15 | 10 | 0.0 | 102 | 102 |
| 25 | 6 | 0.0 | 97 | 97 |
| 50 | 0 | 0.0 | 91 | 91 |
| 100 | -6 | 0.0 | 85 | 85 |
| 200 | -12 | 0.0 | 79 | 79 |
| 300 | -16 | 0.0 | 76 | 76 |
| 400 | -18 | 0.0 | 73 | 73 |
| 500 | -20 | 0.0 | 71 | 71 |
| 600 | -22 | 0.0 | 70 | 70 |
| 700 | -23 | 0.0 | 68 | 68 |
| 800 | -24 | 0.0 | 67 | 67 |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or "Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971

2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

Geometric attenuation based on 6 dB per doubling of distance.

Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

**Table 21. Detailed Construction Noise Analysis, Phase 1-I : Utilities/Roads - Paving**

| Source Data: | Maximum Sound Level (dBA) | Utilization Factor | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Grader - Sound level (dBA) at 50 feet = | 85 | 100% | 85.0 |
| Source 2: Grader - Sound level (dBA) at 50 feet = | 85 | 100% | 85.0 |
| Calculated Data: | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 88 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 88 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 15 | 10 | 0.0 | 98 | 98 |
| 25 | 6 | 0.0 | 94 | 94 |
| 50 | 0 | 0.0 | 88 | 88 |
| 100 | -6 | 0.0 | 82 | 82 |
| 200 | -12 | 0.0 | 76 | 76 |
| 300 | -16 | 0.0 | 72 | 72 |
| 400 | -18 | 0.0 | 70 | 70 |
| 500 | -20 | 0.0 | 68 | 68 |
| 600 | -22 | 0.0 | 66 | 66 |
| 700 | -23 | 0.0 | 65 | 65 |
| 800 | -24 | 0.0 | 64 | 64 |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or "Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

Geometric attenuation based on 6 dB per doubling of distance.

Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

**Table 22. Detailed Construction Noise Analysis, Phase 1-J : Surface Parking - Grading**

| Source Data: | Maximum Sound Level (dBA) | Utilization Factor | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Grader - Sound level (dBA) at 50 feet = | 85 | 100% | 85.0 |
| Source 2: Grader - Sound level (dBA) at 50 feet = | 85 | 100% | 85.0 |
| Calculated Data: | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 88 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 88 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 50 | 0 | 0.0 | 88 | 88 |
| 100 | -6 | 0.0 | 82 | 82 |
| 200 | -12 | 0.0 | 76 | 76 |
| 300 | -16 | 0.0 | 72 | 72 |
| 400 | -18 | 0.0 | 70 | 70 |
| 500 | -20 | 0.0 | 68 | 68 |
| 600 | -22 | 0.0 | 66 | 66 |
| 700 | -23 | 0.0 | 65 | 65 |
| 800 | -24 | 0.0 | 64 | 64 |
| 900 | -25 | 0.0 | 63 | 63 |
| 1000 | -26 | 0.0 | 62 | 62 |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or "Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

Geometric attenuation based on 6 dB per doubling of distance.

Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

**Table 23. Detailed Construction Noise Analysis, Phase 1-K : Surface Parking - Site Preparation**

| Source Data: | Maximum Sound Level (dBA) | Utilization Factor | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Grader - Sound level (dBA) at 50 feet = | 85 | 100% | 85.0 |
| Source 2: Grader - Sound level (dBA) at 50 feet = | 85 | 100% | 85.0 |
| Calculated Data: | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 88 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 88 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 50 | 0 | 0.0 | 88 | 88 |
| 100 | -6 | 0.0 | 82 | 82 |
| 200 | -12 | 0.0 | 76 | 76 |
| 300 | -16 | 0.0 | 72 | 72 |
| 400 | -18 | 0.0 | 70 | 70 |
| 500 | -20 | 0.0 | 68 | 68 |
| 600 | -22 | 0.0 | 66 | 66 |
| 700 | -23 | 0.0 | 65 | 65 |
| 800 | -24 | 0.0 | 64 | 64 |
| 900 | -25 | 0.0 | 63 | 63 |
| 1000 | -26 | 0.0 | 62 | 62 |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or "Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

Geometric attenuation based on 6 dB per doubling of distance.
Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

**Table 24. Detailed Construction Noise Analysis, Phase 1-L : Surface Parking - Paving**

| Source Data: | Maximum Sound Level (dBA) | Utilization Factor | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Grader - Sound level (dBA) at 50 feet = | 85 | 100% | 85.0 |
| Source 2: Grader - Sound level (dBA) at 50 feet = | 85 | 100% | 85.0 |
| Calculated Data: | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 88 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 88 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 50 | 0 | 0.0 | 88 | 88 |
| 100 | -6 | 0.0 | 82 | 82 |
| 200 | -12 | 0.0 | 76 | 76 |
| 300 | -16 | 0.0 | 72 | 72 |
| 400 | -18 | 0.0 | 70 | 70 |
| 500 | -20 | 0.0 | 68 | 68 |
| 600 | -22 | 0.0 | 66 | 66 |
| 700 | -23 | 0.0 | 65 | 65 |
| 800 | -24 | 0.0 | 64 | 64 |
| 900 | -25 | 0.0 | 63 | 63 |
| 1000 | -26 | 0.0 | 62 | 62 |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or "Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

Geometric attenuation based on 6 dB per doubling of distance.

Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

**Table 25. Detailed Construction Noise Analysis, Phase 2-A : Buildings (All) - Site Preparation**

| Source Data: | Maximum Sound Level (dBA) | Utilization Factor | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Tractor - Sound level (dBA) at 50 feet = | 84 | 100% | 84.0 |
| Source 2: Tractor - Sound level (dBA) at 50 feet = | 84 | 100% | 84.0 |
| Calculated Data: | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 87 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 87 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 50 | 0 | 0.0 | 87 | 87 |
| 100 | -6 | 0.0 | 81 | 81 |
| 200 | -12 | 0.0 | 75 | 75 |
| 300 | -16 | 0.0 | 71 | 71 |
| 400 | -18 | 0.0 | 69 | 69 |
| 500 | -20 | 0.0 | 67 | 67 |
| 600 | -22 | 0.0 | 65 | 65 |
| 700 | -23 | 0.0 | 64 | 64 |
| 800 | -24 | 0.0 | 63 | 63 |
| 900 | -25 | 0.0 | 62 | 62 |
| 1000 | -26 | 0.0 | 61 | 61 |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or
"Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

Geometric attenuation based on 6 dB per doubling of distance.
Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

**Table 26. Detailed Construction Noise Analysis, Phase 2-B : Buildings (All) - Grading**

| Source Data: | Maximum Sound Level (dBA) | Utilization Factor | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Tractor - Sound level (dBA) at 50 feet = | 84 | 100% | 84.0 |
| Source 2: Tractor - Sound level (dBA) at 50 feet = | 84 | 100% | 84.0 |
| Calculated Data: | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 87 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 87 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 50 | 0 | 0.0 | 87 | 87 |
| 100 | -6 | 0.0 | 81 | 81 |
| 200 | -12 | 0.0 | 75 | 75 |
| 300 | -16 | 0.0 | 71 | 71 |
| 400 | -18 | 0.0 | 69 | 69 |
| 500 | -20 | 0.0 | 67 | 67 |
| 600 | -22 | 0.0 | 65 | 65 |
| 700 | -23 | 0.0 | 64 | 64 |
| 800 | -24 | 0.0 | 63 | 63 |
| 900 | -25 | 0.0 | 62 | 62 |
| 1000 | -26 | 0.0 | 61 | 61 |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or "Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

Geometric attenuation based on 6 dB per doubling of distance.

Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

**Table 27. Detailed Construction Noise Analysis, Phase 2-C : Buildings (All) - Demolition**

| Source Data: | Maximum Sound Level (dBA) | Utilization Factor | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Concrete Saw - Sound level (dBA) at 50 feet = | 90 | 100% | 90.0 |
| Source 2: Concrete Saw - Sound level (dBA) at 50 feet = | 90 | 100% | 90.0 |
| Calculated Data: | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 93 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 93 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 50 | 0 | 0.0 | 93 | 93 |
| 100 | -6 | 0.0 | 87 | 87 |
| 200 | -12 | 0.0 | 81 | 81 |
| 300 | -16 | 0.0 | 77 | 77 |
| 400 | -18 | 0.0 | 75 | 75 |
| 500 | -20 | 0.0 | 73 | 73 |
| 600 | -22 | 0.0 | 71 | 71 |
| 700 | -23 | 0.0 | 70 | 70 |
| 800 | -24 | 0.0 | 69 | 69 |
| 900 | -25 | 0.0 | 68 | 68 |
| 1000 | -26 | 0.0 | 67 | 67 |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or "Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971

2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

Geometric attenuation based on 6 dB per doubling of distance.

Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

**Table 28. Detailed Construction Noise Analysis, Phase 2-D-1-A : Buildings Vertical Construction - Research Building #1 Foundations**

| Source Data [a]: | Maximum Sound Level (dBA) | Utilization Factor | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Concrete Pump Truck - Sound level (dBA) at 50 feet = | 81 | 100% | 81.0 |
| Source 2: Concrete Mixer Truck - Sound level (dBA) at 50 feet = | 79 | 100% | 79.0 |
| Calculated Data: | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 83 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 83 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 50 | 0 | 0.0 | 83 | 83 |
| 100 | -6 | 0.0 | 77 | 77 |
| 200 | -12 | 0.0 | 71 | 71 |
| 300 | -16 | 0.0 | 68 | 68 |
| 400 | -18 | 0.0 | 65 | 65 |
| 500 | -20 | 0.0 | 63 | 63 |
| 600 | -22 | 0.0 | 62 | 62 |
| 700 | -23 | 0.0 | 60 | 60 |
| 800 | -24 | 0.0 | 59 | 59 |
| 900 | -25 | 0.0 | 58 | 58 |
| 1000 | -26 | 0.0 | 57 | 57 |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or
"Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971

2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

[a] Although no off-road equipment is included in the foundations sub-phase, concrete pump trucks and concrete mixer trucks would be used to pour mat foundations and would contribute to on-site construction noise.

Geometric attenuation based on 6 dB per doubling of distance.

Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

**Table 29. Detailed Construction Noise Analysis, Phase 2-D-1-B : Buildings Vertical Construction - Research Building #1 Trenching**

| Source Data: | Maximum Sound Level (dBA) | Utilization Factor | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Compactor (ground) - Sound level (dBA) at 50 feet = | 83 | 100% | 83.0 |
| Source 2: Compactor (ground) - Sound level (dBA) at 50 feet = | 83 | 100% | 83.0 |
| Calculated Data: | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 86 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 86 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 50 | 0 | 0.0 | 86 | 86 |
| 100 | -6 | 0.0 | 80 | 80 |
| 200 | -12 | 0.0 | 74 | 74 |
| 300 | -16 | 0.0 | 70 | 70 |
| 400 | -18 | 0.0 | 68 | 68 |
| 500 | -20 | 0.0 | 66 | 66 |
| 600 | -22 | 0.0 | 64 | 64 |
| 700 | -23 | 0.0 | 63 | 63 |
| 800 | -24 | 0.0 | 62 | 62 |
| 900 | -25 | 0.0 | 61 | 61 |
| 1000 | -26 | 0.0 | 60 | 60 |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or "Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

Geometric attenuation based on 6 dB per doubling of distance.

Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

**Table 30. Detailed Construction Noise Analysis, Phase 2-D-1-C : Buildings Vertical Construction - Research Building #1 Core and Shell**

| Source Data: | Maximum Sound Level (dBA) | Utilization Factor | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Crane - Sound level (dBA) at 50 feet = | 81 | 100% | 81.0 |
| Source 2: Crane - Sound level (dBA) at 50 feet = | 81 | 100% | 81.0 |
| Calculated Data: | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 84 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 84 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 50 | 0 | 0.0 | 84 | 84 |
| 100 | -6 | 0.0 | 78 | 78 |
| 200 | -12 | 0.0 | 72 | 72 |
| 300 | -16 | 0.0 | 68 | 68 |
| 400 | -18 | 0.0 | 66 | 66 |
| 500 | -20 | 0.0 | 64 | 64 |
| 600 | -22 | 0.0 | 62 | 62 |
| 700 | -23 | 0.0 | 61 | 61 |
| 800 | -24 | 0.0 | 60 | 60 |
| 900 | -25 | 0.0 | 59 | 59 |
| 1000 | -26 | 0.0 | 58 | 58 |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or
"Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

Geometric attenuation based on 6 dB per doubling of distance.

Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

**Table 31. Detailed Construction Noise Analysis, Phase 2-D-2-A : Buildings Vertical Construction - Research Building #5 Foundations**

| Source Data [a]: | Maximum Sound Level (dBA) | Utilization Factor | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Concrete Pump Truck - Sound level (dBA) at 50 feet = | 81 | 100% | 81.0 |
| Source 2: Concrete Mixer Truck - Sound level (dBA) at 50 feet = | 79 | 100% | 79.0 |
| Calculated Data: | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 83 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 83 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 50 | 0 | 0.0 | 83 | 83 |
| 100 | -6 | 0.0 | 77 | 77 |
| 200 | -12 | 0.0 | 71 | 71 |
| 300 | -16 | 0.0 | 68 | 68 |
| 400 | -18 | 0.0 | 65 | 65 |
| 500 | -20 | 0.0 | 63 | 63 |
| 600 | -22 | 0.0 | 62 | 62 |
| 700 | -23 | 0.0 | 60 | 60 |
| 800 | -24 | 0.0 | 59 | 59 |
| 900 | -25 | 0.0 | 58 | 58 |
| 1000 | -26 | 0.0 | 57 | 57 |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or
"Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

[a] Although no off-road equipment is included in the foundations sub-phase, concrete pump trucks and concrete mixer trucks would be used to pour mat foundations and would contribute to on-site construction noise.

Geometric attenuation based on 6 dB per doubling of distance.

Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

**Table 32. Detailed Construction Noise Analysis, Phase 2-D-2-B : Buildings Vertical Construction - Research Building #5 Trenching**

| Source Data: | Maximum Sound Level (dBA) | Utilization Factor | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Compactor (ground) - Sound level (dBA) at 50 feet = | 83 | 100% | 83.0 |
| Source 2: Compactor (ground) - Sound level (dBA) at 50 feet = | 83 | 100% | 83.0 |
| Calculated Data: | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 86 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 86 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 50 | 0 | 0.0 | 86 | 86 |
| 100 | -6 | 0.0 | 80 | 80 |
| 200 | -12 | 0.0 | 74 | 74 |
| 300 | -16 | 0.0 | 70 | 70 |
| 400 | -18 | 0.0 | 68 | 68 |
| 500 | -20 | 0.0 | 66 | 66 |
| 600 | -22 | 0.0 | 64 | 64 |
| 700 | -23 | 0.0 | 63 | 63 |
| 800 | -24 | 0.0 | 62 | 62 |
| 900 | -25 | 0.0 | 61 | 61 |
| 1000 | -26 | 0.0 | 60 | 60 |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or
"Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

Geometric attenuation based on 6 dB per doubling of distance.
Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

**Table 33. Detailed Construction Noise Analysis, Phase 2-D-2-C : Buildings Vertical Construction - Research Building #5 Core and Shell**

| Source Data: | Maximum Sound Level (dBA) | Utilization Factor | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Crane - Sound level (dBA) at 50 feet = | 81 | 100% | 81.0 |
| Source 2: Crane - Sound level (dBA) at 50 feet = | 81 | 100% | 81.0 |
| Calculated Data: | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 84 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 84 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 50 | 0 | 0.0 | 84 | 84 |
| 100 | -6 | 0.0 | 78 | 78 |
| 200 | -12 | 0.0 | 72 | 72 |
| 300 | -16 | 0.0 | 68 | 68 |
| 400 | -18 | 0.0 | 66 | 66 |
| 500 | -20 | 0.0 | 64 | 64 |
| 600 | -22 | 0.0 | 62 | 62 |
| 700 | -23 | 0.0 | 61 | 61 |
| 800 | -24 | 0.0 | 60 | 60 |
| 900 | -25 | 0.0 | 59 | 59 |
| 1000 | -26 | 0.0 | 58 | 58 |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or "Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

Geometric attenuation based on 6 dB per doubling of distance.

Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

**Table 34. Detailed Construction Noise Analysis, Phase 2-E-1 : Buildings Architectural Coating - Research Building #1**

| Source Data: | Maximum Sound Level (dBA) | Utilization Factor | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Compressor (air) - Sound level (dBA) at 50 feet = | 78 | 100% | 78.0 |
| Source 2: Compressor (air) - Sound level (dBA) at 50 feet = | 78 | 100% | 78.0 |
| Calculated Data: | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 81 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 81 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 50 | 0 | 0.0 | 81 | 81 |
| 100 | -6 | 0.0 | 75 | 75 |
| 200 | -12 | 0.0 | 69 | 69 |
| 300 | -16 | 0.0 | 65 | 65 |
| 400 | -18 | 0.0 | 63 | 63 |
| 500 | -20 | 0.0 | 61 | 61 |
| 600 | -22 | 0.0 | 59 | 59 |
| 700 | -23 | 0.0 | 58 | 58 |
| 800 | -24 | 0.0 | 57 | 57 |
| 900 | -25 | 0.0 | 56 | 56 |
| 1000 | -26 | 0.0 | 55 | 55 |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or
"Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

Geometric attenuation based on 6 dB per doubling of distance.

Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

**Table 35. Detailed Construction Noise Analysis, Phase 2-E-2 : Buildings Architectural Coating - Research Building #5**

| Source Data: | Maximum Sound Level (dBA) | Utilization Factor | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Compressor (air) - Sound level (dBA) at 50 feet = | 78 | 100% | 78.0 |
| Source 2: Compressor (air) - Sound level (dBA) at 50 feet = | 78 | 100% | 78.0 |
| Calculated Data: | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 81 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 81 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 50 | 0 | 0.0 | 81 | 81 |
| 100 | -6 | 0.0 | 75 | 75 |
| 200 | -12 | 0.0 | 69 | 69 |
| 300 | -16 | 0.0 | 65 | 65 |
| 400 | -18 | 0.0 | 63 | 63 |
| 500 | -20 | 0.0 | 61 | 61 |
| 600 | -22 | 0.0 | 59 | 59 |
| 700 | -23 | 0.0 | 58 | 58 |
| 800 | -24 | 0.0 | 57 | 57 |
| 900 | -25 | 0.0 | 56 | 56 |
| 1000 | -26 | 0.0 | 55 | 55 |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or "Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

Geometric attenuation based on 6 dB per doubling of distance.

Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

**Table 36. Detailed Construction Noise Analysis, Phase 2-F-1-A : Buildings Vertical Construction - Conference/Hotel Foundations**

| Source Data [a]: | Maximum Sound Level (dBA) | Utilization Factor | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Concrete Pump Truck - Sound level (dBA) at 50 feet = | 81 | 100% | 81.0 |
| Source 2: Concrete Mixer Truck - Sound level (dBA) at 50 feet = | 79 | 100% | 79.0 |
| Calculated Data: | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 83 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 83 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 50 | 0 | 0.0 | 83 | 83 |
| 100 | -6 | 0.0 | 77 | 77 |
| 200 | -12 | 0.0 | 71 | 71 |
| 300 | -16 | 0.0 | 68 | 68 |
| 400 | -18 | 0.0 | 65 | 65 |
| 500 | -20 | 0.0 | 63 | 63 |
| 600 | -22 | 0.0 | 62 | 62 |
| 700 | -23 | 0.0 | 60 | 60 |
| 800 | -24 | 0.0 | 59 | 59 |
| 900 | -25 | 0.0 | 58 | 58 |
| 1000 | -26 | 0.0 | 57 | 57 |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or
"Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971

2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

[a] Although no off-road equipment is included in the foundations sub-phase, concrete pump trucks and concrete mixer trucks would be used to pour mat foundations and would contribute to on-site construction noise.

Geometric attenuation based on 6 dB per doubling of distance.

Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

**Table 37. Detailed Construction Noise Analysis, Phase 2-F-1-B : Buildings Vertical Construction - Conference/Hotel Trenching**

| Source Data: | Maximum Sound Level (dBA) | Utilization Factor | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Compactor (ground) - Sound level (dBA) at 50 feet = | 83 | 100% | 83.0 |
| Source 2: Compactor (ground) - Sound level (dBA) at 50 feet = | 83 | 100% | 83.0 |
| Calculated Data: | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 86 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 86 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 50 | 0 | 0.0 | 86 | 86 |
| 100 | -6 | 0.0 | 80 | 80 |
| 200 | -12 | 0.0 | 74 | 74 |
| 300 | -16 | 0.0 | 70 | 70 |
| 400 | -18 | 0.0 | 68 | 68 |
| 500 | -20 | 0.0 | 66 | 66 |
| 600 | -22 | 0.0 | 64 | 64 |
| 700 | -23 | 0.0 | 63 | 63 |
| 800 | -24 | 0.0 | 62 | 62 |
| 900 | -25 | 0.0 | 61 | 61 |
| 1000 | -26 | 0.0 | 60 | 60 |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or "Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

Geometric attenuation based on 6 dB per doubling of distance.

Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

**Table 38. Detailed Construction Noise Analysis, Phase 2-F-1-C : Buildings Vertical Construction - Conference/Hotel Core and Shell**

| Source Data: | Maximum Sound Level (dBA) | Utilization Factor | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Crane - Sound level (dBA) at 50 feet = | 81 | 100% | 81.0 |
| Source 2: Crane - Sound level (dBA) at 50 feet = | 81 | 100% | 81.0 |
| Calculated Data: | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 84 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 84 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 50 | 0 | 0.0 | 84 | 84 |
| 100 | -6 | 0.0 | 78 | 78 |
| 200 | -12 | 0.0 | 72 | 72 |
| 300 | -16 | 0.0 | 68 | 68 |
| 400 | -18 | 0.0 | 66 | 66 |
| 500 | -20 | 0.0 | 64 | 64 |
| 600 | -22 | 0.0 | 62 | 62 |
| 700 | -23 | 0.0 | 61 | 61 |
| 800 | -24 | 0.0 | 60 | 60 |
| 900 | -25 | 0.0 | 59 | 59 |
| 1000 | -26 | 0.0 | 58 | 58 |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or "Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

Geometric attenuation based on 6 dB per doubling of distance.

Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

**Table 39. Detailed Construction Noise Analysis, Phase 2-G : Buildings Architectural Coating - Conference/Hotel**

| Source Data: | Maximum Sound Level (dBA) | Utilization Factor | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Compressor (air) - Sound level (dBA) at 50 feet = | 78 | 100% | 78.0 |
| Source 2: Compressor (air) - Sound level (dBA) at 50 feet = | 78 | 100% | 78.0 |
| Calculated Data: | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 81 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 81 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 50 | 0 | 0.0 | 81 | 81 |
| 100 | -6 | 0.0 | 75 | 75 |
| 200 | -12 | 0.0 | 69 | 69 |
| 300 | -16 | 0.0 | 65 | 65 |
| 400 | -18 | 0.0 | 63 | 63 |
| 500 | -20 | 0.0 | 61 | 61 |
| 600 | -22 | 0.0 | 59 | 59 |
| 700 | -23 | 0.0 | 58 | 58 |
| 800 | -24 | 0.0 | 57 | 57 |
| 900 | -25 | 0.0 | 56 | 56 |
| 1000 | -26 | 0.0 | 55 | 55 |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or "Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

Geometric attenuation based on 6 dB per doubling of distance.

Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

**Table 40. Detailed Construction Noise Analysis, Phase 2-H-1-A : Buildings Vertical Construction - Active Use #13 Foundations**

| Source Data [a]: | Maximum Sound Level (dBA) | Utilization Factor | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Concrete Pump Truck - Sound level (dBA) at 50 feet = | 81 | 100% | 81.0 |
| Source 2: Concrete Mixer Truck - Sound level (dBA) at 50 feet = | 79 | 100% | 79.0 |
| Calculated Data: | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 83 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 83 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 50 | 0 | 0.0 | 83 | 83 |
| 100 | -6 | 0.0 | 77 | 77 |
| 200 | -12 | 0.0 | 71 | 71 |
| 300 | -16 | 0.0 | 68 | 68 |
| 400 | -18 | 0.0 | 65 | 65 |
| 500 | -20 | 0.0 | 63 | 63 |
| 600 | -22 | 0.0 | 62 | 62 |
| 700 | -23 | 0.0 | 60 | 60 |
| 800 | -24 | 0.0 | 59 | 59 |
| 900 | -25 | 0.0 | 58 | 58 |
| 1000 | -26 | 0.0 | 57 | 57 |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or
"Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

[a] Although no off-road equipment is included in the foundations sub-phase, concrete pump trucks and concrete mixer trucks would be used to pour mat foundations and would contribute to on-site construction noise.

Geometric attenuation based on 6 dB per doubling of distance.

Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

**Table 41. Detailed Construction Noise Analysis, Phase 2-H-1-B : Buildings Vertical Construction - Active Use #13 Trenching**

| Source Data: | Maximum Sound Level (dBA) | Utilization Factor | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Compactor (ground) - Sound level (dBA) at 50 feet = | 83 | 100% | 83.0 |
| Source 2: Compactor (ground) - Sound level (dBA) at 50 feet = | 83 | 100% | 83.0 |
| Calculated Data: | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 86 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 86 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 50 | 0 | 0.0 | 86 | 86 |
| 100 | -6 | 0.0 | 80 | 80 |
| 200 | -12 | 0.0 | 74 | 74 |
| 300 | -16 | 0.0 | 70 | 70 |
| 400 | -18 | 0.0 | 68 | 68 |
| 500 | -20 | 0.0 | 66 | 66 |
| 600 | -22 | 0.0 | 64 | 64 |
| 700 | -23 | 0.0 | 63 | 63 |
| 800 | -24 | 0.0 | 62 | 62 |
| 900 | -25 | 0.0 | 61 | 61 |
| 1000 | -26 | 0.0 | 60 | 60 |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or
"Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

Geometric attenuation based on 6 dB per doubling of distance.

Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

**Table 42. Detailed Construction Noise Analysis, Phase 2-H-1-C : Buildings Vertical Construction - Active Use #13 Core and Shell**

| Source Data: | Maximum Sound Level (dBA) | Utilization Factor | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Crane - Sound level (dBA) at 50 feet = | 81 | 100% | 81.0 |
| Source 2: Crane - Sound level (dBA) at 50 feet = | 81 | 100% | 81.0 |
| Calculated Data: | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 84 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 84 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 50 | 0 | 0.0 | 84 | 84 |
| 100 | -6 | 0.0 | 78 | 78 |
| 200 | -12 | 0.0 | 72 | 72 |
| 300 | -16 | 0.0 | 68 | 68 |
| 400 | -18 | 0.0 | 66 | 66 |
| 500 | -20 | 0.0 | 64 | 64 |
| 600 | -22 | 0.0 | 62 | 62 |
| 700 | -23 | 0.0 | 61 | 61 |
| 800 | -24 | 0.0 | 60 | 60 |
| 900 | -25 | 0.0 | 59 | 59 |
| 1000 | -26 | 0.0 | 58 | 58 |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or "Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

Geometric attenuation based on 6 dB per doubling of distance.

Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

**Table 43. Detailed Construction Noise Analysis, Phase 2-H-2-A : Buildings Vertical Construction - Active Use #14 Foundations**

| Source Data [a]: | Maximum Sound Level (dBA) | Utilization Factor | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Concrete Pump Truck - Sound level (dBA) at 50 feet = | 81 | 100% | 81.0 |
| Source 2: Concrete Mixer Truck - Sound level (dBA) at 50 feet = | 79 | 100% | 79.0 |
| Calculated Data: | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 83 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 83 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 50 | 0 | 0.0 | 83 | 83 |
| 100 | -6 | 0.0 | 77 | 77 |
| 200 | -12 | 0.0 | 71 | 71 |
| 300 | -16 | 0.0 | 68 | 68 |
| 400 | -18 | 0.0 | 65 | 65 |
| 500 | -20 | 0.0 | 63 | 63 |
| 600 | -22 | 0.0 | 62 | 62 |
| 700 | -23 | 0.0 | 60 | 60 |
| 800 | -24 | 0.0 | 59 | 59 |
| 900 | -25 | 0.0 | 58 | 58 |
| 1000 | -26 | 0.0 | 57 | 57 |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or
"Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971

2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

[a] Although no off-road equipment is included in the foundations sub-phase, concrete pump trucks and concrete mixer trucks would be used to pour mat foundations and would contribute to on-site construction noise.

Geometric attenuation based on 6 dB per doubling of distance.

Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

**Table 44. Detailed Construction Noise Analysis, Phase 2-H-2-B : Buildings Vertical Construction - Active Use #14 Trenching**

| Source Data: | Maximum Sound Level (dBA) | Utilization Factor | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Compactor (ground) - Sound level (dBA) at 50 feet = | 83 | 100% | 83.0 |
| Source 2: Compactor (ground) - Sound level (dBA) at 50 feet = | 83 | 100% | 83.0 |
| Calculated Data: | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 86 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 86 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 50 | 0 | 0.0 | 86 | 86 |
| 100 | -6 | 0.0 | 80 | 80 |
| 200 | -12 | 0.0 | 74 | 74 |
| 300 | -16 | 0.0 | 70 | 70 |
| 400 | -18 | 0.0 | 68 | 68 |
| 500 | -20 | 0.0 | 66 | 66 |
| 600 | -22 | 0.0 | 64 | 64 |
| 700 | -23 | 0.0 | 63 | 63 |
| 800 | -24 | 0.0 | 62 | 62 |
| 900 | -25 | 0.0 | 61 | 61 |
| 1000 | -26 | 0.0 | 60 | 60 |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or "Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

Geometric attenuation based on 6 dB per doubling of distance.

Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

**Table 45. Detailed Construction Noise Analysis, Phase 2-H-2-C : Buildings Vertical Construction - Active Use #14 Core and Shell**

| Source Data: | Maximum Sound Level (dBA) | Utilization Factor | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Crane - Sound level (dBA) at 50 feet = | 81 | 100% | 81.0 |
| Source 2: Crane - Sound level (dBA) at 50 feet = | 81 | 100% | 81.0 |
| Calculated Data: | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 84 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 84 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 50 | 0 | 0.0 | 84 | 84 |
| 100 | -6 | 0.0 | 78 | 78 |
| 200 | -12 | 0.0 | 72 | 72 |
| 300 | -16 | 0.0 | 68 | 68 |
| 400 | -18 | 0.0 | 66 | 66 |
| 500 | -20 | 0.0 | 64 | 64 |
| 600 | -22 | 0.0 | 62 | 62 |
| 700 | -23 | 0.0 | 61 | 61 |
| 800 | -24 | 0.0 | 60 | 60 |
| 900 | -25 | 0.0 | 59 | 59 |
| 1000 | -26 | 0.0 | 58 | 58 |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or
"Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

Geometric attenuation based on 6 dB per doubling of distance.

Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

**Table 46. Detailed Construction Noise Analysis, Phase 2-I :Buildings Architectual Coating - Active Use**

| Source Data: | Maximum Sound Level (dBA) | Utilization Factor | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Compressor (air) - Sound level (dBA) at 50 feet = | 78 | 100% | 78.0 |
| Source 2: Compressor (air) - Sound level (dBA) at 50 feet = | 78 | 100% | 78.0 |
| Calculated Data: | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 81 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 81 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 50 | 0 | 0.0 | 81 | 81 |
| 100 | -6 | 0.0 | 75 | 75 |
| 200 | -12 | 0.0 | 69 | 69 |
| 300 | -16 | 0.0 | 65 | 65 |
| 400 | -18 | 0.0 | 63 | 63 |
| 500 | -20 | 0.0 | 61 | 61 |
| 600 | -22 | 0.0 | 59 | 59 |
| 700 | -23 | 0.0 | 58 | 58 |
| 800 | -24 | 0.0 | 57 | 57 |
| 900 | -25 | 0.0 | 56 | 56 |
| 1000 | -26 | 0.0 | 55 | 55 |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or
"Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

Geometric attenuation based on 6 dB per doubling of distance.
Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

**Table 47. Detailed Construction Noise Analysis, Phase 2-J : Utilities/Roads - Grubbing and Land Clearing**

| Source Data: | Maximum Sound Level (dBA) | Utilization Factor | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Grader - Sound level (dBA) at 50 feet = | 85 | 100% | 85.0 |
| Source 2: Grader - Sound level (dBA) at 50 feet = | 85 | 100% | 85.0 |
| Calculated Data: | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 88 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 88 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 15 | 10 | 0.0 | 98 | 98 |
| 25 | 6 | 0.0 | 94 | 94 |
| 50 | 0 | 0.0 | 88 | 88 |
| 100 | -6 | 0.0 | 82 | 82 |
| 200 | -12 | 0.0 | 76 | 76 |
| 300 | -16 | 0.0 | 72 | 72 |
| 400 | -18 | 0.0 | 70 | 70 |
| 500 | -20 | 0.0 | 68 | 68 |
| 600 | -22 | 0.0 | 66 | 66 |
| 700 | -23 | 0.0 | 65 | 65 |
| 800 | -24 | 0.0 | 64 | 64 |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or "Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

Geometric attenuation based on 6 dB per doubling of distance.

Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

**Table 48. Detailed Construction Noise Analysis, Phase 2-K : Utilities/Roads - Excavation**

| Source Data: | Maximum Sound Level (dBA) | Utilization Factor | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Grader - Sound level (dBA) at 50 feet = | 85 | 100% | 85.0 |
| Source 2: Concrete Saw - Sound level (dBA) at 50 feet = | 90 | 100% | 90.0 |
| Calculated Data: | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 91 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 91 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 15 | 10 | 0.0 | 102 | 102 |
| 25 | 6 | 0.0 | 97 | 97 |
| 50 | 0 | 0.0 | 91 | 91 |
| 100 | -6 | 0.0 | 85 | 85 |
| 200 | -12 | 0.0 | 79 | 79 |
| 300 | -16 | 0.0 | 76 | 76 |
| 400 | -18 | 0.0 | 73 | 73 |
| 500 | -20 | 0.0 | 71 | 71 |
| 600 | -22 | 0.0 | 70 | 70 |
| 700 | -23 | 0.0 | 68 | 68 |
| 800 | -24 | 0.0 | 67 | 67 |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or "Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

Geometric attenuation based on 6 dB per doubling of distance.
Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

**Table 49. Detailed Construction Noise Analysis, Phase 2-L : Utilities/Roads - Drainage and Subgrade**

| Source Data: | Maximum Sound Level (dBA) | Utilization Factor | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Grader - Sound level (dBA) at 50 feet = | 85 | 100% | 85.0 |
| Source 2: Concrete Saw - Sound level (dBA) at 50 feet = | 90 | 100% | 90.0 |
| Calculated Data: | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 91 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 91 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 15 | 10 | 0.0 | 102 | 102 |
| 25 | 6 | 0.0 | 97 | 97 |
| 50 | 0 | 0.0 | 91 | 91 |
| 100 | -6 | 0.0 | 85 | 85 |
| 200 | -12 | 0.0 | 79 | 79 |
| 300 | -16 | 0.0 | 76 | 76 |
| 400 | -18 | 0.0 | 73 | 73 |
| 500 | -20 | 0.0 | 71 | 71 |
| 600 | -22 | 0.0 | 70 | 70 |
| 700 | -23 | 0.0 | 68 | 68 |
| 800 | -24 | 0.0 | 67 | 67 |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or "Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

Geometric attenuation based on 6 dB per doubling of distance.

Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

**Table 50. Detailed Construction Noise Analysis, Phase 2-M : Utilities/Roads - Paving**

| Source Data: | Maximum Sound Level (dBA) | Utilization Factor | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Grader - Sound level (dBA) at 50 feet = | 85 | 100% | 85.0 |
| Source 2: Grader - Sound level (dBA) at 50 feet = | 85 | 100% | 85.0 |
| Calculated Data: | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 88 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 88 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 15 | 10 | 0.0 | 98 | 98 |
| 25 | 6 | 0.0 | 94 | 94 |
| 50 | 0 | 0.0 | 88 | 88 |
| 100 | -6 | 0.0 | 82 | 82 |
| 200 | -12 | 0.0 | 76 | 76 |
| 300 | -16 | 0.0 | 72 | 72 |
| 400 | -18 | 0.0 | 70 | 70 |
| 500 | -20 | 0.0 | 68 | 68 |
| 600 | -22 | 0.0 | 66 | 66 |
| 700 | -23 | 0.0 | 65 | 65 |
| 800 | -24 | 0.0 | 64 | 64 |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or "Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

Geometric attenuation based on 6 dB per doubling of distance.

Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

**Table 51. Detailed Construction Noise Analysis, Phase 2-N : Surface Parking - Grading**

| Source Data: | Maximum Sound Level (dBA) | Utilization Factor | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Grader - Sound level (dBA) at 50 feet = | 85 | 100% | 85.0 |
| Source 2: Grader - Sound level (dBA) at 50 feet = | 85 | 100% | 85.0 |
| Calculated Data: | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 88 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 88 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 50 | 0 | 0.0 | 88 | 88 |
| 100 | -6 | 0.0 | 82 | 82 |
| 200 | -12 | 0.0 | 76 | 76 |
| 300 | -16 | 0.0 | 72 | 72 |
| 400 | -18 | 0.0 | 70 | 70 |
| 500 | -20 | 0.0 | 68 | 68 |
| 600 | -22 | 0.0 | 66 | 66 |
| 700 | -23 | 0.0 | 65 | 65 |
| 800 | -24 | 0.0 | 64 | 64 |
| 900 | -25 | 0.0 | 63 | 63 |
| 1000 | -26 | 0.0 | 62 | 62 |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or
"Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

Geometric attenuation based on 6 dB per doubling of distance.
Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

**Table 52. Detailed Construction Noise Analysis, Phase 2-O : Surface Parking - Site Preparation**

| Source Data: | Maximum Sound Level (dBA) | Utilization Factor | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Grader - Sound level (dBA) at 50 feet = | 85 | 100% | 85.0 |
| Source 2: Grader - Sound level (dBA) at 50 feet = | 85 | 100% | 85.0 |
| Calculated Data: | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 88 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 88 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 50 | 0 | 0.0 | 88 | 88 |
| 100 | -6 | 0.0 | 82 | 82 |
| 200 | -12 | 0.0 | 76 | 76 |
| 300 | -16 | 0.0 | 72 | 72 |
| 400 | -18 | 0.0 | 70 | 70 |
| 500 | -20 | 0.0 | 68 | 68 |
| 600 | -22 | 0.0 | 66 | 66 |
| 700 | -23 | 0.0 | 65 | 65 |
| 800 | -24 | 0.0 | 64 | 64 |
| 900 | -25 | 0.0 | 63 | 63 |
| 1000 | -26 | 0.0 | 62 | 62 |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or "Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

Geometric attenuation based on 6 dB per doubling of distance.
Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

**Table 53. Detailed Construction Noise Analysis, Phase 2-P : Surface Parking - Paving**

| Source Data: | Maximum Sound Level (dBA) | Utilization Factor | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Grader - Sound level (dBA) at 50 feet = | 85 | 100% | 85.0 |
| Source 2: Grader - Sound level (dBA) at 50 feet = | 85 | 100% | 85.0 |
| Calculated Data: | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 88 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 88 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 50 | 0 | 0.0 | 88 | 88 |
| 100 | -6 | 0.0 | 82 | 82 |
| 200 | -12 | 0.0 | 76 | 76 |
| 300 | -16 | 0.0 | 72 | 72 |
| 400 | -18 | 0.0 | 70 | 70 |
| 500 | -20 | 0.0 | 68 | 68 |
| 600 | -22 | 0.0 | 66 | 66 |
| 700 | -23 | 0.0 | 65 | 65 |
| 800 | -24 | 0.0 | 64 | 64 |
| 900 | -25 | 0.0 | 63 | 63 |
| 1000 | -26 | 0.0 | 62 | 62 |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or "Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

Geometric attenuation based on 6 dB per doubling of distance.

Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

**Table 54. Detailed Construction Noise Analysis, Phase 3-A : Buildings (All) - Site Preparation**

| Source Data: | Maximum Sound Level (dBA) | Utilization Factor | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Tractor - Sound level (dBA) at 50 feet = | 84 | 100% | 84.0 |
| Source 2: Tractor - Sound level (dBA) at 50 feet = | 84 | 100% | 84.0 |
| Calculated Data: | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 87 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 87 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 50 | 0 | 0.0 | 87 | 87 |
| 100 | -6 | 0.0 | 81 | 81 |
| 200 | -12 | 0.0 | 75 | 75 |
| 300 | -16 | 0.0 | 71 | 71 |
| 400 | -18 | 0.0 | 69 | 69 |
| 500 | -20 | 0.0 | 67 | 67 |
| 600 | -22 | 0.0 | 65 | 65 |
| 700 | -23 | 0.0 | 64 | 64 |
| 800 | -24 | 0.0 | 63 | 63 |
| 900 | -25 | 0.0 | 62 | 62 |
| 1000 | -26 | 0.0 | 61 | 61 |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or "Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

Geometric attenuation based on 6 dB per doubling of distance.

Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

**Table 55. Detailed Construction Noise Analysis, Phase 3-B : Buildings (All) - Grading**

| Source Data: | Maximum Sound Level (dBA) | Utilization Factor | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Tractor - Sound level (dBA) at 50 feet = | 84 | 100% | 84.0 |
| Source 2: Tractor - Sound level (dBA) at 50 feet = | 84 | 100% | 84.0 |
| Calculated Data: | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 87 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 87 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 50 | 0 | 0.0 | 87 | 87 |
| 100 | -6 | 0.0 | 81 | 81 |
| 200 | -12 | 0.0 | 75 | 75 |
| 300 | -16 | 0.0 | 71 | 71 |
| 400 | -18 | 0.0 | 69 | 69 |
| 500 | -20 | 0.0 | 67 | 67 |
| 600 | -22 | 0.0 | 65 | 65 |
| 700 | -23 | 0.0 | 64 | 64 |
| 800 | -24 | 0.0 | 63 | 63 |
| 900 | -25 | 0.0 | 62 | 62 |
| 1000 | -26 | 0.0 | 61 | 61 |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or "Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

Geometric attenuation based on 6 dB per doubling of distance.

Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

**Table 56. Detailed Construction Noise Analysis, Phase 3-C : Buildings (All) - Demolition**

| Source Data: | Maximum Sound Level (dBA) | Utilization Factor | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Concrete Saw - Sound level (dBA) at 50 feet = | 90 | 100% | 90.0 |
| Source 2: Concrete Saw - Sound level (dBA) at 50 feet = | 90 | 100% | 90.0 |
| Calculated Data: | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 93 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 93 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 50 | 0 | 0.0 | 93 | 93 |
| 100 | -6 | 0.0 | 87 | 87 |
| 200 | -12 | 0.0 | 81 | 81 |
| 300 | -16 | 0.0 | 77 | 77 |
| 400 | -18 | 0.0 | 75 | 75 |
| 500 | -20 | 0.0 | 73 | 73 |
| 600 | -22 | 0.0 | 71 | 71 |
| 700 | -23 | 0.0 | 70 | 70 |
| 800 | -24 | 0.0 | 69 | 69 |
| 900 | -25 | 0.0 | 68 | 68 |
| 1000 | -26 | 0.0 | 67 | 67 |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or "Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971

2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

Geometric attenuation based on 6 dB per doubling of distance.

Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

**Table 57. Detailed Construction Noise Analysis, Phase 3-D-1-A : Buildings Vertical Construction - Research Building #7 Foundations**

| Source Data [a]: | Maximum Sound Level (dBA) | Utilization Factor | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Concrete Pump Truck - Sound level (dBA) at 50 feet = | 81 | 100% | 81.0 |
| Source 2: Concrete Mixer Truck - Sound level (dBA) at 50 feet = | 79 | 100% | 79.0 |
| Calculated Data: | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 83 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 83 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 50 | 0 | 0.0 | 83 | 83 |
| 100 | -6 | 0.0 | 77 | 77 |
| 200 | -12 | 0.0 | 71 | 71 |
| 300 | -16 | 0.0 | 68 | 68 |
| 400 | -18 | 0.0 | 65 | 65 |
| 500 | -20 | 0.0 | 63 | 63 |
| 600 | -22 | 0.0 | 62 | 62 |
| 700 | -23 | 0.0 | 60 | 60 |
| 800 | -24 | 0.0 | 59 | 59 |
| 900 | -25 | 0.0 | 58 | 58 |
| 1000 | -26 | 0.0 | 57 | 57 |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or
"Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

[a] Although no off-road equipment is included in the foundations sub-phase, concrete pump trucks and concrete mixer trucks would be used to pour mat foundations and would contribute to on-site construction noise.

Geometric attenuation based on 6 dB per doubling of distance.

Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

**Table 58. Detailed Construction Noise Analysis, Phase 3-D-1-B : Buildings Vertical Construction - Research Building #7 Trenching**

| Source Data: | Maximum Sound Level (dBA) | Utilization Factor | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Compactor (ground) - Sound level (dBA) at 50 feet = | 83 | 100% | 83.0 |
| Source 2: Compactor (ground) - Sound level (dBA) at 50 feet = | 83 | 100% | 83.0 |
| Calculated Data: | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 86 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 86 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 50 | 0 | 0.0 | 86 | 86 |
| 100 | -6 | 0.0 | 80 | 80 |
| 200 | -12 | 0.0 | 74 | 74 |
| 300 | -16 | 0.0 | 70 | 70 |
| 400 | -18 | 0.0 | 68 | 68 |
| 500 | -20 | 0.0 | 66 | 66 |
| 600 | -22 | 0.0 | 64 | 64 |
| 700 | -23 | 0.0 | 63 | 63 |
| 800 | -24 | 0.0 | 62 | 62 |
| 900 | -25 | 0.0 | 61 | 61 |
| 1000 | -26 | 0.0 | 60 | 60 |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or "Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

Geometric attenuation based on 6 dB per doubling of distance.

Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

**Table 59. Detailed Construction Noise Analysis, Phase 3-D-1-C : Buildings Vertical Construction - Research Building #7 Core and Shell**

| Source Data: | Maximum Sound Level (dBA) | Utilization Factor | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Crane - Sound level (dBA) at 50 feet = | 81 | 100% | 81.0 |
| Source 2: Crane - Sound level (dBA) at 50 feet = | 81 | 100% | 81.0 |
| Calculated Data: | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 84 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 84 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 50 | 0 | 0.0 | 84 | 84 |
| 100 | -6 | 0.0 | 78 | 78 |
| 200 | -12 | 0.0 | 72 | 72 |
| 300 | -16 | 0.0 | 68 | 68 |
| 400 | -18 | 0.0 | 66 | 66 |
| 500 | -20 | 0.0 | 64 | 64 |
| 600 | -22 | 0.0 | 62 | 62 |
| 700 | -23 | 0.0 | 61 | 61 |
| 800 | -24 | 0.0 | 60 | 60 |
| 900 | -25 | 0.0 | 59 | 59 |
| 1000 | -26 | 0.0 | 58 | 58 |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or "Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

Geometric attenuation based on 6 dB per doubling of distance.

Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

**Table 60. Detailed Construction Noise Analysis, Phase 3-D-2-A : Buildings Vertical Construction - Research Building #8 Foundations**

| Source Data [a]: | Maximum Sound Level (dBA) | Utilization Factor | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Concrete Pump Truck - Sound level (dBA) at 50 feet = | 81 | 100% | 81.0 |
| Source 2: Concrete Mixer Truck - Sound level (dBA) at 50 feet = | 79 | 100% | 79.0 |
| Calculated Data: | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 83 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 83 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 50 | 0 | 0.0 | 83 | 83 |
| 100 | -6 | 0.0 | 77 | 77 |
| 200 | -12 | 0.0 | 71 | 71 |
| 300 | -16 | 0.0 | 68 | 68 |
| 400 | -18 | 0.0 | 65 | 65 |
| 500 | -20 | 0.0 | 63 | 63 |
| 600 | -22 | 0.0 | 62 | 62 |
| 700 | -23 | 0.0 | 60 | 60 |
| 800 | -24 | 0.0 | 59 | 59 |
| 900 | -25 | 0.0 | 58 | 58 |
| 1000 | -26 | 0.0 | 57 | 57 |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or
"Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

[a] Although no off-road equipment is included in the foundations sub-phase, concrete pump trucks and concrete mixer trucks would be used to pour mat foundations and would contribute to on-site construction noise.

Geometric attenuation based on 6 dB per doubling of distance.

Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

**Table 61. Detailed Construction Noise Analysis, Phase 3-D-2-B : Buildings Vertical Construction - Research Building #8 Trenching**

| Source Data: | Maximum Sound Level (dBA) | Utilization Factor | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Compactor (ground) - Sound level (dBA) at 50 feet = | 83 | 100% | 83.0 |
| Source 2: Compactor (ground) - Sound level (dBA) at 50 feet = | 83 | 100% | 83.0 |
| Calculated Data: | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 86 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 86 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 50 | 0 | 0.0 | 86 | 86 |
| 100 | -6 | 0.0 | 80 | 80 |
| 200 | -12 | 0.0 | 74 | 74 |
| 300 | -16 | 0.0 | 70 | 70 |
| 400 | -18 | 0.0 | 68 | 68 |
| 500 | -20 | 0.0 | 66 | 66 |
| 600 | -22 | 0.0 | 64 | 64 |
| 700 | -23 | 0.0 | 63 | 63 |
| 800 | -24 | 0.0 | 62 | 62 |
| 900 | -25 | 0.0 | 61 | 61 |
| 1000 | -26 | 0.0 | 60 | 60 |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or "Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

Geometric attenuation based on 6 dB per doubling of distance.
Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

**Table 62. Detailed Construction Noise Analysis, Phase 3-D-2-C : Buildings Vertical Construction - Research Building #8 Core and Shell**

| Source Data: | Maximum Sound Level (dBA) | Utilization Factor | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Crane - Sound level (dBA) at 50 feet = | 81 | 100% | 81.0 |
| Source 2: Crane - Sound level (dBA) at 50 feet = | 81 | 100% | 81.0 |
| Calculated Data: | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 84 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 84 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 50 | 0 | 0.0 | 84 | 84 |
| 100 | -6 | 0.0 | 78 | 78 |
| 200 | -12 | 0.0 | 72 | 72 |
| 300 | -16 | 0.0 | 68 | 68 |
| 400 | -18 | 0.0 | 66 | 66 |
| 500 | -20 | 0.0 | 64 | 64 |
| 600 | -22 | 0.0 | 62 | 62 |
| 700 | -23 | 0.0 | 61 | 61 |
| 800 | -24 | 0.0 | 60 | 60 |
| 900 | -25 | 0.0 | 59 | 59 |
| 1000 | -26 | 0.0 | 58 | 58 |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or "Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

Geometric attenuation based on 6 dB per doubling of distance.

Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

**Table 63. Detailed Construction Noise Analysis, Phase 3-E-1 : Buildings Architectural Coating - Research Building #7**

| Source Data: | Maximum Sound Level (dBA) | Utilization Factor | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Compressor (air) - Sound level (dBA) at 50 feet = | 78 | 100% | 78.0 |
| Source 2: Compressor (air) - Sound level (dBA) at 50 feet = | 78 | 100% | 78.0 |
| Calculated Data: | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 81 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 81 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 50 | 0 | 0.0 | 81 | 81 |
| 100 | -6 | 0.0 | 75 | 75 |
| 200 | -12 | 0.0 | 69 | 69 |
| 300 | -16 | 0.0 | 65 | 65 |
| 400 | -18 | 0.0 | 63 | 63 |
| 500 | -20 | 0.0 | 61 | 61 |
| 600 | -22 | 0.0 | 59 | 59 |
| 700 | -23 | 0.0 | 58 | 58 |
| 800 | -24 | 0.0 | 57 | 57 |
| 900 | -25 | 0.0 | 56 | 56 |
| 1000 | -26 | 0.0 | 55 | 55 |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or "Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

Geometric attenuation based on 6 dB per doubling of distance.
Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

**Table 64. Detailed Construction Noise Analysis, Phase 3-E-2 : Buildings Architectural Coating - Research Building #8**

| Source Data: | Maximum Sound Level (dBA) | Utilization Factor | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Compressor (air) - Sound level (dBA) at 50 feet = | 78 | 100% | 78.0 |
| Source 2: Compressor (air) - Sound level (dBA) at 50 feet = | 78 | 100% | 78.0 |
| Calculated Data: | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 81 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 81 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 50 | 0 | 0.0 | 81 | 81 |
| 100 | -6 | 0.0 | 75 | 75 |
| 200 | -12 | 0.0 | 69 | 69 |
| 300 | -16 | 0.0 | 65 | 65 |
| 400 | -18 | 0.0 | 63 | 63 |
| 500 | -20 | 0.0 | 61 | 61 |
| 600 | -22 | 0.0 | 59 | 59 |
| 700 | -23 | 0.0 | 58 | 58 |
| 800 | -24 | 0.0 | 57 | 57 |
| 900 | -25 | 0.0 | 56 | 56 |
| 1000 | -26 | 0.0 | 55 | 55 |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or "Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

Geometric attenuation based on 6 dB per doubling of distance.

Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

**Table 65. Detailed Construction Noise Analysis, Phase 3-F : Utilities/Roads - Grubbing and Land Clearing**

| Source Data: | Maximum Sound Level (dBA) | Utilization Factor | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Grader - Sound level (dBA) at 50 feet = | 85 | 100% | 85.0 |
| Source 2: Grader - Sound level (dBA) at 50 feet = | 85 | 100% | 85.0 |
| Calculated Data: | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 88 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 88 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 15 | 10 | 0.0 | 98 | 98 |
| 25 | 6 | 0.0 | 94 | 94 |
| 50 | 0 | 0.0 | 88 | 88 |
| 100 | -6 | 0.0 | 82 | 82 |
| 200 | -12 | 0.0 | 76 | 76 |
| 300 | -16 | 0.0 | 72 | 72 |
| 400 | -18 | 0.0 | 70 | 70 |
| 500 | -20 | 0.0 | 68 | 68 |
| 600 | -22 | 0.0 | 66 | 66 |
| 700 | -23 | 0.0 | 65 | 65 |
| 800 | -24 | 0.0 | 64 | 64 |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or "Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

Geometric attenuation based on 6 dB per doubling of distance.

Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

**Table 66. Detailed Construction Noise Analysis, Phase 3-G : Utilities/Roads - Excavation**

| Source Data: | Maximum Sound Level (dBA) | Utilization Factor | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Grader - Sound level (dBA) at 50 feet = | 85 | 100% | 85.0 |
| Source 2: Concrete Saw - Sound level (dBA) at 50 feet = | 90 | 100% | 90.0 |
| Calculated Data: | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 91 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 91 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 15 | 10 | 0.0 | 102 | 102 |
| 25 | 6 | 0.0 | 97 | 97 |
| 50 | 0 | 0.0 | 91 | 91 |
| 100 | -6 | 0.0 | 85 | 85 |
| 200 | -12 | 0.0 | 79 | 79 |
| 300 | -16 | 0.0 | 76 | 76 |
| 400 | -18 | 0.0 | 73 | 73 |
| 500 | -20 | 0.0 | 71 | 71 |
| 600 | -22 | 0.0 | 70 | 70 |
| 700 | -23 | 0.0 | 68 | 68 |
| 800 | -24 | 0.0 | 67 | 67 |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or "Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

Geometric attenuation based on 6 dB per doubling of distance.
Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

**Table 67. Detailed Construction Noise Analysis, Phase 3-H : Utilities/Roads - Drainage and Subgrade**

| Source Data: | Maximum Sound Level (dBA) | Utilization Factor | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Grader - Sound level (dBA) at 50 feet = | 85 | 100% | 85.0 |
| Source 2: Concrete Saw - Sound level (dBA) at 50 feet = | 90 | 100% | 90.0 |
| Calculated Data: | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 91 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 91 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 15 | 10 | 0.0 | 102 | 102 |
| 25 | 6 | 0.0 | 97 | 97 |
| 50 | 0 | 0.0 | 91 | 91 |
| 100 | -6 | 0.0 | 85 | 85 |
| 200 | -12 | 0.0 | 79 | 79 |
| 300 | -16 | 0.0 | 76 | 76 |
| 400 | -18 | 0.0 | 73 | 73 |
| 500 | -20 | 0.0 | 71 | 71 |
| 600 | -22 | 0.0 | 70 | 70 |
| 700 | -23 | 0.0 | 68 | 68 |
| 800 | -24 | 0.0 | 67 | 67 |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or
"Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

Geometric attenuation based on 6 dB per doubling of distance.
Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

**Table 68. Detailed Construction Noise Analysis, Phase 3-I : Utilities/Roads - Paving**

| Source Data: | Maximum Sound Level (dBA) | Utilization Factor | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Grader - Sound level (dBA) at 50 feet = | 85 | 100% | 85.0 |
| Source 2: Grader - Sound level (dBA) at 50 feet = | 85 | 100% | 85.0 |
| Calculated Data: | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 88 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 88 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 15 | 10 | 0.0 | 98 | 98 |
| 25 | 6 | 0.0 | 94 | 94 |
| 50 | 0 | 0.0 | 88 | 88 |
| 100 | -6 | 0.0 | 82 | 82 |
| 200 | -12 | 0.0 | 76 | 76 |
| 300 | -16 | 0.0 | 72 | 72 |
| 400 | -18 | 0.0 | 70 | 70 |
| 500 | -20 | 0.0 | 68 | 68 |
| 600 | -22 | 0.0 | 66 | 66 |
| 700 | -23 | 0.0 | 65 | 65 |
| 800 | -24 | 0.0 | 64 | 64 |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or "Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

Geometric attenuation based on 6 dB per doubling of distance.

Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

**Table 69. Detailed Construction Noise Analysis, Phase 3-J : Parking Structure - Grading**

| Source Data: | Maximum Sound Level (dBA) | Utilization Factor | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Grader - Sound level (dBA) at 50 feet = | 85 | 100% | 85.0 |
| Source 2: Dozer - Sound level (dBA) at 50 feet = | 82 | 100% | 82.0 |
| Calculated Data: | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 87 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 87 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 50 | 0 | 0.0 | 87 | 87 |
| 100 | -6 | 0.0 | 81 | 81 |
| 200 | -12 | 0.0 | 75 | 75 |
| 300 | -16 | 0.0 | 71 | 71 |
| 400 | -18 | 0.0 | 69 | 69 |
| 500 | -20 | 0.0 | 67 | 67 |
| 600 | -22 | 0.0 | 65 | 65 |
| 700 | -23 | 0.0 | 64 | 64 |
| 800 | -24 | 0.0 | 63 | 63 |
| 900 | -25 | 0.0 | 62 | 62 |
| 1000 | -26 | 0.0 | 61 | 61 |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or
"Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

Geometric attenuation based on 6 dB per doubling of distance.

Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

**Table 70. Detailed Construction Noise Analysis, Phase 3-K : Parking Structure - Site Preparation**

| Source Data: | Maximum Sound Level (dBA) | Utilization Factor | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Grader - Sound level (dBA) at 50 feet = | 85 | 100% | 85.0 |
| Source 2: Dozer - Sound level (dBA) at 50 feet = | 82 | 100% | 82.0 |
| Calculated Data: | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 87 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 87 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 50 | 0 | 0.0 | 87 | 87 |
| 100 | -6 | 0.0 | 81 | 81 |
| 200 | -12 | 0.0 | 75 | 75 |
| 300 | -16 | 0.0 | 71 | 71 |
| 400 | -18 | 0.0 | 69 | 69 |
| 500 | -20 | 0.0 | 67 | 67 |
| 600 | -22 | 0.0 | 65 | 65 |
| 700 | -23 | 0.0 | 64 | 64 |
| 800 | -24 | 0.0 | 63 | 63 |
| 900 | -25 | 0.0 | 62 | 62 |
| 1000 | -26 | 0.0 | 61 | 61 |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or "Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

Geometric attenuation based on 6 dB per doubling of distance.

Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

**Table 71. Detailed Construction Noise Analysis, Phase 3-L : Parking Structure - Building Construction**

| Source Data: | Maximum Sound Level (dBA) | Utilization Factor | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Crane - Sound level (dBA) at 50 feet = | 81 | 100% | 81.0 |
| Source 2: Generator - Sound level (dBA) at 50 feet = | 81 | 100% | 81.0 |
| Calculated Data: | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 84 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 84 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 50 | 0 | 0.0 | 84 | 84 |
| 100 | -6 | 0.0 | 78 | 78 |
| 200 | -12 | 0.0 | 72 | 72 |
| 300 | -16 | 0.0 | 68 | 68 |
| 400 | -18 | 0.0 | 66 | 66 |
| 500 | -20 | 0.0 | 64 | 64 |
| 600 | -22 | 0.0 | 62 | 62 |
| 700 | -23 | 0.0 | 61 | 61 |
| 800 | -24 | 0.0 | 60 | 60 |
| 900 | -25 | 0.0 | 59 | 59 |
| 1000 | -26 | 0.0 | 58 | 58 |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or "Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

Geometric attenuation based on 6 dB per doubling of distance.
Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

**Table 72. Detailed Construction Noise Analysis, Phase 3-M : Parking Structure - Building Coatings**

| Source Data: | Maximum Sound Level (dBA) | Utilization Factor | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Compressor (air) - Sound level (dBA) at 50 feet = | 78 | 100% | 78.0 |
| Calculated Data: | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 78 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 78 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 50 | 0 | 0.0 | 78 | 78 |
| 100 | -6 | 0.0 | 72 | 72 |
| 200 | -12 | 0.0 | 66 | 66 |
| 300 | -16 | 0.0 | 62 | 62 |
| 400 | -18 | 0.0 | 60 | 60 |
| 500 | -20 | 0.0 | 58 | 58 |
| 600 | -22 | 0.0 | 56 | 56 |
| 700 | -23 | 0.0 | 55 | 55 |
| 800 | -24 | 0.0 | 54 | 54 |
| 900 | -25 | 0.0 | 53 | 53 |
| 1000 | -26 | 0.0 | 52 | 52 |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or
"Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

Geometric attenuation based on 6 dB per doubling of distance.
Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

**Table 73. Detailed Construction Noise Analysis, Phase 3-N : Parking Structure - Paving**

| Source Data: | Maximum Sound Level (dBA) | Utilization Factor | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Roller - Sound level (dBA) at 50 feet = | 80 | 100% | 80.0 |
| Source 2: Concrete Mixer Truck - Sound level (dBA) at 50 feet = | 79 | 100% | 79.0 |
| Calculated Data: | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 83 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 83 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 50 | 0 | 0.0 | 83 | 83 |
| 100 | -6 | 0.0 | 77 | 77 |
| 200 | -12 | 0.0 | 70 | 70 |
| 300 | -16 | 0.0 | 67 | 67 |
| 400 | -18 | 0.0 | 64 | 64 |
| 500 | -20 | 0.0 | 63 | 63 |
| 600 | -22 | 0.0 | 61 | 61 |
| 700 | -23 | 0.0 | 60 | 60 |
| 800 | -24 | 0.0 | 58 | 58 |
| 900 | -25 | 0.0 | 57 | 57 |
| 1000 | -26 | 0.0 | 57 | 57 |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or "Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

Geometric attenuation based on 6 dB per doubling of distance.
Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

**Table 74. Detailed Construction Noise Analysis, Phase 3-O : Surface Parking - Grading**

| Source Data: | Maximum Sound Level (dBA) | Utilization Factor | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Grader - Sound level (dBA) at 50 feet = | 85 | 100% | 85.0 |
| Source 2: Grader - Sound level (dBA) at 50 feet = | 85 | 100% | 85.0 |
| Calculated Data: | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 88 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 88 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 50 | 0 | 0.0 | 88 | 88 |
| 100 | -6 | 0.0 | 82 | 82 |
| 200 | -12 | 0.0 | 76 | 76 |
| 300 | -16 | 0.0 | 72 | 72 |
| 400 | -18 | 0.0 | 70 | 70 |
| 500 | -20 | 0.0 | 68 | 68 |
| 600 | -22 | 0.0 | 66 | 66 |
| 700 | -23 | 0.0 | 65 | 65 |
| 800 | -24 | 0.0 | 64 | 64 |
| 900 | -25 | 0.0 | 63 | 63 |
| 1000 | -26 | 0.0 | 62 | 62 |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or "Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

Geometric attenuation based on 6 dB per doubling of distance.

Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

**Table 75. Detailed Construction Noise Analysis, Phase 3-P : Surface Parking - Site Preparation**

| Source Data: | Maximum Sound Level (dBA) | Utilization Factor | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Grader - Sound level (dBA) at 50 feet = | 85 | 100% | 85.0 |
| Source 2: Grader - Sound level (dBA) at 50 feet = | 85 | 100% | 85.0 |
| Calculated Data: | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 88 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 88 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 50 | 0 | 0.0 | 88 | 88 |
| 100 | -6 | 0.0 | 82 | 82 |
| 200 | -12 | 0.0 | 76 | 76 |
| 300 | -16 | 0.0 | 72 | 72 |
| 400 | -18 | 0.0 | 70 | 70 |
| 500 | -20 | 0.0 | 68 | 68 |
| 600 | -22 | 0.0 | 66 | 66 |
| 700 | -23 | 0.0 | 65 | 65 |
| 800 | -24 | 0.0 | 64 | 64 |
| 900 | -25 | 0.0 | 63 | 63 |
| 1000 | -26 | 0.0 | 62 | 62 |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or "Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

Geometric attenuation based on 6 dB per doubling of distance.

Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

**Table 76. Detailed Construction Noise Analysis, Phase 3-Q : Surface Parking - Paving**

| Source Data: | Maximum Sound Level (dBA) | Utilization Factor | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Grader - Sound level (dBA) at 50 feet = | 85 | 100% | 85.0 |
| Source 2: Grader - Sound level (dBA) at 50 feet = | 85 | 100% | 85.0 |
| Calculated Data: | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 88 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 88 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 50 | 0 | 0.0 | 88 | 88 |
| 100 | -6 | 0.0 | 82 | 82 |
| 200 | -12 | 0.0 | 76 | 76 |
| 300 | -16 | 0.0 | 72 | 72 |
| 400 | -18 | 0.0 | 70 | 70 |
| 500 | -20 | 0.0 | 68 | 68 |
| 600 | -22 | 0.0 | 66 | 66 |
| 700 | -23 | 0.0 | 65 | 65 |
| 800 | -24 | 0.0 | 64 | 64 |
| 900 | -25 | 0.0 | 63 | 63 |
| 1000 | -26 | 0.0 | 62 | 62 |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or "Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

Geometric attenuation based on 6 dB per doubling of distance.
Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

**Table 77. Detailed Construction Noise Analysis, Phase 4-A : Buildings (All) - Site Preparation**

| Source Data: | Maximum Sound Level (dBA) | Utilization Factor | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Tractor - Sound level (dBA) at 50 feet = | 84 | 100% | 84.0 |
| Source 2: Tractor - Sound level (dBA) at 50 feet = | 84 | 100% | 84.0 |
| Calculated Data: | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 87 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 87 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 50 | 0 | 0.0 | 87 | 87 |
| 100 | -6 | 0.0 | 81 | 81 |
| 200 | -12 | 0.0 | 75 | 75 |
| 300 | -16 | 0.0 | 71 | 71 |
| 400 | -18 | 0.0 | 69 | 69 |
| 500 | -20 | 0.0 | 67 | 67 |
| 600 | -22 | 0.0 | 65 | 65 |
| 700 | -23 | 0.0 | 64 | 64 |
| 800 | -24 | 0.0 | 63 | 63 |
| 900 | -25 | 0.0 | 62 | 62 |
| 1000 | -26 | 0.0 | 61 | 61 |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or "Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

Geometric attenuation based on 6 dB per doubling of distance.
Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

**Table 78. Detailed Construction Noise Analysis, Phase 4-B : Buildings (All) - Grading**

| Source Data: | Maximum Sound Level (dBA) | Utilization Factor | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Tractor - Sound level (dBA) at 50 feet = | 84 | 100% | 84.0 |
| Source 2: Tractor - Sound level (dBA) at 50 feet = | 84 | 100% | 84.0 |
| Calculated Data: | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 87 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 87 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 50 | 0 | 0.0 | 87 | 87 |
| 100 | -6 | 0.0 | 81 | 81 |
| 200 | -12 | 0.0 | 75 | 75 |
| 300 | -16 | 0.0 | 71 | 71 |
| 400 | -18 | 0.0 | 69 | 69 |
| 500 | -20 | 0.0 | 67 | 67 |
| 600 | -22 | 0.0 | 65 | 65 |
| 700 | -23 | 0.0 | 64 | 64 |
| 800 | -24 | 0.0 | 63 | 63 |
| 900 | -25 | 0.0 | 62 | 62 |
| 1000 | -26 | 0.0 | 61 | 61 |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or "Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

Geometric attenuation based on 6 dB per doubling of distance.
Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

**Table 79. Detailed Construction Noise Analysis, Phase 4-C : Buildings (All) - Demolition**

| Source Data: | Maximum Sound Level (dBA) | Utilization Factor | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Concrete Saw - Sound level (dBA) at 50 feet = | 90 | 100% | 90.0 |
| Source 2: Concrete Saw - Sound level (dBA) at 50 feet = | 90 | 100% | 90.0 |
| Calculated Data: | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 93 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 93 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 50 | 0 | 0.0 | 93 | 93 |
| 100 | -6 | 0.0 | 87 | 87 |
| 200 | -12 | 0.0 | 81 | 81 |
| 300 | -16 | 0.0 | 77 | 77 |
| 400 | -18 | 0.0 | 75 | 75 |
| 500 | -20 | 0.0 | 73 | 73 |
| 600 | -22 | 0.0 | 71 | 71 |
| 700 | -23 | 0.0 | 70 | 70 |
| 800 | -24 | 0.0 | 69 | 69 |
| 900 | -25 | 0.0 | 68 | 68 |
| 1000 | -26 | 0.0 | 67 | 67 |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or
"Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

Geometric attenuation based on 6 dB per doubling of distance.
Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

**Table 80. Detailed Construction Noise Analysis, Phase 4-D-1-A : Buildings Vertical Construction - Research Building #9 Foundations**

| Source Data [a]: | Maximum Sound Level (dBA) | Utilization Factor | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Concrete Pump Truck - Sound level (dBA) at 50 feet = | 81 | 100% | 81.0 |
| Source 2: Concrete Mixer Truck - Sound level (dBA) at 50 feet = | 79 | 100% | 79.0 |
| Calculated Data: | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 83 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 83 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 50 | 0 | 0.0 | 83 | 83 |
| 100 | -6 | 0.0 | 77 | 77 |
| 200 | -12 | 0.0 | 71 | 71 |
| 300 | -16 | 0.0 | 68 | 68 |
| 400 | -18 | 0.0 | 65 | 65 |
| 500 | -20 | 0.0 | 63 | 63 |
| 600 | -22 | 0.0 | 62 | 62 |
| 700 | -23 | 0.0 | 60 | 60 |
| 800 | -24 | 0.0 | 59 | 59 |
| 900 | -25 | 0.0 | 58 | 58 |
| 1000 | -26 | 0.0 | 57 | 57 |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or "Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

[a] Although no off-road equipment is included in the foundations sub-phase, concrete pump trucks and concrete mixer trucks would be used to pour mat foundations and would contribute to on-site construction noise.

Geometric attenuation based on 6 dB per doubling of distance.

Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

**Table 81. Detailed Construction Noise Analysis, Phase 4-D-1-B : Buildings Vertical Construction - Research Building #9 Trenching**

| Source Data: | Maximum Sound Level (dBA) | Utilization Factor | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Compactor (ground) - Sound level (dBA) at 50 feet = | 83 | 100% | 83.0 |
| Source 2: Compactor (ground) - Sound level (dBA) at 50 feet = | 83 | 100% | 83.0 |
| Calculated Data: | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 86 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 86 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 50 | 0 | 0.0 | 86 | 86 |
| 100 | -6 | 0.0 | 80 | 80 |
| 200 | -12 | 0.0 | 74 | 74 |
| 300 | -16 | 0.0 | 70 | 70 |
| 400 | -18 | 0.0 | 68 | 68 |
| 500 | -20 | 0.0 | 66 | 66 |
| 600 | -22 | 0.0 | 64 | 64 |
| 700 | -23 | 0.0 | 63 | 63 |
| 800 | -24 | 0.0 | 62 | 62 |
| 900 | -25 | 0.0 | 61 | 61 |
| 1000 | -26 | 0.0 | 60 | 60 |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or "Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

Geometric attenuation based on 6 dB per doubling of distance.

Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

**Table 82. Detailed Construction Noise Analysis, Phase 4-D-1-C : Buildings Vertical Construction - Research Building #9 Core and Shell**

| Source Data: | Maximum Sound Level (dBA) | Utilization Factor | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Crane - Sound level (dBA) at 50 feet = | 81 | 100% | 81.0 |
| Source 2: Crane - Sound level (dBA) at 50 feet = | 81 | 100% | 81.0 |
| **Calculated Data:** | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 84 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 84 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 50 | 0 | 0.0 | 84 | 84 |
| 100 | -6 | 0.0 | 78 | 78 |
| 200 | -12 | 0.0 | 72 | 72 |
| 300 | -16 | 0.0 | 68 | 68 |
| 400 | -18 | 0.0 | 66 | 66 |
| 500 | -20 | 0.0 | 64 | 64 |
| 600 | -22 | 0.0 | 62 | 62 |
| 700 | -23 | 0.0 | 61 | 61 |
| 800 | -24 | 0.0 | 60 | 60 |
| 900 | -25 | 0.0 | 59 | 59 |
| 1000 | -26 | 0.0 | 58 | 58 |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or "Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

Geometric attenuation based on 6 dB per doubling of distance.

Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

**Table 83. Detailed Construction Noise Analysis, Phase 4-D-2-A : Buildings Vertical Construction - Research Building #10 Foundations**

| Source Data [a]: | Maximum Sound Level (dBA) | Utilization Factor | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Concrete Pump Truck - Sound level (dBA) at 50 feet = | 81 | 100% | 81.0 |
| Source 2: Concrete Mixer Truck - Sound level (dBA) at 50 feet = | 79 | 100% | 79.0 |
| Calculated Data: | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 83 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 83 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 50 | 0 | 0.0 | 83 | 83 |
| 100 | -6 | 0.0 | 77 | 77 |
| 200 | -12 | 0.0 | 71 | 71 |
| 300 | -16 | 0.0 | 68 | 68 |
| 400 | -18 | 0.0 | 65 | 65 |
| 500 | -20 | 0.0 | 63 | 63 |
| 600 | -22 | 0.0 | 62 | 62 |
| 700 | -23 | 0.0 | 60 | 60 |
| 800 | -24 | 0.0 | 59 | 59 |
| 900 | -25 | 0.0 | 58 | 58 |
| 1000 | -26 | 0.0 | 57 | 57 |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or
"Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

[a] Although no off-road equipment is included in the foundations sub-phase, concrete pump trucks and concrete mixer trucks would be used to pour mat foundations and would contribute to on-site construction noise.

Geometric attenuation based on 6 dB per doubling of distance.

Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

**Table 84. Detailed Construction Noise Analysis, Phase 4-D-2-B : Buildings Vertical Construction - Research Building #10 Trenching**

| Source Data: | Maximum Sound Level (dBA) | Utilization Factor | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Compactor (ground) - Sound level (dBA) at 50 feet = | 83 | 100% | 83.0 |
| Source 2: Compactor (ground) - Sound level (dBA) at 50 feet = | 83 | 100% | 83.0 |
| Calculated Data: | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 86 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 86 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 50 | 0 | 0.0 | 86 | 86 |
| 100 | -6 | 0.0 | 80 | 80 |
| 200 | -12 | 0.0 | 74 | 74 |
| 300 | -16 | 0.0 | 70 | 70 |
| 400 | -18 | 0.0 | 68 | 68 |
| 500 | -20 | 0.0 | 66 | 66 |
| 600 | -22 | 0.0 | 64 | 64 |
| 700 | -23 | 0.0 | 63 | 63 |
| 800 | -24 | 0.0 | 62 | 62 |
| 900 | -25 | 0.0 | 61 | 61 |
| 1000 | -26 | 0.0 | 60 | 60 |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or
"Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

Geometric attenuation based on 6 dB per doubling of distance.

Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

**Table 85. Detailed Construction Noise Analysis, Phase 4-D-2-C : Buildings Vertical Construction - Research Building #10 Core and Shell**

| Source Data: | Maximum Sound Level (dBA) | Utilization Factor | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Crane - Sound level (dBA) at 50 feet = | 81 | 100% | 81.0 |
| Source 2: Crane - Sound level (dBA) at 50 feet = | 81 | 100% | 81.0 |
| Calculated Data: | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 84 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 84 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 50 | 0 | 0.0 | 84 | 84 |
| 100 | -6 | 0.0 | 78 | 78 |
| 200 | -12 | 0.0 | 72 | 72 |
| 300 | -16 | 0.0 | 68 | 68 |
| 400 | -18 | 0.0 | 66 | 66 |
| 500 | -20 | 0.0 | 64 | 64 |
| 600 | -22 | 0.0 | 62 | 62 |
| 700 | -23 | 0.0 | 61 | 61 |
| 800 | -24 | 0.0 | 60 | 60 |
| 900 | -25 | 0.0 | 59 | 59 |
| 1000 | -26 | 0.0 | 58 | 58 |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or
"Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

Geometric attenuation based on 6 dB per doubling of distance.
Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

**Table 86. Detailed Construction Noise Analysis, Phase 4-E-1 : Buildings Architectural Coatings, Research Building #9**

| Source Data: | Maximum Sound Level (dBA) | Utilization Factor | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Compressor (air) - Sound level (dBA) at 50 feet = | 78 | 100% | 78.0 |
| Source 2: Compressor (air) - Sound level (dBA) at 50 feet = | 78 | 100% | 78.0 |
| Calculated Data: | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 81 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 81 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 50 | 0 | 0.0 | 81 | 81 |
| 100 | -6 | 0.0 | 75 | 75 |
| 200 | -12 | 0.0 | 69 | 69 |
| 300 | -16 | 0.0 | 65 | 65 |
| 400 | -18 | 0.0 | 63 | 63 |
| 500 | -20 | 0.0 | 61 | 61 |
| 600 | -22 | 0.0 | 59 | 59 |
| 700 | -23 | 0.0 | 58 | 58 |
| 800 | -24 | 0.0 | 57 | 57 |
| 900 | -25 | 0.0 | 56 | 56 |
| 1000 | -26 | 0.0 | 55 | 55 |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or
"Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

Geometric attenuation based on 6 dB per doubling of distance.

Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

**Table 87. Detailed Construction Noise Analysis, Phase 4-E-2 : Buildings Architectural Coatings, Research Building #10**

| Source Data: | Maximum Sound Level (dBA) | Utilization Factor | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Compressor (air) - Sound level (dBA) at 50 feet = | 78 | 100% | 78.0 |
| Source 2: Compressor (air) - Sound level (dBA) at 50 feet = | 78 | 100% | 78.0 |
| Calculated Data: | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 81 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 81 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 50 | 0 | 0.0 | 81 | 81 |
| 100 | -6 | 0.0 | 75 | 75 |
| 200 | -12 | 0.0 | 69 | 69 |
| 300 | -16 | 0.0 | 65 | 65 |
| 400 | -18 | 0.0 | 63 | 63 |
| 500 | -20 | 0.0 | 61 | 61 |
| 600 | -22 | 0.0 | 59 | 59 |
| 700 | -23 | 0.0 | 58 | 58 |
| 800 | -24 | 0.0 | 57 | 57 |
| 900 | -25 | 0.0 | 56 | 56 |
| 1000 | -26 | 0.0 | 55 | 55 |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or "Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

Geometric attenuation based on 6 dB per doubling of distance.

Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

**Table 88. Detailed Construction Noise Analysis, Phase 4-F-1-A : Buildings Vertical Construction, Residential Foundations**

| Source Data [a]: | Maximum Sound Level (dBA) | Utilization Factor | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Concrete Pump Truck - Sound level (dBA) at 50 feet = | 81 | 100% | 81.0 |
| Source 2: Concrete Mixer Truck - Sound level (dBA) at 50 feet = | 79 | 100% | 79.0 |
| Calculated Data: | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 83 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 83 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 50 | 0 | 0.0 | 83 | 83 |
| 100 | -6 | 0.0 | 77 | 77 |
| 200 | -12 | 0.0 | 71 | 71 |
| 300 | -16 | 0.0 | 68 | 68 |
| 400 | -18 | 0.0 | 65 | 65 |
| 500 | -20 | 0.0 | 63 | 63 |
| 600 | -22 | 0.0 | 62 | 62 |
| 700 | -23 | 0.0 | 60 | 60 |
| 800 | -24 | 0.0 | 59 | 59 |
| 900 | -25 | 0.0 | 58 | 58 |
| 1000 | -26 | 0.0 | 57 | 57 |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or
"Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971

2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

[a] Although no off-road equipment is included in the foundations sub-phase, concrete pump trucks and concrete mixer trucks would be used to pour mat foundations and would contribute to on-site construction noise.

Geometric attenuation based on 6 dB per doubling of distance.

Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

**Table 89. Detailed Construction Noise Analysis, Phase 4-F-1-B : Buildings Vertical Construction, Residential Trenching**

| Source Data: | Maximum Sound Level (dBA) | Utilization Factor | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Compactor (ground) - Sound level (dBA) at 50 feet = | 83 | 100% | 83.0 |
| Source 2: Compactor (ground) - Sound level (dBA) at 50 feet = | 83 | 100% | 83.0 |
| Calculated Data: | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 86 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 86 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 50 | 0 | 0.0 | 86 | 86 |
| 100 | -6 | 0.0 | 80 | 80 |
| 200 | -12 | 0.0 | 74 | 74 |
| 300 | -16 | 0.0 | 70 | 70 |
| 400 | -18 | 0.0 | 68 | 68 |
| 500 | -20 | 0.0 | 66 | 66 |
| 600 | -22 | 0.0 | 64 | 64 |
| 700 | -23 | 0.0 | 63 | 63 |
| 800 | -24 | 0.0 | 62 | 62 |
| 900 | -25 | 0.0 | 61 | 61 |
| 1000 | -26 | 0.0 | 60 | 60 |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or
"Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

Geometric attenuation based on 6 dB per doubling of distance.

Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

**Table 90. Detailed Construction Noise Analysis, Phase 4-F-1-C : Buildings Vertical Construction, Residential Core and Shell**

| Source Data: | Maximum Sound Level (dBA) | Utilization Factor | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Crane - Sound level (dBA) at 50 feet = | 81 | 100% | 81.0 |
| Source 2: Crane - Sound level (dBA) at 50 feet = | 81 | 100% | 81.0 |
| Calculated Data: | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 84 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 84 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 50 | 0 | 0.0 | 84 | 84 |
| 100 | -6 | 0.0 | 78 | 78 |
| 200 | -12 | 0.0 | 72 | 72 |
| 300 | -16 | 0.0 | 68 | 68 |
| 400 | -18 | 0.0 | 66 | 66 |
| 500 | -20 | 0.0 | 64 | 64 |
| 600 | -22 | 0.0 | 62 | 62 |
| 700 | -23 | 0.0 | 61 | 61 |
| 800 | -24 | 0.0 | 60 | 60 |
| 900 | -25 | 0.0 | 59 | 59 |
| 1000 | -26 | 0.0 | 58 | 58 |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or "Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

Geometric attenuation based on 6 dB per doubling of distance.

Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

**Table 91. Detailed Construction Noise Analysis, Phase 4-G : Buildings Architectural Coatings - Residential**

| Source Data: | Maximum Sound Level (dBA) | Utilization Factor | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Compressor (air) - Sound level (dBA) at 50 feet = | 78 | 100% | 78.0 |
| Source 2: Compressor (air) - Sound level (dBA) at 50 feet = | 78 | 100% | 78.0 |
| Calculated Data: | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 81 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 81 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 50 | 0 | 0.0 | 81 | 81 |
| 100 | -6 | 0.0 | 75 | 75 |
| 200 | -12 | 0.0 | 69 | 69 |
| 300 | -16 | 0.0 | 65 | 65 |
| 400 | -18 | 0.0 | 63 | 63 |
| 500 | -20 | 0.0 | 61 | 61 |
| 600 | -22 | 0.0 | 59 | 59 |
| 700 | -23 | 0.0 | 58 | 58 |
| 800 | -24 | 0.0 | 57 | 57 |
| 900 | -25 | 0.0 | 56 | 56 |
| 1000 | -26 | 0.0 | 55 | 55 |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or
"Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

Geometric attenuation based on 6 dB per doubling of distance.
Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

**Table 92. Detailed Construction Noise Analysis, Phase 4-H : Utilities/Roads - Grubbing and Land Clearing**

| Source Data: | Maximum Sound Level (dBA) | Utilization Factor | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Grader - Sound level (dBA) at 50 feet = | 85 | 100% | 85.0 |
| Source 2: Grader - Sound level (dBA) at 50 feet = | 85 | 100% | 85.0 |
| Calculated Data: | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 88 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 88 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 15 | 10 | 0.0 | 98 | 98 |
| 25 | 6 | 0.0 | 94 | 94 |
| 50 | 0 | 0.0 | 88 | 88 |
| 100 | -6 | 0.0 | 82 | 82 |
| 200 | -12 | 0.0 | 76 | 76 |
| 300 | -16 | 0.0 | 72 | 72 |
| 400 | -18 | 0.0 | 70 | 70 |
| 500 | -20 | 0.0 | 68 | 68 |
| 600 | -22 | 0.0 | 66 | 66 |
| 700 | -23 | 0.0 | 65 | 65 |
| 800 | -24 | 0.0 | 64 | 64 |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or "Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971

2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

Geometric attenuation based on 6 dB per doubling of distance.

Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

**Table 93. Detailed Construction Noise Analysis, Phase 4-I : Utilities/Roads - Excavation**

| Source Data: | Maximum Sound Level (dBA) | Utilization Factor | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Grader - Sound level (dBA) at 50 feet = | 85 | 100% | 85.0 |
| Source 2: Concrete Saw - Sound level (dBA) at 50 feet = | 90 | 100% | 90.0 |
| Calculated Data: | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 91 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 91 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 15 | 10 | 0.0 | 102 | 102 |
| 25 | 6 | 0.0 | 97 | 97 |
| 50 | 0 | 0.0 | 91 | 91 |
| 100 | -6 | 0.0 | 85 | 85 |
| 200 | -12 | 0.0 | 79 | 79 |
| 300 | -16 | 0.0 | 76 | 76 |
| 400 | -18 | 0.0 | 73 | 73 |
| 500 | -20 | 0.0 | 71 | 71 |
| 600 | -22 | 0.0 | 70 | 70 |
| 700 | -23 | 0.0 | 68 | 68 |
| 800 | -24 | 0.0 | 67 | 67 |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or "Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

Geometric attenuation based on 6 dB per doubling of distance.

Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

**Table 94. Detailed Construction Noise Analysis, Phase 4-J : Utilities/Roads - Drainage and Subgrade**

| Source Data: | Maximum Sound Level (dBA) | Utilization Factor | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Grader - Sound level (dBA) at 50 feet = | 85 | 100% | 85.0 |
| Source 2: Concrete Saw - Sound level (dBA) at 50 feet = | 90 | 100% | 90.0 |
| Calculated Data: | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 91 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 91 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 15 | 10 | 0.0 | 102 | 102 |
| 25 | 6 | 0.0 | 97 | 97 |
| 50 | 0 | 0.0 | 91 | 91 |
| 100 | -6 | 0.0 | 85 | 85 |
| 200 | -12 | 0.0 | 79 | 79 |
| 300 | -16 | 0.0 | 76 | 76 |
| 400 | -18 | 0.0 | 73 | 73 |
| 500 | -20 | 0.0 | 71 | 71 |
| 600 | -22 | 0.0 | 70 | 70 |
| 700 | -23 | 0.0 | 68 | 68 |
| 800 | -24 | 0.0 | 67 | 67 |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or "Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

Geometric attenuation based on 6 dB per doubling of distance.

Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

**Table 95. Detailed Construction Noise Analysis, Phase 4-K : Utilities/Roads - Paving**

| Source Data: | Maximum Sound Level (dBA) | Utilization Factor | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Grader - Sound level (dBA) at 50 feet = | 85 | 100% | 85.0 |
| Source 2: Grader - Sound level (dBA) at 50 feet = | 85 | 100% | 85.0 |
| Calculated Data: | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 88 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 88 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 15 | 10 | 0.0 | 98 | 98 |
| 25 | 6 | 0.0 | 94 | 94 |
| 50 | 0 | 0.0 | 88 | 88 |
| 100 | -6 | 0.0 | 82 | 82 |
| 200 | -12 | 0.0 | 76 | 76 |
| 300 | -16 | 0.0 | 72 | 72 |
| 400 | -18 | 0.0 | 70 | 70 |
| 500 | -20 | 0.0 | 68 | 68 |
| 600 | -22 | 0.0 | 66 | 66 |
| 700 | -23 | 0.0 | 65 | 65 |
| 800 | -24 | 0.0 | 64 | 64 |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or "Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971

2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

Geometric attenuation based on 6 dB per doubling of distance.

Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

**Table 96. Detailed Construction Noise Analysis, Phase 4-L : Parking Structure - Grading**

| Source Data: | Maximum Sound Level (dBA) | Utilization Factor | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Grader - Sound level (dBA) at 50 feet = | 85 | 100% | 85.0 |
| Source 2: Dozer - Sound level (dBA) at 50 feet = | 82 | 100% | 82.0 |
| Calculated Data: | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 87 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 87 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 50 | 0 | 0.0 | 87 | 87 |
| 100 | -6 | 0.0 | 81 | 81 |
| 200 | -12 | 0.0 | 75 | 75 |
| 300 | -16 | 0.0 | 71 | 71 |
| 400 | -18 | 0.0 | 69 | 69 |
| 500 | -20 | 0.0 | 67 | 67 |
| 600 | -22 | 0.0 | 65 | 65 |
| 700 | -23 | 0.0 | 64 | 64 |
| 800 | -24 | 0.0 | 63 | 63 |
| 900 | -25 | 0.0 | 62 | 62 |
| 1000 | -26 | 0.0 | 61 | 61 |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or "Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

Geometric attenuation based on 6 dB per doubling of distance.

Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

**Table 97. Detailed Construction Noise Analysis, Phase 4-M : Parking Structure - Site Preparation**

| Source Data: | Maximum Sound Level (dBA) | Utilization Factor | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Grader - Sound level (dBA) at 50 feet = | 85 | 100% | 85.0 |
| Source 2: Dozer - Sound level (dBA) at 50 feet = | 82 | 100% | 82.0 |
| Calculated Data: | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 87 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 87 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 50 | 0 | 0.0 | 87 | 87 |
| 100 | -6 | 0.0 | 81 | 81 |
| 200 | -12 | 0.0 | 75 | 75 |
| 300 | -16 | 0.0 | 71 | 71 |
| 400 | -18 | 0.0 | 69 | 69 |
| 500 | -20 | 0.0 | 67 | 67 |
| 600 | -22 | 0.0 | 65 | 65 |
| 700 | -23 | 0.0 | 64 | 64 |
| 800 | -24 | 0.0 | 63 | 63 |
| 900 | -25 | 0.0 | 62 | 62 |
| 1000 | -26 | 0.0 | 61 | 61 |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or "Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

Geometric attenuation based on 6 dB per doubling of distance.
Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

**Table 98. Detailed Construction Noise Analysis, Phase 4-N : Parking Structure - Building Construction**

| Source Data: | Maximum Sound Level (dBA) | Utilization Factor | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Crane - Sound level (dBA) at 50 feet = | 81 | 100% | 81.0 |
| Source 2: Generator - Sound level (dBA) at 50 feet = | 81 | 100% | 81.0 |
| Calculated Data: | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 84 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 84 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 50 | 0 | 0.0 | 84 | 84 |
| 100 | -6 | 0.0 | 78 | 78 |
| 200 | -12 | 0.0 | 72 | 72 |
| 300 | -16 | 0.0 | 68 | 68 |
| 400 | -18 | 0.0 | 66 | 66 |
| 500 | -20 | 0.0 | 64 | 64 |
| 600 | -22 | 0.0 | 62 | 62 |
| 700 | -23 | 0.0 | 61 | 61 |
| 800 | -24 | 0.0 | 60 | 60 |
| 900 | -25 | 0.0 | 59 | 59 |
| 1000 | -26 | 0.0 | 58 | 58 |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or "Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

Geometric attenuation based on 6 dB per doubling of distance.
Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

**Table 99. Detailed Construction Noise Analysis, Phase 4-O : Parking Structure - Building Coatings**

| Source Data: | Maximum Sound Level (dBA) | Utilization Factor | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Compressor (air) - Sound level (dBA) at 50 feet = | 78 | 100% | 78.0 |
| Calculated Data: | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 78 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 78 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 50 | 0 | 0.0 | 78 | 78 |
| 100 | -6 | 0.0 | 72 | 72 |
| 200 | -12 | 0.0 | 66 | 66 |
| 300 | -16 | 0.0 | 62 | 62 |
| 400 | -18 | 0.0 | 60 | 60 |
| 500 | -20 | 0.0 | 58 | 58 |
| 600 | -22 | 0.0 | 56 | 56 |
| 700 | -23 | 0.0 | 55 | 55 |
| 800 | -24 | 0.0 | 54 | 54 |
| 900 | -25 | 0.0 | 53 | 53 |
| 1000 | -26 | 0.0 | 52 | 52 |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or
"Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

Geometric attenuation based on 6 dB per doubling of distance.

Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

**Table 100. Detailed Construction Noise Analysis, Phase 4-P : Parking Structure - Paving**

| Source Data: | Maximum Sound Level (dBA) | Utilization Factor | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Roller - Sound level (dBA) at 50 feet = | 80 | 100% | 80.0 |
| Source 2: Concrete Mixer Truck - Sound level (dBA) at 50 feet = | 79 | 100% | 79.0 |
| Calculated Data: | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 83 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 83 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 50 | 0 | 0.0 | 83 | 83 |
| 100 | -6 | 0.0 | 77 | 77 |
| 200 | -12 | 0.0 | 70 | 70 |
| 300 | -16 | 0.0 | 67 | 67 |
| 400 | -18 | 0.0 | 64 | 64 |
| 500 | -20 | 0.0 | 63 | 63 |
| 600 | -22 | 0.0 | 61 | 61 |
| 700 | -23 | 0.0 | 60 | 60 |
| 800 | -24 | 0.0 | 58 | 58 |
| 900 | -25 | 0.0 | 57 | 57 |
| 1000 | -26 | 0.0 | 57 | 57 |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or "Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

Geometric attenuation based on 6 dB per doubling of distance.

Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

**Table 101. Detailed Construction Noise Analysis, Phase WRF-A : Site Preparation**

| Source Data: | Maximum Sound Level (dBA) | Utilization Factor | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Tractor - Sound level (dBA) at 50 feet = | 84 | 100% | 84.0 |
| Source 2: Tractor - Sound level (dBA) at 50 feet = | 84 | 100% | 84.0 |
| Calculated Data: | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 87 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 87 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 50 | 0 | 0.0 | 87 | 87 |
| 100 | -6 | 0.0 | 81 | 81 |
| 200 | -12 | 0.0 | 75 | 75 |
| 300 | -16 | 0.0 | 71 | 71 |
| 400 | -18 | 0.0 | 69 | 69 |
| 500 | -20 | 0.0 | 67 | 67 |
| 600 | -22 | 0.0 | 65 | 65 |
| 700 | -23 | 0.0 | 64 | 64 |
| 800 | -24 | 0.0 | 63 | 63 |
| 900 | -25 | 0.0 | 62 | 62 |
| 1000 | -26 | 0.0 | 61 | 61 |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or
"Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

Geometric attenuation based on 6 dB per doubling of distance.
Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

**Table 102. Detailed Construction Noise Analysis, Phase WRF-B : Grading**

| Source Data: | Maximum Sound Level (dBA) | Utilization Factor | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Tractor - Sound level (dBA) at 50 feet = | 84 | 100% | 84.0 |
| Source 2: Tractor - Sound level (dBA) at 50 feet = | 84 | 100% | 84.0 |
| Calculated Data: | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 87 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 87 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 50 | 0 | 0.0 | 87 | 87 |
| 100 | -6 | 0.0 | 81 | 81 |
| 200 | -12 | 0.0 | 75 | 75 |
| 300 | -16 | 0.0 | 71 | 71 |
| 400 | -18 | 0.0 | 69 | 69 |
| 500 | -20 | 0.0 | 67 | 67 |
| 600 | -22 | 0.0 | 65 | 65 |
| 700 | -23 | 0.0 | 64 | 64 |
| 800 | -24 | 0.0 | 63 | 63 |
| 900 | -25 | 0.0 | 62 | 62 |
| 1000 | -26 | 0.0 | 61 | 61 |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or
"Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

Geometric attenuation based on 6 dB per doubling of distance.
Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

**Table 103. Detailed Construction Noise Analysis, Phase WRF-C : Vertical Construction**

| Source Data: | Maximum Sound Level (dBA) | Utilization Factor | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Front End Loader - Sound level (dBA) at 50 feet = | 79 | 100% | 79.0 |
| Source 2: Front End Loader - Sound level (dBA) at 50 feet = | 79 | 100% | 79.0 |
| Calculated Data: | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 82 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 82 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 50 | 0 | 0.0 | 82 | 82 |
| 100 | -6 | 0.0 | 76 | 76 |
| 200 | -12 | 0.0 | 70 | 70 |
| 300 | -16 | 0.0 | 66 | 66 |
| 400 | -18 | 0.0 | 64 | 64 |
| 500 | -20 | 0.0 | 62 | 62 |
| 600 | -22 | 0.0 | 60 | 60 |
| 700 | -23 | 0.0 | 59 | 59 |
| 800 | -24 | 0.0 | 58 | 58 |
| 900 | -25 | 0.0 | 57 | 57 |
| 1000 | -26 | 0.0 | 56 | 56 |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or "Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

Geometric attenuation based on 6 dB per doubling of distance.
Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

**Table 104. Detailed Construction Noise Analysis, Phase CUP-A : Site Preparation**

| Source Data: | Maximum Sound Level (dBA) | Utilization Factor | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Tractor - Sound level (dBA) at 50 feet = | 84 | 100% | 84.0 |
| Source 2: Tractor - Sound level (dBA) at 50 feet = | 84 | 100% | 84.0 |
| Calculated Data: | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 87 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 87 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 50 | 0 | 0.0 | 87 | 87 |
| 100 | -6 | 0.0 | 81 | 81 |
| 200 | -12 | 0.0 | 75 | 75 |
| 300 | -16 | 0.0 | 71 | 71 |
| 400 | -18 | 0.0 | 69 | 69 |
| 500 | -20 | 0.0 | 67 | 67 |
| 600 | -22 | 0.0 | 65 | 65 |
| 700 | -23 | 0.0 | 64 | 64 |
| 800 | -24 | 0.0 | 63 | 63 |
| 900 | -25 | 0.0 | 62 | 62 |
| 1000 | -26 | 0.0 | 61 | 61 |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or "Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

Geometric attenuation based on 6 dB per doubling of distance.
Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

**Table 105. Detailed Construction Noise Analysis, Phase CUP-B : Grading**

| Source Data: | Maximum Sound Level (dBA) | Utilization Factor | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Tractor - Sound level (dBA) at 50 feet = | 84 | 100% | 84.0 |
| Source 2: Tractor - Sound level (dBA) at 50 feet = | 84 | 100% | 84.0 |
| Calculated Data: | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 87 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 87 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 50 | 0 | 0.0 | 87 | 87 |
| 100 | -6 | 0.0 | 81 | 81 |
| 200 | -12 | 0.0 | 75 | 75 |
| 300 | -16 | 0.0 | 71 | 71 |
| 400 | -18 | 0.0 | 69 | 69 |
| 500 | -20 | 0.0 | 67 | 67 |
| 600 | -22 | 0.0 | 65 | 65 |
| 700 | -23 | 0.0 | 64 | 64 |
| 800 | -24 | 0.0 | 63 | 63 |
| 900 | -25 | 0.0 | 62 | 62 |
| 1000 | -26 | 0.0 | 61 | 61 |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or "Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

Geometric attenuation based on 6 dB per doubling of distance.

Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

**Table 106. Detailed Construction Noise Analysis, Phase CUP-C : Vertical Construction**

| Source Data: | Maximum Sound Level (dBA) | Utilization Factor | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Front End Loader - Sound level (dBA) at 50 feet = | 79 | 100% | 79.0 |
| Source 2: Front End Loader - Sound level (dBA) at 50 feet = | 79 | 100% | 79.0 |
| Calculated Data: | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 82 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 82 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 50 | 0 | 0.0 | 82 | 82 |
| 100 | -6 | 0.0 | 76 | 76 |
| 200 | -12 | 0.0 | 70 | 70 |
| 300 | -16 | 0.0 | 66 | 66 |
| 400 | -18 | 0.0 | 64 | 64 |
| 500 | -20 | 0.0 | 62 | 62 |
| 600 | -22 | 0.0 | 60 | 60 |
| 700 | -23 | 0.0 | 59 | 59 |
| 800 | -24 | 0.0 | 58 | 58 |
| 900 | -25 | 0.0 | 57 | 57 |
| 1000 | -26 | 0.0 | 56 | 56 |

1. Obtained or estimated from:
FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or "Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", BBN/EPA, December 31, 1971
2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

Geometric attenuation based on 6 dB per doubling of distance.
Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

**Table 107. Detailed Construction Noise Analysis, Nighttime Construction Modeling - Concrete Pours**

| Source Data: | Maximum Sound Level (dBA) [1] | Utilization Factor [1,2] | Leq Sound Level (dBA) |
|---|---|---|---|
| Source 1: Concrete Mixer Truck - Sound level (dBA) at 50 feet = | 79 | 100% | 79.0 |
| Source 2: Concrete Pump Truck - Sound level (dBA) at 50 feet = | 81 | 100% | 81.0 |
| Calculated Data: | | | |
| All Sources Combined - Lmax sound level (dBA) at 50 feet = | | | 83 |
| All Sources Combined - Leq sound level (dBA) at 50 feet = | | | 83 |

| Distance Between Source and Receiver (ft.) | Geometric Attenuation (dB) | Ground Effect Attenuation (dB) | Calculated Lmax Sound Level (dBA) | Calculated Leq Sound Level (dBA) |
|---|---|---|---|---|
| 50 | 0 | 0.0 | 83 | 83 |
| 100 | -6 | 0.0 | 77 | 77 |
| 200 | -12 | 0.0 | 71 | 71 |
| 300 | -16 | 0.0 | 68 | 68 |
| 400 | -18 | 0.0 | 65 | 65 |
| 500 | -20 | 0.0 | 63 | 63 |
| 600 | -22 | 0.0 | 62 | 62 |
| 700 | -23 | 0.0 | 60 | 60 |
| 800 | -24 | 0.0 | 59 | 59 |
| 900 | -25 | 0.0 | 58 | 58 |
| 1000 | -26 | 0.0 | 57 | 57 |

1. Obtained or estimated from:

FHWA Roadway Construction Noise Model (RCNM), Version 1.1, December 8, 2008; and/or

"Transit Noise and Vibration Impact Assessment Manual", FTA Report No. 0123, September 2018; and/or

"Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances;" BBN/EPA, December 31, 1971

2. Usage Factor = percentage of time equipment is operating in noisiest mode while in use

Geometric attenuation based on 6 dB per doubling of distance.

Note: This calculation does not include the effects, if any, of local shielding from walls, topography or other barriers which may reduce sound levels further.

# Construction Haul Truck Noise Modeling

**Table 1. Detailed Traffic Noise Analysis, Input Data**

| Roadway | Segment | Heavy Truck % | Speed Limit (MPH) | Existing Conditions | Existing Heavy Trucks | Construction Haul Trucks | Construction Vendor Trucks | Existing + Construction Trucks | Exisitng + Construction Heavy Truck % |
|---|---|---|---|---|---|---|---|---|---|
| Cody Road [1] | Between Ellis Street and Girard Road | 2% | 25 | 2,380 | 48 | 91 | 20 | 2,491 | 6% |
| Ellis Street | Between Manila Avenue and NASA Ames Driveway | 2% | 25 | 2,380 | 48 | 91 | 20 | 2,491 | 6% |
| Ellis Street | Between US-101 Northbound Ramps and Manila Avenue | 2% | 40 | 7,100 | 142 | 91 | 20 | 7,211 | 4% |
| Ellis Street | Between US-101 Southbound Ramps and US-101 Northbound Ramps | 2% | 40 | 8,360 | 167 | 91 | 20 | 8,471 | 3% |

1. Traffic counts and estimated average-daily-traffic (ADT) volumes for roadway segments within the campus (beyond the NASA ARC guard stations) were not available/not provided by the project traffic consultant. To evaluate potential haul truck noise effects within the campus, it was conservatively assumed that all traffic passing through the Ellis Street guard station would turn left and travel to the Project Site and the greater campus.

**Table 2. Detailed Haul Truck Noise Noise Analysis, Outputs**

| Roadway | Segment | Existing Traffic Noise Levels (dBA) | | | Existing + Construction Heavy Trucks Traffic Noise Levels (dBA) | | | Change in Sound Level |
|---|---|---|---|---|---|---|---|---|
| | | Ldn | CNEL | Leq | Ldn | CNEL | Leq | (dBA Ldn) |
| Cody Road [1] | Between Ellis Street and Girard Road | 52.7 | 54.6 | 37.1 | 55.4 | 57.3 | 37.1 | 2.7 |
| Ellis Street | Between Manila Avenue and NASA Ames Driveway | 52.7 | 54.6 | 37.1 | 55.4 | 57.3 | 37.1 | 2.7 |
| Ellis Street | Between US-101 Northbound Ramps and Manila Avenue | 61.5 | 63.5 | 39.0 | 62.4 | 64.4 | 39.0 | 0.9 |
| Ellis Street | Between US-101 Southbound Ramps and US-101 Northbound Ramps | 62.2 | 64.2 | 39.0 | 62.7 | 64.7 | 39.0 | 0.5 |

1. Traffic counts and estimated average-daily-traffic (ADT) volumes for roadway segments within the campus (beyond the NASA ARC guard stations) were not available/not provided by the project traffic consultant. To evaluate potential haul truck noise effects within the campus, it was conservatively assumed that all traffic passing through the Ellis Street guard station would turn left and travel to the Project Site and the greater campus.

# Generator Noise Modeling

**Table 1. Detailed Construction Noise Analysis, Build Alternative 1**

| Building Number | Generator Size | Sound Pressure at 50 Feet (combined Engine & Exhaust) | Nearest Receptor Distance [a] (feet) | Nearest Receptor | Attenuation Features? | Decibel Attenuation from Features dB) | Decibel Attenuation from Distance (dB) | Sound Pressure a nearest Receptor |
|---|---|---|---|---|---|---|---|---|
| 2 [b] | 500 kW | 101.5 | 110 | Nearest Commercial/Industrial [c] | Screen | -5 | -6.8 | 89.7 |
| | | | 900 | Residence West of Project Site | Screen | -5 | -25.1 | 71.4 |
| 3 | | | 110 | Nearest Commercial/Industrial [c] | Screen | -5 | -6.8 | 89.7 |
| | | | 1220 | Residence West of Project Site | Screen | -5 | -27.7 | 68.8 |
| 4 | | | 1575 | Residence West of Project Site | Screen | -5 | -30.0 | 66.5 |
| 5 [b] | | | 1635 | Residence West of Project Site | Screen | -5 | -30.3 | 66.2 |
| 7 | | | 1360 | Residence West of Project Site | Screen | -5 | -28.7 | 67.8 |
| 8 | | | 1160 | Residence West of Project Site | Screen | -5 | -27.3 | 69.2 |
| 9 [b] | | | 830 | Residence West of Project Site | Screen | -5 | -24.4 | 72.1 |
| 10 [b] | | | 560 | Residence West of Project Site | Screen | -5 | -21.0 | 75.5 |

[a] Horizontal distances were measured in Google Earth using an image overlay of tentatively proposed generator locations (i.e., conceptual generator zones).

[b] Two generators are proposed at these buildings.

[c] For informational purposes, the nearest commercial/industrial land uses to the project site were included in this analysis. Modeling was only conducted for the project generators that are closest to these uses.

**Table 2. Detailed Construction Noise Analysis, Build Alternative 1 with Water Recycling Facility**

| Building Number | Generator Size | Sound Pressure at 50 Feet (combined Engine & Exhaust) | Nearest Receptor Distance [a] (feet) | Nearest Receptor | Attenuation Features? | Decibel Attenuation from Features dB) | Decibel Attenuation (dB) | Sound Pressure a nearest Receptor |
|---|---|---|---|---|---|---|---|---|
| 2 [b] | 500 kW | 101.5 | 110 | Nearest Commercial/Industrial [d] | Screen | -5 | -6.8 | 89.7 |
| | | | 900 | Residence West of Project Site | Screen | -5 | -25.1 | 71.4 |
| 3 | | | 110 | Nearest Commercial/Industrial [d] | Screen | -5 | -6.8 | 89.7 |
| | | | 1220 | Residence West of Project Site | Screen | -5 | -27.7 | 68.8 |
| 4 | | | 1575 | Residence West of Project Site | Screen | -5 | -30.0 | 66.5 |
| 5 [b] | | | 1635 | Residence West of Project Site | Screen | -5 | -30.3 | 66.2 |
| 7 | | | 1360 | Residence West of Project Site | Screen | -5 | -28.7 | 67.8 |
| 8 | | | 1160 | Residence West of Project Site | Screen | -5 | -27.3 | 69.2 |
| 9 [b] | | | 830 | Residence West of Project Site | Screen | -5 | -24.4 | 72.1 |
| 10 [b] | | | 560 | Residence West of Project Site | Screen | -5 | -21.0 | 75.5 |
| 11 [c] | | | 230 | Residence West of Project Site | Screen | -5 | -13.3 | 83.2 |

[a] Horizontal distances were measured in Google Earth using an image overlay of tentatively proposed generator locations (i.e., conceptual generator zones).

[b] Two generators are proposed at these buildings.

[c] Building 11 would represent the additional generator location for the Water Recycling Facility.

[d] For informational purposes, the nearest commercial/industrial land uses to the project site were included in this analysis. Modeling was only conducted for the project generators that are closest to these uses.

**Table 3. Detailed Construction Noise Analysis, Build Alternative 1 with Central Utility Plant**

| Building Number | Generator Size | Sound Pressure at 50 Feet (combined Engine & Exhaust) | Nearest Receptor Distance [a] (feet) | Nearest Receptor | Attenuation Features? | Decibel Attenuation from Features dB) | Decibel Attenuation (dB) | Sound Pressure a nearest Receptor |
|---|---|---|---|---|---|---|---|---|
| 2 [b] | 500 kW | 101.5 | 110 | Nearest Commercial/Industrial [d] | Screen | -5 | -6.8 | 89.7 |
| | | | 900 | Residence West of Project Site | Screen | -5 | -25.1 | 71.4 |
| 3 | | | 110 | Nearest Commercial/Industrial [d] | Screen | -5 | -6.8 | 89.7 |
| | | | 1220 | Residence West of Project Site | Screen | -5 | -27.7 | 68.8 |
| 4 | | | 1575 | Residence West of Project Site | Screen | -5 | -30.0 | 66.5 |
| 5 [b] | | | 1635 | Residence West of Project Site | Screen | -5 | -30.3 | 66.2 |
| 6 [c] | | | 1580 | Residence West of Project Site | Screen | -5 | -30.0 | 66.5 |
| 7 | | | 1360 | Residence West of Project Site | Screen | -5 | -28.7 | 67.8 |
| 8 | | | 1160 | Residence West of Project Site | Screen | -5 | -27.3 | 69.2 |
| 9 [b] | | | 830 | Residence West of Project Site | Screen | -5 | -24.4 | 72.1 |
| 10 [b] | | | 560 | Residence West of Project Site | Screen | -5 | -21.0 | 75.5 |

[a] Horizontal distances were measured in Google Earth using an image overlay of tentatively proposed generator locations (i.e., conceptual generator zones).

[b] Two generators are proposed at these buildings.

[c] Building 6 would represent the additional generator location for the Central Utility Plant.

[d] For informational purposes, the nearest commercial/industrial land uses to the project site were included in this analysis. Modeling was only conducted for the project generators that are closest to these uses.

**Table 4. Detailed Construction Noise Analysis, Build Alternative 1 No Student/Faculty Housing Variant**

| Building Number | Generator Size | Sound Pressure at 50 Feet (combined Engine & Exhaust) | Nearest Receptor Distance [a] (feet) | Nearest Receptor | Attenuation Features? | Decibel Attenuation from Features dB) | Decibel Attenuation (dB) | Sound Pressure a nearest Receptor |
|---|---|---|---|---|---|---|---|---|
| 2 [b] | 500 kW | 101.5 | 110 | Nearest Commercial/Industrial [c] | Screen | -5 | -6.8 | 89.7 |
| | | | 900 | Residence West of Project Site | Screen | -5 | -25.1 | 71.4 |
| 3 | | | 110 | Nearest Commercial/Industrial [c] | Screen | -5 | -6.8 | 89.7 |
| | | | 1220 | Residence West of Project Site | Screen | -5 | -27.7 | 68.8 |
| 4 | | | 1575 | Residence West of Project Site | Screen | -5 | -30.0 | 66.5 |
| 5 [b] | | | 1635 | Residence West of Project Site | Screen | -5 | -30.3 | 66.2 |
| 7 | | | 1360 | Residence West of Project Site | Screen | -5 | -28.7 | 67.8 |
| 8 | | | 1160 | Residence West of Project Site | Screen | -5 | -27.3 | 69.2 |
| 9 [b] | | | 830 | Residence West of Project Site | Screen | -5 | -24.4 | 72.1 |
| 10 [b] | | | 560 | Residence West of Project Site | Screen | -5 | -21.0 | 75.5 |
| 12 [c] | | | 160 | Residence West of Project Site | Screen | -5 | -10.1 | 86.4 |

[a] Horizontal distances were measured in Google Earth using an image overlay of tentatively proposed generator locations (i.e., conceptual generator zones).

[b] Two generators are proposed at these buildings.

[c] Building 12 would represent the additional generator location when Student/Faculty housing is not included in the design.

[d] For informational purposes, the nearest commercial/industrial land uses to the project site were included in this analysis. Modeling was only conducted for the project generators that are closest to these uses.

**Table 5. Detailed Construction Noise Analysis, Build Alternative 2**

| Building Number | Generator Size | Sound Pressure at 50 Feet (combined Engine & Exhaust) | Nearest Receptor Distance [a] (feet) | Nearest Receptor | Attenuation Features? | Decibel Attenuation from Features dB) | Decibel Attenuation (dB) | Sound Pressure a nearest Receptor |
|---|---|---|---|---|---|---|---|---|
| 2 [b] | 500 kW | 101.5 | 110 | Nearest Commercial/Industrial [c] | Screen | -5 | -6.8 | 89.7 |
| | | | 900 | Residence West of Project Site | Screen | -5 | -25.1 | 71.4 |
| 3 | | | 110 | Nearest Commercial/Industrial [c] | Screen | -5 | -6.8 | 89.7 |
| | | | 1220 | Residence West of Project Site | Screen | -5 | -27.7 | 68.8 |
| 4 | | | 1575 | Residence West of Project Site | Screen | -5 | -30.0 | 66.5 |
| 5 [b] | | | 1635 | Residence West of Project Site | Screen | -5 | -30.3 | 66.2 |
| 7 | | | 1360 | Residence West of Project Site | Screen | -5 | -28.7 | 67.8 |
| 8 | | | 1160 | Residence West of Project Site | Screen | -5 | -27.3 | 69.2 |
| 9 [b] | | | 830 | Residence West of Project Site | Screen | -5 | -24.4 | 72.1 |
| 10 [b] | | | 560 | Residence West of Project Site | Screen | -5 | -21.0 | 75.5 |

[a] Horizontal distances were measured in Google Earth using an image overlay of tentatively proposed generator locations (i.e., conceptual generator zones).

[b] Two generators are proposed at these buildings.

[c] For informational purposes, the nearest commercial/industrial land uses to the project site were included in this analysis. Modeling was only conducted for the project generators that are closest to these uses.

**Table 6. Detailed Construction Noise Analysis, Alternative 2 No Student/Faculty Housing Variant**

| Building Number | Generator Size | Sound Pressure at 50 Feet (combined Engine & Exhaust) | Nearest Receptor Distance (feet) | Nearest Receptor | Attenuation Features? | Decibel Attenuation from Features dB) | Decibel Attenuation (dB) | Sound Pressure a nearest Receptor |
|---|---|---|---|---|---|---|---|---|
| 2 [b] | 500 kW | 101.5 | 110 | Nearest Commercial/Industrial [d] | Screen | -5 | -6.8 | 89.7 |
| | | | 900 | Residence West of Project Site | Screen | -5 | -25.1 | 71.4 |
| 3 | | | 110 | Nearest Commercial/Industrial [d] | Screen | -5 | -6.8 | 89.7 |
| | | | 1220 | Residence West of Project Site | Screen | -5 | -27.7 | 68.8 |
| 4 | | | 1575 | Residence West of Project Site | Screen | -5 | -30.0 | 66.5 |
| 5 [b] | | | 1635 | Residence West of Project Site | Screen | -5 | -30.3 | 66.2 |
| 7 | | | 1360 | Residence West of Project Site | Screen | -5 | -28.7 | 67.8 |
| 8 | | | 1160 | Residence West of Project Site | Screen | -5 | -27.3 | 69.2 |
| 9 [b] | | | 830 | Residence West of Project Site | Screen | -5 | -24.4 | 72.1 |
| 10 [b] | | | 560 | Residence West of Project Site | Screen | -5 | -21.0 | 75.5 |
| 12 [c] | | | 160 | Residence West of Project Site | Screen | -5 | -10.1 | 86.4 |

[a] Horizontal distances were measured in Google Earth using an image overlay of tentatively proposed generator locations (i.e., conceptual generator zones).

[b] Two generators are proposed at these buildings.

[c] Building 12 would represent the additional generator location when Student/Faculty housing is not included in the design.

[d] For informational purposes, the nearest commercial/industrial land uses to the project site were included in this analysis. Modeling was only conducted for the project generators that are closest to these uses.

# BESS Noise Modeling

| Source Details | | | |
|---|---|---|---|
| BESS SPL [1]: | 55 dBA @ | 50 feet | |

[1] Noise data for BESS HVAC equipment was sourced from Marvair outdoor sound data for the ComPac I/II Air Conditioners

| Receiver | Distance | No of nearby BESS | SPL |
|---|---|---|---|
| Wescoat Village | 130 | 1 | 46.70 |

# Traffic Noise Modeling

**Table 1. Detailed Traffic Noise Analysis, Input Data**

| Roadway | Segment | Most Sensitive Land Use Type Along Segment | Heavy Truck % | Speed Limit (MPH) | Existing Conditions ADT | Existing + Project (Alt 1) ADT | Existing + Project (Alt 1 No Housing) ADT | Existing + Project (Alt 2) ADT | Existing + Project (Alt 2 No Housing) ADT |
|---|---|---|---|---|---|---|---|---|---|
| Clark Road | Between R T Jones Road and NASA Ames Driveway | School & Residential | 2% | 25 | 3,930 | 14,900 | 15,120 | 10,960 | 11,170 |
| Ellis Street | Between Manila Avenue and NASA Ames Driveway | Commercial | 2% | 25 | 2,380 | 12,270 | 12,470 | 8,720 | 8,910 |
| Ellis Street | Between Middlefield Road and Driveway North of Middlefield Road | Commercial | 2% | 40 | 5,410 | 6,790 | 6,820 | 6,290 | 6,320 |
| Ellis Street | Between National Avenue and Fairchild Drive | Commercial | 2% | 40 | 6,290 | 7,670 | 7,700 | 7,170 | 7,200 |
| Ellis Street | Between US-101 Northbound Ramps and Manila Avenue | Commercial | 2% | 40 | 7,100 | 13,700 | 13,830 | 11,330 | 11,460 |
| Ellis Street | Between US-101 Southbound Ramps and US-101 Northbound Ramps | Commercial | 2% | 40 | 8,360 | 12,080 | 12,150 | 10,750 | 10,820 |
| Manila Avenue | Between Enterprise Way and Ellis Street | Commercial | 2% | 40 | 5,570 | 8,860 | 8,930 | 7,680 | 7,740 |
| Moffett Boulevard | Between Leong Drive and US-101 Southbound Ramps | Residential | 2% | 40 | 13,010 | 18,410 | 18,520 | 16,470 | 16,570 |
| Moffett Boulevard | Between SR-85 Northbound Off-Ramp and Leong Drive | Residential | 2% | 40 | 13,540 | 18,950 | 19,060 | 17,000 | 17,100 |
| Moffett Boulevard | Between SR-85 Southbound On-Ramp and SR-85 Northbound Off-Ramp | Residential | 2% | 40 | 13,880 | 17,150 | 17,220 | 15,970 | 16,030 |
| Moffett Boulevard | Between US-101 Northbound Ramps and R T Jones Road | Residential | 2% | 40 | 15,530 | 26,500 | 26,720 | 22,560 | 22,770 |
| Moffett Boulevard | Between US-101 Southbound Ramps and US-101 Northbound Ramps | Commercial | 2% | 40 | 13,950 | 22,170 | 22,330 | 19,220 | 19,380 |
| Moffett Park Drive | Between Innovation way and Enterprise Way | Commercial | 2% | 40 | 5,410 | 8,700 | 8,770 | 7,520 | 7,580 |
| Moffett Park Drive | Between Mathilda Avenue and Innovation Way | Commercial | 2% | 40 | 10,990 | 14,270 | 14,340 | 13,090 | 13,150 |
| Wescoat Road [1] | Between Clark Road and Project Site | Residential | 2% | 25 | 3,930 | 14,900 | 15,120 | 10,960 | 11,170 |

[1] Traffic counts and estimated ADT volumes for roadway segments within the campus (beyond the NASA AMES guard shacks) was not available/not provided by the project traffic consultant. To evaluate potential traffic noise effects to existing residential land uses within the campus, it was conservatively assumed that all vehicle that enters at the Clark Road guard shack would continue on Clark Road and turn right onto Wescoat Road to access the project site.

**Table 2.a. Detailed Traffic Noise Analysis, Existing Traffic Noise Analysis, Build Alternative 1**

| Roadway | Segment | Most Sensitive Land Use Type Along Segment | Heavy Truck % | Speed Limit (MPH) | Existing Conditions ADT | Existing + Project (Alt 1) ADT | Traffic Increase (%) | Existing Traffic Noise Levels (dBA) Ldn | CNEL | Leq | Existing + Project (Build Alternative 1) Traffic Noise Levels (dBA) Ldn | CNEL | Leq | Change in Sound Level (dBA Ldn) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Clark Road | Between R T Jones Road and NASA Ames Driveway | School & Residential | 2% | 25 | 3930 | 14900 | 279% | 57.5 | 58.3 | 55.9 | 63.1 | 63.9 | 61.7 | 5.6 |
| Ellis Street | Between Manila Avenue and NASA Ames Driveway | Commercial | 2% | 25 | 2380 | 12270 | 416% | 55.4 | 56.2 | 53.8 | 62.3 | 63.1 | 60.8 | 6.9 |
| Ellis Street | Between Middlefield Road and Driveway North of Middlefield Road | Commercial | 2% | 40 | 5410 | 6790 | 26% | 63.2 | 64.0 | 61.8 | 64.2 | 65.0 | 62.8 | 1.0 |
| Ellis Street | Between National Avenue and Fairchild Drive | Commercial | 2% | 40 | 6290 | 7670 | 22% | 63.9 | 64.7 | 62.4 | 64.7 | 65.5 | 63.3 | 0.8 |
| Ellis Street | Between US-101 Northbound Ramps and Manila Avenue | Commercial | 2% | 40 | 7100 | 13700 | 93% | 64.4 | 65.2 | 63.0 | 67.2 | 68.0 | 65.8 | 2.8 |
| Ellis Street | Between US-101 Southbound Ramps and US-101 Northbound Ramps | Commercial | 2% | 40 | 8360 | 12080 | 44% | 65.1 | 65.9 | 63.7 | 66.7 | 67.5 | 65.3 | 1.6 |
| Manila Avenue | Between Enterprise Way and Ellis Street | Commercial | 2% | 40 | 5570 | 8860 | 59% | 63.4 | 64.2 | 61.9 | 65.3 | 66.2 | 63.9 | 1.9 |
| Moffett Boulevard | Between Leong Drive and US-101 Southbound Ramps | Residential | 2% | 40 | 13010 | 18,410 | 42% | 67.0 | 67.8 | 65.6 | 68.5 | 69.3 | 67.1 | 1.5 |
| Moffett Boulevard | Between SR-85 Northbound Off-Ramp and Leong Drive | Residential | 2% | 40 | 13540 | 18950 | 40% | 67.2 | 68.0 | 65.7 | 68.6 | 69.4 | 67.2 | 1.4 |
| Moffett Boulevard | Between SR-85 Southbound On-Ramp and SR-85 Northbound Off-Ramp | Residential | 2% | 40 | 13880 | 17150 | 24% | 67.3 | 68.1 | 65.9 | 68.2 | 69.0 | 66.8 | 0.9 |
| Moffett Boulevard | Between US-101 Northbound Ramps and R T Jones Road | Residential | 2% | 40 | 15530 | 26500 | 71% | 67.8 | 68.6 | 66.3 | 70.1 | 70.9 | 68.7 | 2.3 |
| Moffett Boulevard | Between US-101 Southbound Ramps and US-101 Northbound Ramps | Commercial | 2% | 40 | 13950 | 22170 | 59% | 67.3 | 68.1 | 65.9 | 69.3 | 70.1 | 67.9 | 2.0 |
| Moffett Park Drive | Between Innovation way and Enterprise Way | Commercial | 2% | 40 | 5410 | 8700 | 61% | 63.2 | 64.0 | 61.8 | 65.3 | 66.1 | 63.8 | 2.1 |
| Moffett Park Drive | Between Mathilda Avenue and Innovation Way | Commercial | 2% | 40 | 10990 | 14270 | 30% | 66.3 | 67.1 | 64.8 | 67.4 | 68.2 | 66.0 | 1.1 |
| Wescoat Road [1] | Between Clark Road and Project Site | Residential | 2% | 25 | 3930 | 14900 | 279% | 57.5 | 58.3 | 55.9 | 63.1 | 63.9 | 61.7 | 5.6 |

Modeled noise levels are calcualted at a distance of 50 feet from the roadway centerline.

[1] Traffic counts and estimated ADT volumes for roadway segments within the campus (beyond the NASA AMES guard shacks) was not available/not provided by the project traffic consultant. To evaluate potential traffic noise effects to existing residential land uses within the campus, it was conservatively assumed that all vehicle that enters at the Clark Road guard shack would continue on Clark Road and turn right onto Wescoat Road to access the project site.

**Table 2.b. Detailed Traffic Noise Analysis, Supplemental Existing Traffic Noise Analysis, Build Alternative 1**

| Roadway | Segment | Modeled Distance to Centerline (feet) | Heavy Truck % | Speed Limit (MPH) | Existing Conditions ADT | Existing + Project (Alt 1) ADT | Project (Alt 1) Only ADT | Project Only (Build Alternative 1) Traffic Noise Levels (dBA Ldn) | Representative Measurement Location | Measured Ambient Noise Level (dBA Ldn) | Composite Ambient + Project Noise Level (dBA Ldn) | Change in Sound Level Compared to Ambient (dBA Ldn) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Clark Road | Between R T Jones Road and NASA Ames Driveway | 200 | 2% | 25 | 3930 | 14900 | 10970 | 55.6 | LT-6 | 63.4 | 64.1 | 0.7 |
| Ellis Street | Between Manila Avenue and NASA Ames Driveway | 150 | 2% | 25 | 2380 | 12270 | 9890 | 56.5 | LT-5 | 69.9 | 70.1 | 0.2 |
| Wescoat Road [1] | Between Clark Road and Project Site | 100 | 2% | 25 | 3930 | 14900 | 10970 | 58.7 | LT-1 | 63.7 | 64.9 | 1.2 |

[1] Traffic counts and estimated ADT volumes for roadway segments within the campus (beyond the NASA AMES guard shacks) was not available/not provided by the project traffic consultant. To evaluate potential traffic noise effects to existing residential land uses within the campus, it was conservatively assumed that all vehicle that enters at the Clark Road guard shack would continue on Clark Road and turn right onto Wescoat Road to access the project site.

**Table 3.a. Detailed Traffic Noise Analysis, Existing Traffic Noise Analysis, Build Alternative 1 (No Housing)**

| | | | | | | | | Existing Traffic Noise Levels (dBA) | | | Existing + Project (Build Alternative 1 No Housing) Traffic Noise Levels (dBA) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Roadway | Segment | Most Sensitive Land Use Type Along Segment | Heavy Truck % | Speed Limit (MPH) | Existing Conditions ADT | Existing + Project (Alt 1 No Housing) ADT | Traffic Increase (%) | Ldn | CNEL | Leq | Ldn | CNEL | Leq | Change in Sound Level (dBA Ldn) |
| Clark Road | Between R T Jones Road and NASA Ames Driveway | School & Residential | 2% | 25 | 3930 | 15,120 | 285% | 57.5 | 58.3 | 55.9 | 63.2 | 64.0 | 61.7 | 5.7 |
| Ellis Street | Between Manila Avenue and NASA Ames Driveway | Commercial | 2% | 25 | 2380 | 12,470 | 424% | 55.4 | 56.2 | 53.8 | 62.4 | 63.2 | 60.9 | 7.0 |
| Ellis Street | Between Middlefield Road and Driveway North of Middlefield Road | Commercial | 2% | 40 | 5410 | 6,820 | 26% | 63.2 | 64.0 | 61.8 | 64.2 | 65.0 | 62.8 | 1.0 |
| Ellis Street | Between National Avenue and Fairchild Drive | Commercial | 2% | 40 | 6290 | 7,700 | 22% | 63.9 | 64.7 | 62.4 | 64.7 | 65.6 | 63.3 | 0.8 |
| Ellis Street | Between US-101 Northbound Ramps and Manila Avenue | Commercial | 2% | 40 | 7100 | 13,830 | 95% | 64.4 | 65.2 | 63.0 | 67.3 | 68.1 | 65.8 | 2.9 |
| Ellis Street | Between US-101 Southbound Ramps and US-101 Northbound Ramps | Commercial | 2% | 40 | 8360 | 12,150 | 45% | 65.1 | 65.9 | 63.7 | 66.7 | 67.5 | 65.3 | 1.6 |
| Manila Avenue | Between Enterprise Way and Ellis Street | Commercial | 2% | 40 | 5570 | 8,930 | 60% | 63.4 | 64.2 | 61.9 | 65.4 | 66.2 | 63.9 | 2.0 |
| Moffett Boulevard | Between Leong Drive and US-101 Southbound Ramps | Residential | 2% | 40 | 13010 | 18,520 | 42% | 67.0 | 67.8 | 65.6 | 68.5 | 69.3 | 67.1 | 1.5 |
| Moffett Boulevard | Between SR-85 Northbound Off-Ramp and Leong Drive | Residential | 2% | 40 | 13540 | 19,060 | 41% | 67.2 | 68.0 | 65.7 | 68.6 | 69.5 | 67.2 | 1.4 |
| Moffett Boulevard | Between SR-85 Southbound On-Ramp and SR-85 Northbound Off-Ramp | Residential | 2% | 40 | 13880 | 17,220 | 24% | 67.3 | 68.1 | 65.9 | 68.2 | 69.0 | 66.8 | 0.9 |
| Moffett Boulevard | Between US-101 Northbound Ramps and R T Jones Road | Residential | 2% | 40 | 15530 | 26,720 | 72% | 67.8 | 68.6 | 66.3 | 70.1 | 70.9 | 68.7 | 2.3 |
| Moffett Boulevard | Between US-101 Southbound Ramps and US-101 Northbound Ramps | Commercial | 2% | 40 | 13950 | 22,330 | 60% | 67.3 | 68.1 | 65.9 | 69.3 | 70.1 | 67.9 | 2.0 |
| Moffett Park Drive | Between Innovation way and Enterprise Way | Commercial | 2% | 40 | 5410 | 8,770 | 62% | 63.2 | 64.0 | 61.8 | 65.3 | 66.1 | 63.9 | 2.1 |
| Moffett Park Drive | Between Mathilda Avenue and Innovation Way | Commercial | 2% | 40 | 10990 | 14,340 | 30% | 66.3 | 67.1 | 64.8 | 67.4 | 68.2 | 66.0 | 1.1 |
| Wescoat Road [1] | Between Clark Road and Project Site | Residential | 2% | 25 | 3930 | 15,120 | 285% | 57.5 | 58.3 | 55.9 | 63.2 | 64.0 | 61.7 | 5.7 |

Modeled noise levels are calcualted at a distance of 50 feet from the roadway centerline.

[1] Traffic counts and estimated ADT volumes for roadway segments within the campus (beyond the NASA AMES guard shacks) was not available/not provided by the project traffic consultant. To evaluate potential traffic noise effects to existing residential land uses within the campus, it was conservatively assumed that all vehicle that enters at the Clark Road guard shack would continue on Clark Road and turn right onto Wescoat Road to access the project site.

**Table 3.b. Detailed Traffic Noise Analysis, Supplemental Existing Traffic Noise Analysis, Build Alternative 1 (No Housing)**

| Roadway | Segment | Modeled Distance to Centerline (feet) | Heavy Truck % | Speed Limit (MPH) | Existing Conditions ADT | Existing + Project (Alt 1) ADT | Project (Alt 1 NO Housing) Only ADT | Project Only (Build Alternative 1) Traffic Noise Levels (dBA Ldn) | Representative Measurement Location | Measured Ambient Noise Level (dBA Ldn) | Composite Ambient + Project Noise Level (dBA Ldn) | Change in Sound Level Compared to Ambient (dBA Ldn) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Clark Road | Between R T Jones Road and NASA Ames Driveway | 200 | 2% | 25 | 3930 | 15120 | 11190 | 55.7 | LT-6 | 63.4 | 64.1 | 0.7 |
| Ellis Street | Between Manila Avenue and NASA Ames Driveway | 150 | 2% | 25 | 2380 | 12470 | 10090 | 56.6 | LT-5 | 69.9 | 70.1 | 0.2 |
| Wescoat Road [1] | Between Clark Road and Project Site | 100 | 2% | 25 | 3930 | 15120 | 11190 | 58.7 | LT-1 | 63.7 | 64.9 | 1.2 |

[1] Traffic counts and estimated ADT volumes for roadway segments within the campus (beyond the NASA AMES guard shacks) was not available/not provided by the project traffic consultant. To evaluate potential traffic noise effects to existing residential land uses within the campus, it was conservatively assumed that all vehicle that enters at the Clark Road guard shack would continue on Clark Road and turn right onto Wescoat Road to access the project site.

**Table 4.a. Detailed Traffic Noise Analysis, Existing Traffic Noise Analysis, Build Alternative 2**

| | | | | | | | | Existing Traffic Noise Levels (dBA) | | | Existing + Project (Build Alternative 2) Traffic Noise Levels (dBA) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Roadway | Segment | Most Sensitive Land Use Type Along Segment | Heavy Truck % | Speed Limit (MPH) | Existing Conditions ADT | Existing + Project (Alt 2) ADT | Traffic Increase (%) | Ldn | CNEL | Leq | Ldn | CNEL | Leq | Change in Sound Level (dBA Ldn) |
| Clark Road | Between R T Jones Road and NASA Ames Driveway | School & Residential | 2% | 25 | 3930 | 10,960 | 179% | 57.5 | 58.3 | 55.9 | 61.8 | 62.6 | 60.4 | 4.3 |
| Ellis Street | Between Manila Avenue and NASA Ames Driveway | Commercial | 2% | 25 | 2380 | 8,720 | 266% | 55.4 | 56.2 | 53.8 | 60.8 | 61.6 | 59.4 | 5.4 |
| Ellis Street | Between Middlefield Road and Driveway North of Middlefield Road | Commercial | 2% | 40 | 5410 | 6,290 | 16% | 63.2 | 64.0 | 61.8 | 63.9 | 64.7 | 62.4 | 0.7 |
| Ellis Street | Between National Avenue and Fairchild Drive | Commercial | 2% | 40 | 6290 | 7,170 | 14% | 63.9 | 64.7 | 62.4 | 64.4 | 65.2 | 63.0 | 0.5 |
| Ellis Street | Between US-101 Northbound Ramps and Manila Avenue | Commercial | 2% | 40 | 7100 | 11,330 | 60% | 64.4 | 65.2 | 63.0 | 66.4 | 67.2 | 65.0 | 2.0 |
| Ellis Street | Between US-101 Southbound Ramps and US-101 Northbound Ramps | Commercial | 2% | 40 | 8360 | 10,750 | 29% | 65.1 | 65.9 | 63.7 | 66.2 | 67.0 | 64.7 | 1.1 |
| Manila Avenue | Between Enterprise Way and Ellis Street | Commercial | 2% | 40 | 5570 | 7,680 | 38% | 63.4 | 64.2 | 61.9 | 64.7 | 65.5 | 63.3 | 1.3 |
| Moffett Boulevard | Between Leong Drive and US-101 Southbound Ramps | Residential | 2% | 40 | 13010 | 16,470 | 27% | 67.0 | 67.8 | 65.6 | 68.0 | 68.8 | 66.6 | 1.0 |
| Moffett Boulevard | Between SR-85 Northbound Off-Ramp and Leong Drive | Residential | 2% | 40 | 13540 | 17,000 | 26% | 67.2 | 68.0 | 65.7 | 68.2 | 69.0 | 66.7 | 1.0 |
| Moffett Boulevard | Between SR-85 Southbound On-Ramp and SR-85 Northbound Off-Ramp | Residential | 2% | 40 | 13880 | 15,970 | 15% | 67.3 | 68.1 | 65.9 | 67.9 | 68.7 | 66.5 | 0.6 |
| Moffett Boulevard | Between US-101 Northbound Ramps and R T Jones Road | Residential | 2% | 40 | 15530 | 22,560 | 45% | 67.8 | 68.6 | 66.3 | 69.4 | 70.2 | 68.0 | 1.6 |
| Moffett Boulevard | Between US-101 Southbound Ramps and US-101 Northbound Ramps | Commercial | 2% | 40 | 13950 | 19,220 | 38% | 67.3 | 68.1 | 65.9 | 68.7 | 69.5 | 67.3 | 1.4 |
| Moffett Park Drive | Between Innovation way and Enterprise Way | Commercial | 2% | 40 | 5410 | 7,520 | 39% | 63.2 | 64.0 | 61.8 | 64.6 | 65.5 | 63.2 | 1.4 |
| Moffett Park Drive | Between Mathilda Avenue and Innovation Way | Commercial | 2% | 40 | 10990 | 13,090 | 19% | 66.3 | 67.1 | 64.8 | 67.0 | 67.8 | 65.6 | 0.7 |
| Wescoat Road [1] | Between Clark Road and Project Site | Residential | 2% | 25 | 3930 | 10,960 | 179% | 57.5 | 58.3 | 55.9 | 61.8 | 62.6 | 60.4 | 4.3 |

Modeled noise levels are calcualted at a distance of 50 feet from the roadway centerline.

[1] Traffic counts and estimated ADT volumes for roadway segments within the campus (beyond the NASA AMES guard shacks) was not available/not provided by the project traffic consultant. To evaluate potential traffic noise effects to existing residential land uses within the campus, it was conservatively assumed that all vehicle that enters at the Clark Road guard shack would continue on Clark Road and turn right onto Wescoat Road to access the project site.

**Table 4.b. Detailed Traffic Noise Analysis, Supplemental Existing Traffic Noise Analysis, Build Alternative 2**

| Roadway | Segment | Modeled Distance to Centerline (feet) | Heavy Truck % | Speed Limit (MPH) | Existing Conditions ADT | Existing + Project (Alt 2) ADT | Project (Alt 1) Only ADT | Project Only (Build Alternative 1) Traffic Noise Levels (dBA Ldn) | Representative Measurement Location | Measured Ambient Noise Level (dBA Ldn) | Composite Ambient + Project Noise Level (dBA Ldn) | Change in Sound Level Compared to Ambient (dBA Ldn) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Clark Road | Between R T Jones Road and NASA Ames Driveway | 200 | 2% | 25 | 3930 | 10,960 | 7030 | 53.7 | LT-6 | 63.4 | 63.8 | 0.4 |
| Ellis Street | Between Manila Avenue and NASA Ames Driveway | 150 | 2% | 25 | 2380 | 8,720 | 6340 | 54.6 | LT-5 | 69.9 | 70.0 | 0.1 |
| Wescoat Road [1] | Between Clark Road and Project Site | 100 | 2% | 25 | 3930 | 10960 | 7030 | 56.8 | LT-1 | 63.7 | 64.5 | 0.8 |

[1] Traffic counts and estimated ADT volumes for roadway segments within the campus (beyond the NASA AMES guard shacks) was not available/not provided by the project traffic consultant. To evaluate potential traffic noise effects to existing residential land uses within the campus, it was conservatively assumed that all vehicle that enters at the Clark Road guard shack would continue on Clark Road and turn right onto Wescoat Road to access the project site.

**Table 5.a. Detailed Traffic Noise Analysis, Existing Traffic Noise Analysis, Build Alternative 2 (No Housing)**

| Roadway | Segment | Most Sensitive Land Use Type Along Segment | Heavy Truck % | Speed Limit (MPH) | Existing Conditions ADT | Existing + Project (Alt 2 No Housing) ADT | Traffic Increase (%) | Existing Traffic Noise Levels (dBA) Ldn | Existing Traffic Noise Levels (dBA) CNEL | Existing Traffic Noise Levels (dBA) Leq | Existing + Project (Build Alternative 2 No Housing) Traffic Noise Levels (dBA) Ldn | Existing + Project (Build Alternative 2 No Housing) Traffic Noise Levels (dBA) CNEL | Existing + Project (Build Alternative 2 No Housing) Traffic Noise Levels (dBA) Leq | Change in Sound Level (dBA Ldn) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Clark Road | Between R T Jones Road and NASA Ames Driveway | School & Residential | 2% | 25 | 3930 | 11,170 | 184% | 57.5 | 58.3 | 55.9 | 61.9 | 62.7 | 60.4 | 4.4 |
| Ellis Street | Between Manila Avenue and NASA Ames Driveway | Commercial | 2% | 25 | 2380 | 8,910 | 274% | 55.4 | 56.2 | 53.8 | 60.9 | 61.7 | 59.5 | 5.5 |
| Ellis Street | Between Middlefield Road and Driveway North of Middlefield Road | Commercial | 2% | 40 | 5410 | 6,320 | 17% | 63.2 | 64.0 | 61.8 | 63.9 | 64.7 | 62.4 | 0.7 |
| Ellis Street | Between National Avenue and Fairchild Drive | Commercial | 2% | 40 | 6290 | 7,200 | 14% | 63.9 | 64.7 | 62.4 | 64.5 | 65.3 | 63.0 | 0.6 |
| Ellis Street | Between US-101 Northbound Ramps and Manila Avenue | Commercial | 2% | 40 | 7100 | 11,460 | 61% | 64.4 | 65.2 | 63.0 | 66.5 | 67.3 | 65.0 | 2.1 |
| Ellis Street | Between US-101 Southbound Ramps and US-101 Northbound Ramps | Commercial | 2% | 40 | 8360 | 10,820 | 29% | 65.1 | 65.9 | 63.7 | 66.2 | 67.0 | 64.8 | 1.1 |
| Manila Avenue | Between Enterprise Way and Ellis Street | Commercial | 2% | 40 | 5570 | 7,740 | 39% | 63.4 | 64.2 | 61.9 | 64.8 | 65.6 | 63.3 | 1.4 |
| Moffett Boulevard | Between Leong Drive and US-101 Southbound Ramps | Residential | 2% | 40 | 13010 | 16,570 | 27% | 67.0 | 67.8 | 65.6 | 68.0 | 68.9 | 66.6 | 1.0 |
| Moffett Boulevard | Between SR-85 Northbound Off-Ramp and Leong Drive | Residential | 2% | 40 | 13540 | 17,100 | 26% | 67.2 | 68.0 | 65.7 | 68.2 | 69.0 | 66.8 | 1.0 |
| Moffett Boulevard | Between SR-85 Southbound On-Ramp and SR-85 Northbound Off-Ramp | Residential | 2% | 40 | 13880 | 16,030 | 15% | 67.3 | 68.1 | 65.9 | 67.9 | 68.7 | 66.5 | 0.6 |
| Moffett Boulevard | Between US-101 Northbound Ramps and R T Jones Road | Residential | 2% | 40 | 15530 | 22,770 | 47% | 67.8 | 68.6 | 66.3 | 69.4 | 70.2 | 68.0 | 1.6 |
| Moffett Boulevard | Between US-101 Southbound Ramps and US-101 Northbound Ramps | Commercial | 2% | 40 | 13950 | 19,380 | 39% | 67.3 | 68.1 | 65.9 | 68.7 | 69.5 | 67.3 | 1.4 |
| Moffett Park Drive | Between Innovation way and Enterprise Way | Commercial | 2% | 40 | 5410 | 7,580 | 40% | 63.2 | 64.0 | 61.8 | 64.7 | 65.5 | 63.2 | 1.5 |
| Moffett Park Drive | Between Mathilda Avenue and Innovation Way | Commercial | 2% | 40 | 10990 | 13,150 | 20% | 66.3 | 67.1 | 64.8 | 67.0 | 67.9 | 65.6 | 0.7 |
| Wescoat Road [1] | Between Clark Road and Project Site | Residential | 2% | 25 | 3930 | 11,170 | 184% | 57.5 | 58.3 | 55.9 | 61.9 | 62.7 | 60.4 | 4.4 |

Modeled noise levels are calcualted at a distance of 50 feet from the roadway centerline.

[1] Traffic counts and estimated ADT volumes for roadway segments within the campus (beyond the NASA AMES guard shacks) was not available/not provided by the project traffic consultant. To evaluate potential traffic noise effects to existing residential land uses within the campus, it was conservatively assumed that all vehicle that enters at the Clark Road guard shack would continue on Clark Road and turn right onto Wescoat Road to access the project site.

**Table 5.b. Detailed Traffic Noise Analysis, Supplemental Existing Traffic Noise Analysis, Build Alternative 2 (No Housing)**

| Roadway | Segment | Modeled Distance to Centerline (feet) | Heavy Truck % | Speed Limit (MPH) | Existing Conditions ADT | Existing + Project (Alt 1) ADT | Project (Alt 1 NO Housing) Only ADT | Project Only (Build Alternative 1) Traffic Noise Levels (dBA Ldn) | Representative Measurement Location | Measured Ambient Noise Level (dBA Ldn) | Composite Ambient + Project Noise Level (dBA Ldn) | Change in Sound Level Compared to Ambient (dBA Ldn) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Clark Road | Between R T Jones Road and NASA Ames Driveway | 200 | 2% | 25 | 3930 | 11170 | 7240 | 53.9 | LT-6 | 63.4 | 63.9 | 0.5 |
| Ellis Street | Between Manila Avenue and NASA Ames Driveway | 150 | 2% | 25 | 2380 | 8910 | 6530 | 54.8 | LT-5 | 69.9 | 70.0 | 0.1 |
| Wescoat Road [1] | Between Clark Road and Project Site | 100 | 2% | 25 | 3930 | 11170 | 7240 | 56.9 | LT-1 | 63.7 | 64.5 | 0.8 |

[1] Traffic counts and estimated ADT volumes for roadway segments within the campus (beyond the NASA AMES guard shacks) was not available/not provided by the project traffic consultant. To evaluate potential traffic noise effects to existing residential land uses within the campus, it was conservatively assumed that all vehicle that enters at the Clark Road guard shack would continue on Clark Road and turn right onto Wescoat Road to access the project site.

**Table 1. Detailed Traffic Noise Analysis, Cumulative Input Data**

| Roadway | Segment | Most Sensitive Land Use Type Along Segment | Heavy Truck % | Speed Limit (MPH) | Existing Conditions ADT | Cumulative No Project ADT | Cumulative + Project (Alt 1) ADT | Cumulative + Project (Alt 1 No Housing) ADT | Cumulative + Project (Alt 2) ADT | Cumulative + Project (Alt 2 No Housing) ADT |
|---|---|---|---|---|---|---|---|---|---|---|
| Clark Road | Between R T Jones Road and NASA Ames Driveway | School & Residential | 2% | 25 | 3,930 | 12600 | 22870 | 23090 | 18930 | 19140 |
| Ellis Street | Between Manila Avenue and NASA Ames Driveway | Commercial | 2% | 25 | 2,380 | 10110 | 19370 | 19570 | 15820 | 16010 |
| Ellis Street | Between Middlefield Road and Driveway North of Middlefield Road | Commercial | 2% | 40 | 5,410 | 15880 | 17170 | 17200 | 16670 | 16700 |
| Ellis Street | Between National Avenue and Fairchild Drive | Commercial | 2% | 40 | 6,290 | 14880 | 16170 | 16200 | 15680 | 15710 |
| Ellis Street | Between US-101 Northbound Ramps and Manila Avenue | Commercial | 2% | 40 | 7,100 | 15120 | 21290 | 21420 | 18920 | 19050 |
| Ellis Street | Between US-101 Southbound Ramps and US-101 Northbound Ramps | Commercial | 2% | 40 | 8,360 | 17470 | 20960 | 21030 | 19630 | 19700 |
| Manila Avenue | Between Enterprise Way and Ellis Street | Commercial | 2% | 40 | 5,570 | 11160 | 14240 | 14310 | 13070 | 13130 |
| Moffett Boulevard | Between Leong Drive and US-101 Southbound Ramps | Residential | 2% | 40 | 13,010 | 27770 | 32820 | 32930 | 30880 | 30980 |
| Moffett Boulevard | Between SR-85 Northbound Off-Ramp and Leong Drive | Residential | 2% | 40 | 13,540 | 28260 | 33320 | 33430 | 31380 | 31480 |
| Moffett Boulevard | Between SR-85 Southbound On-Ramp and SR-85 Northbound Off-Ramp | Residential | 2% | 40 | 13,880 | 27620 | 30670 | 30740 | 29510 | 29570 |
| Moffett Boulevard | Between US-101 Northbound Ramps and R T Jones Road | Residential | 2% | 40 | 15,530 | 26270 | 36530 | 36750 | 32600 | 32810 |
| Moffett Boulevard | Between US-101 Southbound Ramps and US-101 Northbound Ramps | Commercial | 2% | 40 | 13,950 | 28770 | 36470 | 36630 | 33510 | 33670 |
| Moffett Park Drive | Between Innovation way and Enterprise Way | Commercial | 2% | 40 | 5,410 | 9830 | 12910 | 12980 | 11730 | 11790 |
| Moffett Park Drive | Between Mathilda Avenue and Innovation Way | Commercial | 2% | 40 | 10,990 | 17000 | 20070 | 20140 | 18900 | 18960 |
| Wescoat Road [1] | Between Clark Road and Project Site | Residential | 2% | 25 | 3,930 | 12600 | 22870 | 23090 | 18930 | 19140 |

[1] Traffic counts and estimated ADT volumes for roadway segments within the campus (beyond the NASA AMES guard shacks) was not available/not provided by the project traffic consultant. To evaluate potential traffic noise effects to existing residential land uses within the campus, it was conservatively assumed that all vehicle that enters at the Clark Road guard shack would continue on Clark Road and turn right onto Wescoat Road to access the project site.

**Table 2. Detailed Traffic Noise Analysis, Cumulative ADT Minus Existing ADT, Input Data**

| Roadway | Segment | Most Sensitive Land Use Type Along Segment | Heavy Truck % | Speed Limit (MPH) | Modeled Distance to Centerline (feet) | Cumulative No Project MINUS Existing ADT | Cumulative + Project (Alt 1) MINUS Existing ADT | Cumulative + Project (Alt 1 No Housing) MINUS Existing ADT | Cumulative + Project (Alt 2) MINUS Existing ADT | Cumulative + Project (Alt 2 No Housing) MINUS Existing ADT |
|---|---|---|---|---|---|---|---|---|---|---|
| Clark Road | Between R T Jones Road and NASA Ames Driveway | School & Residential | 2% | 25 | 200 | 8,670 | 18,940 | 19,160 | 15,000 | 15,210 |
| Moffett Boulevard | Between US-101 Northbound Ramps and R T Jones Road | Residential | 2% | 40 | 400 | 10,740 | 21,000 | 21,220 | 17,070 | 17,280 |
| Wescoat Road [1] | Between Clark Road and Project Site | Residential | 2% | 25 | 100 | 8,670 | 18,940 | 19,160 | 15,000 | 15,210 |

[1] Traffic counts and estimated ADT volumes for roadway segments within the campus (beyond the NASA AMES guard shacks) was not available/not provided by the project traffic consultant. To evaluate potential traffic noise effects to existing residential land uses within the campus, it was conservatively assumed that all vehicle that enters at the Clark Road guard shack would continue on Clark Road and turn right onto Wescoat Road to access the project site.

**Table 3a. Detailed Traffic Noise Analysis, Cumulative Traffic Noise Analysis, Build Alternative 1**

| Roadway | Segment | Most Sensitive Land Use Type Along Segment | Heavy Truck % | Speed Limit (MPH) | Existing Conditions ADT | Cumulative No Project ADT | Cumulative + Project (Alt 1) ADT | Traffic Increase (%) | Existing Traffic Noise Levels (dBA Ldn) | Cumulative No Project Traffic Noise Levels (dBA Ldn) | Cumulative + Project (Build Alternative 1) Traffic Noise Levels (dBA Ldn) | Change in Sound Level from Existing to Cumulative+Project (dBA Ldn) | Change in Sound Level from Cumulative No Project to Cumulative+Project (dBA Ldn) | Significant Cumulative Increase? [2] | Potential Cumulatively Considerable Contribution? [3] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Clark Road | Between R T Jones Road and NASA Ames Driveway | School & Residential | 2% | 25 | 3,930 | 12,600 | 22,870 | 482% | 57.5 | 62.4 | 65.0 | 7.5 | 2.6 | Yes | Yes |
| Ellis Street | Between Manila Avenue and NASA Ames Driveway | Commercial | 2% | 25 | 2,380 | 10,110 | 19,370 | 714% | 55.4 | 61.5 | 64.3 | 8.9 | 2.8 | No | N/A |
| Ellis Street | Between Middlefield Road and Driveway North of Middlefield Road | Commercial | 2% | 40 | 5,410 | 15,880 | 17,170 | 217% | 63.2 | 67.9 | 68.2 | 5.0 | 0.3 | No | N/A |
| Ellis Street | Between National Avenue and Fairchild Drive | Commercial | 2% | 40 | 6,290 | 14,880 | 16,170 | 157% | 63.9 | 67.6 | 67.9 | 4.0 | 0.3 | No | N/A |
| Ellis Street | Between US-101 Northbound Ramps and Manila Avenue | Commercial | 2% | 40 | 7,100 | 15,120 | 21,290 | 200% | 64.4 | 67.6 | 69.1 | 4.7 | 1.5 | No | N/A |
| Ellis Street | Between US-101 Southbound Ramps and US-101 Northbound Ramps | Commercial | 2% | 40 | 8,360 | 17,470 | 20,960 | 151% | 65.1 | 68.3 | 69.1 | 4.0 | 0.8 | No | N/A |
| Manila Avenue | Between Enterprise Way and Ellis Street | Commercial | 2% | 40 | 5,570 | 11,160 | 14,240 | 156% | 63.4 | 66.3 | 67.4 | 4.0 | 1.1 | No | N/A |
| Moffett Boulevard | Between Leong Drive and US-101 Southbound Ramps | Residential | 2% | 40 | 13,010 | 27,770 | 32,820 | 152% | 67.0 | 70.3 | 71.0 | 4.0 | 0.7 | Yes | No |
| Moffett Boulevard | Between SR-85 Northbound Off-Ramp and Leong Drive | Residential | 2% | 40 | 13,540 | 28,260 | 33,320 | 146% | 67.2 | 70.4 | 71.1 | 3.9 | 0.7 | Yes | No |
| Moffett Boulevard | Between SR-85 Southbound On-Ramp and SR-85 Northbound Off-Ramp | Residential | 2% | 40 | 13,880 | 27,620 | 30,670 | 121% | 67.3 | 70.3 | 70.7 | 3.4 | 0.4 | Yes | No |
| Moffett Boulevard | Between US-101 Northbound Ramps and R T Jones Road | Residential | 2% | 40 | 15,530 | 26,270 | 36,530 | 135% | 67.8 | 70.0 | 71.5 | 3.7 | 1.5 | Yes | Yes |
| Moffett Boulevard | Between US-101 Southbound Ramps and US-101 Northbound Ramps | Commercial | 2% | 40 | 13,950 | 28,770 | 36,470 | 161% | 67.3 | 70.4 | 71.5 | 4.2 | 1.1 | No | N/A |
| Moffett Park Drive | Between Innovation way and Enterprise Way | Commercial | 2% | 40 | 5,410 | 9,830 | 12,910 | 139% | 63.2 | 65.8 | 67.0 | 3.8 | 1.2 | No | N/A |
| Moffett Park Drive | Between Mathilda Avenue and Innovation Way | Commercial | 2% | 40 | 10,990 | 17,000 | 20,070 | 83% | 66.3 | 68.2 | 68.9 | 2.6 | 0.7 | No | N/A |
| Wescoat Road [1] | Between Clark Road and Project Site | Residential | 2% | 25 | 3,930 | 12,600 | 22,870 | 482% | 57.5 | 62.4 | 65.0 | 7.5 | 2.6 | Yes | Yes |

Modeled noise levels are calcualted at a distance of 50 feet from the roadway centerline.

[1] Traffic counts and estimated ADT volumes for roadway segments within the campus (beyond the NASA AMES guard shacks) was not available/not provided by the project traffic consultant. To evaluate potential traffic noise effects to existing residential land uses within the campus, it was conservatively assumed that all vehicle that enters at the Clark Road guard shack would continue on Clark Road and turn right onto Wescoat Road to access the project site.

[2] A cumulative impact would occur if the modled noise increase is greater than 3 dB and land uses along the roadway segment are sensitive to noise (i.e., Residential)

3. No = Project does not result in Cumulatively Considerable Contribution because there is land use type along the segment is not a sensitive use. N/A = A Cumulatively Considerable Contribution is not applicable because no Significant Cumulative Impact due to noise level increase occurs along the roadway segment.

**Table 3b. Detailed Traffic Noise Analysis, Supplemental Cumulative Traffic Noise Analysis, Build Alternative 1**

| Roadway | Segment | Modeled Distance to Centerline (feet) | Heavy Truck % | Speed Limit (MPH) | Existing Conditions ADT | Cumulative No Project ADT | Cumulative + Project (Alt 1) ADT | Traffic Increase (%) | Ambient Measure Data Noise Levels: Measurement Location | Ambient Measure Data Noise Levels: (dBA Ldn) | Ambient with Cumulative No Project (Build Alternative 1) Traffic Noise Levels (dBA Ldn) | Ambient with Cumulative + Project (Build Alternative 1) Traffic Noise Levels (dBA Ldn) | Change in Sound Level from Existing to Cumulative+Project (dBA Ldn) | Change in Sound Level from Cumulative No Project to Cumulative+Project (dBA Ldn) | Significant Cumulative Increase? | Potential Cumulatively Considerable Contribution? |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Clark Road | Between R T Jones Road and NASA Ames Driveway | 200 | 2% | 25 | 3,930 | 12,600 | 22,870 | 482% | LT-6 | 63.4 | 63.9 | 64.5 | 1.1 | 0.6 | No | N/A |
| Moffett Boulevard | Between US-101 Northbound Ramps and R T Jones Road | 400 | 2% | 40 | 15,530 | 26,270 | 36,530 | 135% | LT-6 | 63.4 | 64.2 | 64.8 | 1.4 | 0.6 | No | N/A |
| Wescoat Road [1] | Between Clark Road and Project Site | 100 | 2% | 25 | 3,930 | 12,600 | 22,870 | 482% | LT-1 | 63.7 | 64.7 | 65.6 | 1.9 | 0.9 | No | N/A |

[1] Traffic counts and estimated ADT volumes for roadway segments within the campus (beyond the NASA AMES guard shacks) was not available/not provided by the project traffic consultant. To evaluate potential traffic noise effects to existing residential land uses within the campus, it was conservatively assumed that all vehicle that enters at the Clark Road guard shack would continue on Clark Road and turn right onto Wescoat Road to access the project site.

**Table 4a. Detailed Traffic Noise Analysis, Cumulative Traffic Noise Analysis, Build Alternative 1 (No Housing)**

| Roadway | Segment | Most Sensitive Land Use Type Along Segment | Heavy Truck % | Speed Limit (MPH) | Existing Conditions ADT | Cumulative No Project ADT | Cumulative + Project (Alt 1 No Housing) ADT | Traffic Increase (%) | Existing Traffic Noise Levels (dBA Ldn) | Cumulative No Project Traffic Noise Levels (dBA Ldn) | Cumulative + Project (Build Alternative 1 No Housing) Traffic Noise Levels (dBA Ldn) | Change in Sound Level from Existing to Cumulative+Project (dBA Ldn) | Change in Sound Level from Cumulative No Project to Cumulative+Project (dBA Ldn) | Significant Cumulative Increase? [2] | Potential Cumulatively Considerable Contribution? [3] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Clark Road | Between R T Jones Road and NASA Ames Driveway | School & Residential | 2% | 25 | 3930 | 12600 | 23090 | 488% | 57.5 | 62.4 | 65.0 | 7.5 | 2.6 | Yes | Yes |
| Ellis Street | Between Manila Avenue and NASA Ames Driveway | Commercial | 2% | 25 | 2380 | 10110 | 19570 | 722% | 55.4 | 61.5 | 64.3 | 8.9 | 2.8 | No | N/A |
| Ellis Street | Between Middlefield Road and Driveway North of Middlefield Road | Commercial | 2% | 40 | 5410 | 15880 | 17200 | 218% | 63.2 | 67.9 | 68.2 | 5.0 | 0.3 | No | N/A |
| Ellis Street | Between National Avenue and Fairchild Drive | Commercial | 2% | 40 | 6290 | 14880 | 16200 | 158% | 63.9 | 67.6 | 67.9 | 4.0 | 0.3 | No | N/A |
| Ellis Street | Between US-101 Northbound Ramps and Manila Avenue | Commercial | 2% | 40 | 7100 | 15120 | 21420 | 202% | 64.4 | 67.6 | 69.2 | 4.8 | 1.6 | No | N/A |
| Ellis Street | Between US-101 Southbound Ramps and US-101 Northbound Ramps | Commercial | 2% | 40 | 8360 | 17470 | 21030 | 152% | 65.1 | 68.3 | 69.1 | 4.0 | 0.8 | No | N/A |
| Manila Avenue | Between Enterprise Way and Ellis Street | Commercial | 2% | 40 | 5570 | 11160 | 14310 | 157% | 63.4 | 66.3 | 67.4 | 4.0 | 1.1 | No | N/A |
| Moffett Boulevard | Between Leong Drive and US-101 Southbound Ramps | Residential | 2% | 40 | 13010 | 27770 | 32930 | 153% | 67.0 | 70.3 | 71.0 | 4.0 | 0.7 | Yes | No |
| Moffett Boulevard | Between SR-85 Northbound Off-Ramp and Leong Drive | Residential | 2% | 40 | 13540 | 28260 | 33430 | 147% | 67.2 | 70.4 | 71.1 | 3.9 | 0.7 | Yes | No |
| Moffett Boulevard | Between SR-85 Southbound On-Ramp and SR-85 Northbound Off-Ramp | Residential | 2% | 40 | 13880 | 27620 | 30740 | 121% | 67.3 | 70.3 | 70.7 | 3.4 | 0.4 | Yes | No |
| Moffett Boulevard | Between US-101 Northbound Ramps and R T Jones Road | Residential | 2% | 40 | 15530 | 26270 | 36750 | 137% | 67.8 | 70.0 | 71.5 | 3.7 | 1.5 | Yes | Yes |
| Moffett Boulevard | Between US-101 Southbound Ramps and US-101 Northbound Ramps | Commercial | 2% | 40 | 13950 | 28770 | 36630 | 163% | 67.3 | 70.4 | 71.5 | 4.2 | 1.1 | No | N/A |
| Moffett Park Drive | Between Innovation way and Enterprise Way | Commercial | 2% | 40 | 5410 | 9830 | 12980 | 140% | 63.2 | 65.8 | 67.0 | 3.8 | 1.2 | No | N/A |
| Moffett Park Drive | Between Mathilda Avenue and Innovation Way | Commercial | 2% | 40 | 10990 | 17000 | 20140 | 83% | 66.3 | 68.2 | 68.9 | 2.6 | 0.7 | No | N/A |
| Wescoat Road [1] | Between Clark Road and Project Site | Residential | 2% | 25 | 3930 | 12600 | 23090 | 488% | 57.5 | 62.4 | 65.0 | 7.5 | 2.6 | Yes | Yes |

Modeled noise levels are calcualted at a distance of 50 feet from the roadway centerline.

[1] Traffic counts and estimated ADT volumes for roadway segments within the campus (beyond the NASA AMES guard shacks) was not available/not provided by the project traffic consultant. To evaluate potential traffic noise effects to existing residential land uses within the campus, it was conservatively assumed that all vehicle that enters at the Clark Road guard shack would continue on Clark Road and turn right onto Wescoat Road to access the project site.

[2] A cumulative impact would occur if the modled noise increase is greater than 3 dB and land uses along the roadway segment are sensitive to noise (i.e., Residential)

[3] No = Project does not result in Cumulatively Considerable Contribution because there is land use type along the segment is not a sensitive use. N/A = A Cumulatively Considerable Contribution is not applicable because no Significant Cumulative Impact due to noise level increase occurs along the roadway segment.

**Table 4b. Detailed Traffic Noise Analysis, Supplemental Cumulative Traffic Noise Analysis, Build Alternative 1 (No Housing)**

| Roadway | Segment | Modeled Distance to Centerline (feet) | Heavy Truck % | Speed Limit (MPH) | Existing Conditions ADT | Cumulative No Project ADT | Cumulative + Project (Alt 1 No Housing) ADT | Traffic Increase (%) | Ambient Measure Data Noise Levels: Measurement Location | Ambient Measure Data Noise Levels: (dBA Ldn) | Ambient with Cumulative No Project (Build Alternative 1) Traffic Noise Levels (dBA Ldn) | Ambient with Cumulative + Project (Build Alternative 1) Traffic Noise Levels (dBA Ldn) | Change in Sound Level from Existing to Cumulative+Project (dBA Ldn) | Change in Sound Level from Cumulative No Project to Cumulative+Project (dBA Ldn) | Significant Cumulative Increase? | Potential Cumulatively Considerable Contribution? |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Clark Road | Between R T Jones Road and NASA Ames Driveway | 200 | 2% | 25 | 3,930 | 12,600 | 23,090 | 488% | LT-6 | 63.4 | 63.9 | 64.5 | 1.1 | 0.6 | No | N/A |
| Moffett Boulevard | Between US-101 Northbound Ramps and R T Jones Road | 400 | 2% | 40 | 15,530 | 26,270 | 36,750 | 137% | LT-6 | 63.4 | 64.2 | 64.8 | 1.4 | 0.6 | No | N/A |
| Wescoat Road [1] | Between Clark Road and Project Site | 100 | 2% | 25 | 3,930 | 12,600 | 23,090 | 488% | LT-1 | 63.7 | 64.7 | 65.6 | 1.9 | 0.9 | No | N/A |

[1] Traffic counts and estimated ADT volumes for roadway segments within the campus (beyond the NASA AMES guard shacks) was not available/not provided by the project traffic consultant. To evaluate potential traffic noise effects to existing residential land uses within the campus, it was conservatively assumed that all vehicle that enters at the Clark Road guard shack would continue on Clark Road and turn right onto Wescoat Road to access the project site.

**Table 5a. Detailed Traffic Noise Analysis, Cumulative Traffic Noise Analysis, Build Alternative 2**

| Roadway | Segment | Most Sensitive Land Use Type Along Segment | Heavy Truck % | Speed Limit (MPH) | Existing Conditions ADT | Cumulative No Project ADT | Cumulative + Project (Alt 2) ADT | Traffic Increase (%) | Existing Traffic Noise Levels (dBA Ldn) | Cumulative No Project Traffic Noise Levels (dBA Ldn) | Cumulative + Project (Build Alternative 2) Traffic Noise Levels (dBA Ldn) | Change in Sound Level from Existing to Cumulative+Project (dBA Ldn) | Change in Sound Level from Cumulative No Project to Cumulative+Project (dBA Ldn) | Significant Cumulative Increase? [2] | Potential Cumulatively Considerable Contribution? [3] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Clark Road | Between R T Jones Road and NASA Ames Driveway | School & Residential | 2% | 25 | 3930 | 12600 | 18930 | 382% | 57.5 | 62.4 | 65.0 | 7.5 | 2.6 | Yes | Yes |
| Ellis Street | Between Manila Avenue and NASA Ames Driveway | Commercial | 2% | 25 | 2380 | 10110 | 15820 | 565% | 55.4 | 61.5 | 64.3 | 8.9 | 2.8 | No | N/A |
| Ellis Street | Between Middlefield Road and Driveway North of Middlefield Road | Commercial | 2% | 40 | 5410 | 15880 | 16670 | 208% | 63.2 | 67.9 | 68.2 | 5.0 | 0.3 | No | N/A |
| Ellis Street | Between National Avenue and Fairchild Drive | Commercial | 2% | 40 | 6290 | 14880 | 15680 | 149% | 63.9 | 67.6 | 67.9 | 4.0 | 0.3 | No | N/A |
| Ellis Street | Between US-101 Northbound Ramps and Manila Avenue | Commercial | 2% | 40 | 7100 | 15120 | 18920 | 166% | 64.4 | 67.6 | 69.1 | 4.7 | 1.5 | No | N/A |
| Ellis Street | Between US-101 Southbound Ramps and US-101 Northbound Ramps | Commercial | 2% | 40 | 8360 | 17470 | 19630 | 135% | 65.1 | 68.3 | 69.1 | 4.0 | 0.8 | No | N/A |
| Manila Avenue | Between Enterprise Way and Ellis Street | Commercial | 2% | 40 | 5570 | 11160 | 13070 | 135% | 63.4 | 66.3 | 67.4 | 4.0 | 1.1 | No | N/A |
| Moffett Boulevard | Between Leong Drive and US-101 Southbound Ramps | Residential | 2% | 40 | 13010 | 27770 | 30880 | 137% | 67.0 | 70.3 | 71.0 | 4.0 | 0.7 | Yes | No |
| Moffett Boulevard | Between SR-85 Northbound Off-Ramp and Leong Drive | Residential | 2% | 40 | 13540 | 28260 | 31380 | 132% | 67.2 | 70.4 | 71.1 | 3.9 | 0.7 | Yes | No |
| Moffett Boulevard | Between SR-85 Southbound On-Ramp and SR-85 Northbound Off-Ramp | Residential | 2% | 40 | 13880 | 27620 | 29510 | 113% | 67.3 | 70.3 | 70.7 | 3.4 | 0.4 | Yes | No |
| Moffett Boulevard | Between US-101 Northbound Ramps and R T Jones Road | Residential | 2% | 40 | 15530 | 26270 | 32600 | 110% | 67.8 | 70.0 | 71.5 | 3.7 | 1.5 | Yes | Yes |
| Moffett Boulevard | Between US-101 Southbound Ramps and US-101 Northbound Ramps | Commercial | 2% | 40 | 13950 | 28770 | 33510 | 140% | 67.3 | 70.4 | 71.5 | 4.2 | 1.1 | No | N/A |
| Moffett Park Drive | Between Innovation way and Enterprise Way | Commercial | 2% | 40 | 5410 | 9830 | 11730 | 117% | 63.2 | 65.8 | 67.0 | 3.8 | 1.2 | No | n/A |
| Moffett Park Drive | Between Mathilda Avenue and Innovation Way | Commercial | 2% | 40 | 10990 | 17000 | 18900 | 72% | 66.3 | 68.2 | 68.9 | 2.6 | 0.7 | No | N/A |
| Wescoat Road [1] | Between Clark Road and Project Site | Residential | 2% | 25 | 3930 | 12600 | 18930 | 382% | 57.5 | 62.4 | 65.0 | 7.5 | 2.6 | Yes | Yes |

Modeled noise levels are calcualted at a distance of 50 feet from the roadway centerline.

[1] Traffic counts and estimated ADT volumes for roadway segments within the campus (beyond the NASA AMES guard shacks) was not available/not provided by the project traffic consultant. To evaluate potential traffic noise effects to existing residential land uses within the campus, it was conservatively assumed that all vehicle that enters at the Clark Road guard shack would continue on Clark Road and turn right onto Wescoat Road to access the project site.

[2] A cumulative impact would occur if the modled noise increase is greater than 3 dB and land uses along the roadway segment are sensitive to noise (i.e., Residential)

[3] No = Project does not result in Cumulatively Considerable Contribution because there is land use type along the segment is not a sensitive use. N/A = A Cumulatively Considerable Contribution is not applicable because no Significant Cumulative Impact due to noise level increase occurs along the roadway segment.

**Table 5b. Detailed Traffic Noise Analysis, Supplemental Cumulative Traffic Noise Analysis, Build Alternative 2**

| Roadway | Segment | Modeled Distance to Centerline (feet) | Heavy Truck % | Speed Limit (MPH) | Existing Conditions ADT | Cumulative No Project ADT | Cumulative + Project (Alt 2) ADT | Traffic Increase (%) | Ambient Measure Data Noise Levels: Measurement Location | Ambient Measure Data Noise Levels: (dBA Ldn) | Ambient with Cumulative No Project (Build Alternative 2) Traffic Noise Levels (dBA Ldn) | Ambient with Cumulative + Project (Build Alternative 2) Traffic Noise Levels (dBA Ldn) | Change in Sound Level from Existing to Cumulative+Project (dBA Ldn) | Change in Sound Level from Cumulative No Project to Cumulative+Project (dBA Ldn) | Significant Cumulative Increase? | Potential Cumulatively Considerable Contribution? |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Clark Road | Between R T Jones Road and NASA Ames Driveway | 200 | 2% | 25 | 3,930 | 12,600 | 18,930 | 382% | LT-6 | 63.4 | 63.9 | 64.3 | 0.9 | 0.4 | No | N/A |
| Moffett Boulevard | Between US-101 Northbound Ramps and R T Jones Road | 400 | 2% | 40 | 15,530 | 26,270 | 32,600 | 110% | LT-6 | 63.4 | 64.2 | 64.6 | 1.2 | 0.4 | No | N/A |
| Wescoat Road [1] | Between Clark Road and Project Site | 100 | 2% | 25 | 3,930 | 12,600 | 18,930 | 382% | LT-1 | 63.7 | 64.7 | 65.3 | 1.6 | 0.6 | No | N/A |

[1] Traffic counts and estimated ADT volumes for roadway segments within the campus (beyond the NASA AMES guard shacks) was not available/not provided by the project traffic consultant. To evaluate potential traffic noise effects to existing residential land uses within the campus, it was conservatively assumed that all vehicle that enters at the Clark Road guard shack would continue on Clark Road and turn right onto Wescoat Road to access the project site.

**Table 6a. Detailed Traffic Noise Analysis, Cumulative Traffic Noise Analysis, Build Alternative 2 (No Housing)**

| Roadway | Segment | Most Sensitive Land Use Type Along Segment | Heavy Truck % | Speed Limit (MPH) | Existing Conditions ADT | Cumulative No Project ADT | Cumulative + Project (Alt 2 No Housing) ADT | Traffic Increase (%) | Existing Traffic Noise Levels (dBA Ldn) | Cumulative No Project Traffic Noise Levels (dBA Ldn) | Cumulative + Project (Build Alternative 2 No Housing) Traffic Noise Levels (dBA Ldn) | Change in Sound Level from Existing to Cumulative+Project (dBA Ldn) | Change in Sound Level from Cumulative No Project to Cumulative+Project (dBA Ldn) | Significant Cumulative Increase? [2] | Potential Cumulatively Considerable Contribution? [3] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Clark Road | Between R T Jones Road and NASA Ames Driveway | School & Residential | 2% | 25 | 3930 | 12600 | 19140 | 387% | 57.5 | 62.4 | 64.2 | 6.7 | 1.8 | Yes | Yes |
| Ellis Street | Between Manila Avenue and NASA Ames Driveway | Commercial | 2% | 25 | 2380 | 10110 | 16010 | 573% | 55.4 | 61.5 | 63.4 | 8.0 | 1.9 | No | N/A |
| Ellis Street | Between Middlefield Road and Driveway North of Middlefield Road | Commercial | 2% | 40 | 5410 | 15880 | 16700 | 209% | 63.2 | 67.9 | 68.1 | 4.9 | 0.2 | No | N/A |
| Ellis Street | Between National Avenue and Fairchild Drive | Commercial | 2% | 40 | 6290 | 14880 | 15710 | 150% | 63.9 | 67.6 | 67.8 | 3.9 | 0.2 | No | N/A |
| Ellis Street | Between US-101 Northbound Ramps and Manila Avenue | Commercial | 2% | 40 | 7100 | 15120 | 19050 | 168% | 64.4 | 67.6 | 68.6 | 4.2 | 1.0 | No | N/A |
| Ellis Street | Between US-101 Southbound Ramps and US-101 Northbound Ramps | Commercial | 2% | 40 | 8360 | 17470 | 19700 | 136% | 65.1 | 68.3 | 68.8 | 3.7 | 0.5 | No | N/A |
| Manila Avenue | Between Enterprise Way and Ellis Street | Commercial | 2% | 40 | 5570 | 11160 | 13130 | 136% | 63.4 | 66.3 | 67.0 | 3.6 | 0.7 | No | N/A |
| Moffett Boulevard | Between Leong Drive and US-101 Southbound Ramps | Residential | 2% | 40 | 13010 | 27770 | 30980 | 138% | 67.0 | 70.3 | 70.8 | 3.8 | 0.5 | Yes | No |
| Moffett Boulevard | Between SR-85 Northbound Off-Ramp and Leong Drive | Residential | 2% | 40 | 13540 | 28260 | 31480 | 132% | 67.2 | 70.4 | 70.8 | 3.6 | 0.4 | Yes | No |
| Moffett Boulevard | Between SR-85 Southbound On-Ramp and SR-85 Northbound Off-Ramp | Residential | 2% | 40 | 13880 | 27620 | 29570 | 113% | 67.3 | 70.3 | 70.5 | 3.2 | 0.2 | Yes | No |
| Moffett Boulevard | Between US-101 Northbound Ramps and R T Jones Road | Residential | 2% | 40 | 15530 | 26270 | 32810 | 111% | 67.8 | 70.0 | 71.0 | 3.2 | 1.0 | Yes | No |
| Moffett Boulevard | Between US-101 Southbound Ramps and US-101 Northbound Ramps | Commercial | 2% | 40 | 13950 | 28770 | 33670 | 141% | 67.3 | 70.4 | 71.1 | 3.8 | 0.7 | No | N/A |
| Moffett Park Drive | Between Innovation way and Enterprise Way | Commercial | 2% | 40 | 5410 | 9830 | 11790 | 118% | 63.2 | 65.8 | 66.6 | 3.4 | 0.8 | No | N/A |
| Moffett Park Drive | Between Mathilda Avenue and Innovation Way | Commercial | 2% | 40 | 10990 | 17000 | 18960 | 73% | 66.3 | 68.2 | 68.6 | 2.3 | 0.4 | No | N/A |
| Wescoat Road [1] | Between Clark Road and Project Site | Residential | 2% | 25 | 3930 | 12600 | 19140 | 387% | 57.5 | 62.4 | 64.2 | 6.7 | 1.8 | Yes | Yes |

Modeled noise levels are calcualted at a distance of 50 feet from the roadway centerline.

[1] Traffic counts and estimated ADT volumes for roadway segments within the campus (beyond the NASA AMES guard shacks) was not available/not provided by the project traffic consultant. To evaluate potential traffic noise effects to existing residential land uses within the campus, it was conservatively assumed that all vehicle that enters at the Clark Road guard shack would continue on Clark Road and turn right onto Wescoat Road to access the project site.

[2] A cumulative impact would occur if the modled noise increase is greater than 3 dB and land uses along the roadway segment are sensitive to noise (i.e., Residential)

[3] No = Project does not result in Cumulatively Considerable Contribution because there is land use type along the segment is not a sensitive use. N/A = A Cumulatively Considerable Contribution is not applicable because no Significant Cumulative Impact due to noise level increase occurs along the roadway segment.

**Table 6b. Detailed Traffic Noise Analysis, Supplemental Cumulative Traffic Noise Analysis, Build Alternative 2 (No Housing)**

| Roadway | Segment | Modeled Distance to Centerline (feet) | Heavy Truck % | Speed Limit (MPH) | Existing Conditions ADT | Cumulative No Project ADT | Cumulative + Project (Alt 2 No Housing) ADT | Traffic Increase (%) | Ambient Measure Data Noise Levels: Measurement Location | Ambient Measure Data Noise Levels: (dBA Ldn) | Ambient with Cumulative No Project Traffic Noise Levels (dBA Ldn) | Ambient with Cumulative + Project (Build Alternative 2 No Housing) Traffic Noise Levels (dBA Ldn) | Change in Sound Level from Existing to Cumulative+Project (dBA Ldn) | Change in Sound Level from Cumulative No Project to Cumulative+Project (dBA Ldn) | Significant Cumulative Increase? | Potential Cumulatively Considerable Contribution? |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Clark Road | Between R T Jones Road and NASA Ames Driveway | 200 | 2% | 25 | 3,930 | 12,600 | 19,140 | 387% | LT-6 | 63.4 | 63.9 | 64.3 | 0.9 | 0.4 | No | N/A |
| Moffett Boulevard | Between US-101 Northbound Ramps and R T Jones Road | 400 | 2% | 40 | 15,530 | 26,270 | 32,810 | 111% | LT-6 | 63.4 | 64.2 | 64.6 | 1.2 | 0.4 | No | N/A |
| Wescoat Road [1] | Between Clark Road and Project Site | 100 | 2% | 25 | 3,930 | 12,600 | 19,140 | 387% | LT-1 | 63.7 | 64.7 | 65.3 | 1.6 | 0.6 | No | N/A |

[1] Traffic counts and estimated ADT volumes for roadway segments within the campus (beyond the NASA AMES guard shacks) was not available/not provided by the project traffic consultant. To evaluate potential traffic noise effects to existing residential land uses within the campus, it was conservatively assumed that all vehicle that enters at the Clark Road guard shack would continue on Clark Road and turn right onto Wescoat Road to access the project site.

# Parking Garage Noise Modeling

**Table 1. Detailed Parking Garage Noise Analysis, Input Data**

| | Assumed Parking Structure Area Ratio (%) | Build Alternative 1 Parking Spaces Per Structure | Build Alternative 2 Parking Spaces Per Structure |
|---|---|---|---|
| **Total** | 100% | 3419 | 2063 |
| **Subarea 4 (Building 6)** | 50% | 1710 | 1032 |
| **Subarea 6 (Building 11)** | 50% | 1710 | 1032 |

**Table 2. Detailed Parking Garage Noise Analysis, Acoustic Average Distance Calculations, by Parking Garage**

| Parking Garage/Receptor | Nearest Distance (feet) | Furthest Distance (feet) | Calculated Acoustic Average (feet) | Acoustic Average Distance Conservatively Rounded Down (feet) |
|---|---|---|---|---|
| **Building 6** | | | | |
| Wescoat Village | 1560 | 1880 | 1713 | 1710 |
| **Building 11** | | | | |
| Wescoat Village | 215 | 560 | 347 | 345 |

**Table 3. Detailed Parking Garage Noise Analysis, Alternative 1, Building 6**

| | | | | | | |
|---|---|---|---|---|---|---|
| **Parking Garage Noise Calculations - DAYTIME PEAK** | | | | | **FTA 2006** | |
| LEQ=**92** + (10*log(635/1000)-**35.6)** | | | | | *convert SEL to LEQ* | 10*log(3600) = 35.6 |
| | **SEL** | 1710 | | | **3600 seconds in an hour** | |
| | 92 | 2.3 | 35.6 | | | **35.6** |
| | **58.7** dBA Leq at 50 feet | | | | "Taking sound energy, and spreading it out over an hour" | |

**Average Daytime Ambient Noise Level Comparison**

| Land Use | Acoustic Average Distance (ft) | Representative Measurement Location | Average Daytime Ambient Noise Level | Modeled Noise Level at Receiver | Delta dB |
|---|---|---|---|---|---|
| Wescoat Village | 1710 | LT-1 | 56.4 | 28.0 | -28.4 |

**Table 4. Detailed Parking Garage Noise Analysis, Alternative 1, Building 11**

| | | | | | | |
|---|---|---|---|---|---|---|
| **Parking Garage Noise Calculations - DAYTIME PEAK** | | | | | **FTA 2006** | |
| LEQ=**92** + (10*log(635/1000)-**35.6)** | | | | | *convert SEL to LEQ* | 10*log(3600) = 35.6 |
| | **SEL** | 1710 | | | **3600 seconds in an hour** | |
| | 92 | 2.3 | 35.6 | | | **35.6** |
| | **58.7** dBA Leq at 50 feet | | | | "Taking sound energy, and spreading it out over an hour" | |

**Average Daytime Ambient Noise Level Comparison**

| Land Use | Acoustic Average Distance (ft) | Representative Measurement Location | Average Daytime Ambient Noise Level | Modeled Noise Level at Receiver | Delta dB |
|---|---|---|---|---|---|
| Wescoat Village | 345 | LT-1 | 56.4 | 41.9 | -14.5 |

**Table 5. Detailed Parking Garage Noise Analysis, Alternative 2, Building 6**

| | | | | | | |
|---|---|---|---|---|---|---|
| **Parking Garage Noise Calculations - DAYTIME PEAK** | | | | | **FTA 2006** | |
| LEQ=**92** + (10*log(635/1000)-**35.6)** | | | | | *convert SEL to LEQ* | 10*log(3600) = 35.6 |
| | **SEL** | 1032 | | | **3600 seconds in an hour** | |
| | 92 | 0.1 | 35.6 | | | **35.6** |
| | **56.5** dBA Leq at 50 feet | | | | "Taking sound energy, and spreading it out over an hour" | |

**Average Daytime Ambient Noise Level Comparison**

| Land Use | Acoustic Average Distance (ft) | Representative Measurement Location | Average Daytime Ambient Noise Level | Modeled Noise Level at Receiver | Delta dB |
|---|---|---|---|---|---|
| Wescoat Village | 1710 | LT-1 | 56.4 | 25.8 | -30.6 |

**Table 6. Detailed Parking Garage Noise Analysis, Alternative 2, Building 11**

| | | | | | | |
|---|---|---|---|---|---|---|
| **Parking Garage Noise Calculations - DAYTIME PEAK** | | | | | **FTA 2006** | |
| LEQ=**92** + (10*log(635/1000)-**35.6)** | | | | | *convert SEL to LEQ* | 10*log(3600) = 35.6 |
| | **SEL** | 1032 | | | **3600 seconds in an hour** | |
| | 92 | 0.1 | 35.6 | | | **35.6** |
| | **56.5** dBA Leq at 50 feet | | | | "Taking sound energy, and spreading it out over an hour" | |

**Average Daytime Ambient Noise Level Comparison**

| Land Use | Acoustic Average Distance (ft) | Representative Measurement Location | Average Daytime Ambient Noise Level | Modeled Noise Level at Receiver | Delta dB |
|---|---|---|---|---|---|
| Wescoat Village | 345 | LT-1 | 56.4 | 39.7 | -16.7 |