ATTACHMENT D

ENVIRONMENTAL IMPACT REPORT

APPENDIX G

NOISE & VIBRATION ANALYSIS

TECHNICAL REPORT

APPENDIX G

Noise and Vibration Analysis Technical Report

Noise and Vibration Analysis Technical Report for the Hughes Circuits Project City of San Marcos, California

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Acronyms and Abbreviations

Acronym/Abbreviation	Definition
Project	Hughes Circuits proposed project
ACC	air-cooled condenser
ADT	average daily traffic
AUF	acoustical usage factor
Caltrans	California Department of Transportation
City	City of San Marcos
CNEL	Community Noise Equivalent Level
dB	decibel
dBA	A-weighted decibel
FTA	Federal Transit Administration
HVAC	heating, ventilating, and air-conditioning
ips	inches per second
L_{dn}	day–night average noise level
L_{eq}	equivalent noise level
L_{max}	maximum sound level
L_{min}	minimum sound level
PPV	peak particle velocity
RCNM	Roadway Construction Noise Model
SF	square feet
SLM	sound level meter
SPL	sound pressure level
veh/hr	vehicles per hour

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1 Introduction and Background

This technical noise report evaluates the potential noise and vibration impacts during construction and operation of the proposed Hughes Circuits project (proposed Project). This assessment utilizes the significance thresholds in Appendix G of the California Environmental Quality Act Guidelines (14 CCR 15000 et seq.).

Project Description

The approximately 14-acre Project site is located within the City of San Marcos (City), California. The vacant Project site is comprised of Assessor's Parcel Numbers (APNs) 219-223-20-00 and 219-223-22-00 and sits north of South Pacific Street on one side and east of South Pacific Street on the other. The project location is shown on Figure 1.

The project consists of development of a 67,410-square foot (SF) manufacturing building to support the expansion of the existing operations of Hughes Circuits Inc., currently located adjacent to the Project site to the south, at 546 S. Pacific Street. The 67,410 SF manufacturing building includes a 56,310 SF first floor, and a 11,100 SF mezzanine. The proposed manufacturing building would be located at the western-most portion of the Project site, and the disturbance area associated with Project construction would be limited to approximately 113,877 SF or 2.6 acres of the 14-acre project site. Proposed development would only occur within APN 219-223-20-00. The proposed manufacturing building would include a fire control room, MPOE room, trash enclosure, outdoor amenity area, electrical room, and grade level loading dock. Parking for the proposed building would include 72 parking spaces, including 4 electric vehicle charging stations, 9 carpool and zero emission parking stalls, 4 accessible stalls, and 1 USPS parking stall. Additionally, 4 short-term bicycle parking spaces and 4 long-term bicycle parking spaces would be provided. Access to the proposed building would be provided via two new driveways along S. Pacific Street, one at the northwestern boundary of the proposed building site, and the other at the southeastern boundary of the proposed building site, as shown in Figure 2, Project Site Plan. Stormwater basins and associated landscaping would be incorporated along the perimeter of the proposed manufacturing building. Approximately 60 employees would work out of the proposed manufacturing building.

The Project site is currently designated as Light Industrial (L-I) under the City's General Plan, and the Project proposes a Light Manufacturing land use, consistent with the City's General Plan. Adjacent land uses include mixed commercial development to the north and south, a public recreational park (Bradley Park) to the west, and undeveloped land to the east. The nearest noise-sensitive receivers are approximately 500 feet west-southwest of the Project and represented by multi-family homes along Beverly Way in the Lake Park Terrace community that is zoned Residential R-3-10 (City of San Marcos 2022).

Noise Characteristics

Sound is mechanical energy transmitted by pressure waves in a compressible medium, such as air. Noise is defined as sound that is loud, unpleasant, unexpected, or undesired. The sound pressure level (SPL) has become the most common descriptor used to characterize the loudness of an ambient sound level. The unit of measurement of sound pressure is a decibel (dB). Under controlled conditions in an acoustics laboratory, the trained, healthy human ear is able to discern changes in sound levels of 1 dB when exposed to steady, single-frequency signals in the mid-frequency range. Outside such controlled conditions, the trained ear can detect changes of 2 dB in normal environmental noise. It is widely accepted that the average healthy ear, however, can barely perceive noise level changes of 3 dB. A change of 5 dB is readily perceptible, and an upward change of 10 dB is perceived as twice as loud (Caltrans 2013). A doubling of sound energy results in a 3 dB increase in sound, which means that a doubling of sound energy (e.g., doubling the number of ground vehicle daily trips along a given road segment) would result in a barely perceptible change in sound level.

Sound may be described in terms of level or amplitude (measured in dB), frequency or pitch (measured in hertz [Hz] or cycles per second), and duration (measured in seconds or minutes). Because the human ear is not equally sensitive to sound at all frequencies, a special frequency-dependent rating scale is used to relate noise to human sensitivity. The A-weighted decibel (dBA) scale performs this compensation by discriminating against low and very high frequencies in a manner approximating the sensitivity of the human ear.

Several descriptors of noise (noise metrics) exist to help predict average community reactions to the adverse effects of environmental noise, including traffic-generated noise. These descriptors include the equivalent noise level over a given period (L_{eq}), the day–night average noise level (L_{dn}), and the community noise equivalent level (CNEL). Each of these descriptors uses units of dBA.

L_{eq} is a decibel quantity that represents the constant or energy-averaged value equivalent to the amount of variable sound energy received by a receptor during a time interval. For example, a 1-hour L_{eq} measurement of 60 dBA would represent the average amount of energy contained in all the noise that occurred in that hour. L_{eq} is an effective noise descriptor because of its ability to assess the total time-varying effects of noise on sensitive receptors, which can then be compared to an established L_{eq} standard or threshold of the same duration. Another descriptor is maximum sound level (L_{max}), which is the greatest sound level measured during a designated time interval or event. The minimum sound level (L_{min}) is often called the *floor* of a measurement period.

Unlike the L_{eq}, L_{max}, and L_{min} metrics, L_{dn} and CNEL descriptors always represent 24-hour periods and differ from a 24-hour L_{eq} value because they apply a time-weighted factor designed to emphasize noise events that occur during the non-daytime hours (when speech and sleep disturbance is of more concern). *Time-weighted* refers to the fact that L_{dn} and CNEL penalize noise that occurs during certain sensitive periods. In the case of CNEL, noise occurring during the daytime (7:00 a.m. to 7:00 p.m.) receives no penalty. Noise during the evening (7:00 p.m. to 10:00 p.m.) is penalized by adding 5 dB, and nighttime (10:00 p.m. to 7:00 a.m.) noise is penalized by adding 10 dB. L_{dn} differs from CNEL in that the daytime period is longer (defined instead as 7:00 a.m. to 10:00 p.m.), thus eliminating the dB adjustment for the evening period. L_{dn} and CNEL are the predominant criteria used to measure roadway noise affecting residential receptors. These two metrics generally differ from one another by no more than 0.5–1 dB, and are often considered or actually defined as being essentially equivalent by many jurisdictions.

Vibration Fundamentals

Vibration is oscillatory movement of mass (typically a solid) over time. It is described in terms of frequency and amplitude and, unlike sound, can be expressed as displacement, velocity, or acceleration. For environmental studies, vibration is often studied as a velocity that, akin to the discussion of sound pressure levels, can also be expressed in dB as a way to cast a large range of quantities into a more convenient scale. These vibration velocity decibels (VdB) are based upon the root-mean-square (RMS) of a vibration velocity signal, and often used in the context of assessing building occupant detection or annoyance towards received groundborne vibration. Potential vibration impacts to buildings, on the other hand, are usually discussed in terms of inches per second (ips) peak particle velocity (PPV). Both of these vibration velocity descriptors will be used herein to discuss predicted Project-attributed groundborne vibration levels and their comparison with relevant standards.

Common sources of vibration within communities include construction activities and railroads. Groundborne vibration generated by construction projects is usually highest during pile driving, rock blasting, soil compacting, jack hammering, and demolition-related activities where sudden releases of subterranean energy or powerful impacts of tools on hard materials occur. Depending on their distances to a sensitive receptor, operation of large bulldozers, graders, loaded dump trucks, or other heavy construction equipment and vehicles on a construction site also have the potential to cause high vibration amplitudes. The maximum vibration level standard used by the California Department of Transportation (Caltrans) for the prevention of structural damage to typical residential buildings is 0.3 ips PPV (Caltrans 2020).

SOURCE: Bing Maps 2022; SanGIS 2022

DUDEK

0 100 200 Feet

FIGURE 1

Noise Measurement Locations

Hughes Circuits Project Environmental Impact Report

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PRELIMINARY
NOT FOR CONSTRUCTION
ISSUE DATE: 6/21/2023

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CITY OF MENIFEE

CONCEPTUAL GRADING, DRAINAGE & UTILITY PLAN
PLOT PLAN NO. 22-0159
PATRIOT - MCLAUGHLIN INDUSTRIAL

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DRAWN BY	D.S.
CHECKED BY	J.M.
FIELD BOOK	
SHEET	2 OF 4 SHEETS
JOB NO.	R314755.01

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2 Regulatory Setting

Federal

Occupational Safety and Health Administration

With regard to noise exposure and workers, the federal Occupational Safety and Health Administration (OSHA) establishes regulations to safeguard the hearing of workers exposed to occupational noise (29 Code of Federal Regulations, Section 1910.95). OSHA specifies that sustained noise that is louder than 85 dBA (8-hour time-weighted average) can be a threat to workers' hearing and if worker exposure exceeds this amount, the employer must develop and implement a monitoring program (29 Code of Federal Regulations, Section 1910.95(d)(1)).

Federal Transit Administration (FTA)

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

The same aforementioned FTA guidance manual also includes recommended groundborne vibration thresholds for building damage risk that depend on the receiving structure type and condition. By way of example, it indicates that for "non-engineered timber and masonry buildings", the criterion would be 0.2 ips PPV or 94 VdB when this value is converted to an RMS signal by a crest factor of 4 (FTA 2018). For "engineered concrete and masonry (no plaster)" buildings, the threshold is less stringent: 0.3 ips PPV or 98 VdB.

For purposes of assessing building occupant annoyance, FTA guidance suggests that residences would be "Category 2" receivers (i.e., "where people normally sleep") for which 72 VdB to 80 VdB would be an appropriate standard depending on the frequency of vibration occurrence (FTA 2018).

State

California Code of Regulations

California Government Code Section 65302(f) mandates that the legislative body of each county and city adopt a noise element as part of its comprehensive general plan. The local noise element must recognize the land use compatibility guidelines established by the State Department of Health Services. The guidelines rank noise land use compatibility in terms of "normally acceptable", "conditionally acceptable", "normally unacceptable", and "clearly unacceptable" noise levels for various land use types. Single-family homes are "normally acceptable" in exterior noise environments up to 60 dBA CNEL and "conditionally acceptable" up to 70 dBA CNEL. Multiple-family residential uses are "normally acceptable" up to dBA 65 CNEL and "conditionally acceptable" up to dBA 70 CNEL. Schools, libraries, and churches are "normally acceptable" up to 70 dBA CNEL, as are office buildings and business, commercial, and professional uses.

California Department of Transportation

In its Transportation and Construction Vibration Guidance Manual, Caltrans recommends a vibration velocity threshold of 0.2 ips PPV (Caltrans 2020) for assessing annoying vibration impacts to occupants of residential structures. Although this Caltrans guidance is not a regulation, it can serve as a quantified standard in the absence of such limits at the local jurisdictional level. Similarly, thresholds to assess building damage risk due to construction vibration vary with the type of structure and its fragility, but tend to range between 0.2 ips and 0.3 ips PPV for typical residential structures (Caltrans 2020).

For office building occupants, the same Caltrans guidance manual refers to International Organization of Standardization (ISO) 2631 that indicates 0.016 ips RMS (80 VdB) would be an appropriate threshold in the context of "detection or discomfort". Converted to PPV using the FTA-recommended crest factor of 4 (FTA 2018), this value translates to 0.04 ips. A building with workshops (or similar interior uses) would have a recommended vibration criteria of 0.08 ips PPV per the same guidance based on ISO 2631, or an rms value of 0.032 ips (86 VdB). The Caltrans guidance manual also refers to the aforementioned FTA impact criteria for Category 3 land uses that ranges between 75 VdB and 83 VdB depending on frequency of vibration occurrence (Caltrans 2020).

Local

City of San Marcos Noise Level Compatibility Standards

The Noise Element of the *City of San Marcos General Plan* (City of San Marcos 2012) establishes target maximum noise levels in the City. Exhibit A (Table 7-3 of the Noise Element) depicts "acceptable," "conditionally acceptable," and "unacceptable" transportation-related exterior noise levels for the indicated land use designations.

With respect to commercial/industrial developments like the proposed Project, the Noise Element states: "the City should consider noise generation and potential impacts to surrounding development. New development can be made compatible with the noise environment by using noise and land use compatibility standards and the Future Noise Contour Diagram (see Figure 7-2) as a guide for planning and development decisions. During the project design review process, the City can work with the project applicant to identify of potential impacts and reasonable mitigation measures. For example, the City can require an acoustical analysis for projects that will potentially generate noise that would affect sensitive receptors. These mitigation measures can include, but not be limited to, acoustically treated and/or quiet designs for furnaces, fans, motors, compressors, valves, pumps and other mechanical equipment. The City may also require limited delivery hours and/or hours of operation in order to reduce impacts to adjacent sensitive uses. In addition, all City departments must comply with State and federal OSHA standards. Any new equipment or vehicles purchased by the City will comply with local, State and federal noise standards."

Exhibit A. Reproduction of Tale 7-3 from the City of San Marcos General Plan Noise Element

Land Use Category		Exterior Noise Level (CNEL) 55	60	65	70	75	80
A	Residential—single family residences, mobile homes, senior/age-restricted housing	Acceptable	Acceptable	Conditionally Acceptable	Conditionally Acceptable	Conditionally Acceptable	Unacceptable
B	Residential—multifamily residences, mixed use (residential/commercial)	Acceptable	Acceptable	Acceptable	Conditionally Acceptable	Conditionally Acceptable	Unacceptable
C	Lodging—hotels, motels	Acceptable	Acceptable	Acceptable	Conditionally Acceptable	Conditionally Acceptable	Unacceptable
D[2]	Schools, churches, hospitals, residential care facility, child care facilities	Acceptable	Acceptable	Acceptable	Conditionally Acceptable	Conditionally Acceptable	Unacceptable
E[2]	Passive recreational parks, nature preserves, contemplative spaces, cemeteries	Acceptable	Acceptable	Acceptable	Conditionally Acceptable	Conditionally Acceptable	Unacceptable
F[2]	Active parks, golf courses, athletic fields, outdoor spectator sports, water recreation	Acceptable	Acceptable	Acceptable	Conditionally Acceptable	Conditionally Acceptable	Unacceptable
G[2]	Office/professional, government, medical/dental, commercial, retail, laboratories	Acceptable	Acceptable	Acceptable	Conditionally Acceptable	Conditionally Acceptable	Unacceptable
H[2]	Industrial, manufacturing, utilities, agriculture, mining, stables, ranching, warehouse, maintenance/repair	Acceptable	Acceptable	Acceptable	Conditionally Acceptable	Conditionally Acceptable	Conditionally Acceptable

Acceptable - Specified land use is satisfactory, based upon the assumption that any buildings involved

Conditionally Acceptable - New construction or development should be undertaken only after a detailed noise analysis is conducted to determine if noise reduction measures are necessary to achieve acceptable levels for land use. Criteria for determining exterior and interior noise levels are listed in Table 7-4, Noise Standards. If a project cannot mitigate noise to a level deemed Acceptable, the appropriate County decision-maker must determine that mitigation has been provided to the greatest extent practicable or that extraordinary circumstances exist.

Unacceptable - New construction or development shall not be undertaken.

Source: City of San Marcos (2012)

Relevant City General Plan Noise Element policies include as follows:

- Policy N-1.1: Address the potential for excessive noise levels when making land use planning decisions in accordance with Table 7-3 Land Use Compatibility Noise Standards.
- Policy N-1.2: Ensure that acceptable noise levels are maintained near noise-sensitive uses.

- Policy N-1.4: Require new development projects to provide barriers to reduce noise levels, or provide sufficient spatial buffers to separate excessive noise generating land uses and noise-sensitive land uses.
- Policy N-1.5: Require an acoustical study for proposed developments in areas where the existing and projected noise level exceeds or would exceed the Normally Acceptable levels identified in Table 7-3.
- Policy N-3.4: Avoid excessive noise of commercial and industrial land uses through site and building design features.

City of San Marcos Noise Ordinance

The City of San Marcos Municipal Code Chapter 10.24: Noise (San Marcos 2017) addresses construction noise. Erection and demolition of buildings is exempt between 7:00 a.m. and 6:00 p.m. Monday through Friday and on Saturdays from 8:00 a.m. to 5:00 p.m. The Municipal Codes does not set noise limits on construction activities. Commonly, the City has utilized the County of San Diego's Noise Ordinance construction noise limit of 75 dBA (8-hour average) as received by occupied properties.

Chapter 20.300 (Site Planning and General Development Standards) of the City's Municipal Code includes noise regulations in the form of noise standards by zone (Section 20.300.070, Performance Standards). It should be noted that Municipal Code noise standards typically pertain to stationary (i.e., non-transportation-related) noise sources. The relevant portions of these noise standards are provided below:

1. Noise shall be measured with a sound-level meter that meets the standards of the American National Standards Institute (ANSI) (Section S1.4-1979, Type 1 or Type 2). Noise levels shall be measured in decibels at the property line of the receptor property, and at least five (5) feet above the ground and ten (10) feet from the nearest structure or wall. The unit of measure shall be designated as an A-weighted decibel (dBA) Leq standard. A calibration check shall be made of the instrument at the time any noise measurement is made (Ord. No. 2017-1446, 7-25-2017)
2. No person shall create or allow the creation of exterior noise that causes the noise level to exceed the noise standards established by Table 20.300-4 (shown in this report as Table 1). Increases in exterior noise levels listed in Table 20.300-4 are permitted but depend on cumulative duration of the increase within the measured hour. For instance, a 5 dB increase is allowed for up to fifteen (15) minutes within the hour, but a 10 dB increase above the limit is allowed for up to 5 cumulative minutes within that hour.
3. Use of compressors or other equipment, including vents, ducts, and conduits, but excluding window or wall-mounted air conditioners, that are located outside of the exterior walls of any building, shall be enclosed within a permanent, non-combustible, view-obscuring enclosure to ensure that the equipment does not emit noise in excess of the ANSI standards.

Table 1. City of San Marcos Exterior Noise Standards

Zone	Applicable Limit (decibels)	Time Period
Single-Family Residential (A, R-1, R-2) [1, 2]	60 50	7:00 a.m. to 10:00 p.m. 10:00 p.m. to 7:00 a.m.
Multifamily Residential (R-3) [1, 2]	65 55	7:00 a.m. to 10:00 p.m. 10:00 p.m. to 7:00 a.m.

Table 1. City of San Marcos Exterior Noise Standards

Zone	Applicable Limit (decibels)	Time Period
Commercial (C, O-P, SR) [3]	65 55	7:00 a.m. to 10:00 p.m. 10:00 p.m. to 7:00 a.m.
Industrial	65 60	7:00 a.m. to 10:00 p.m. 10:00 p.m. to 7:00 a.m.

Source: San Marcos 2017 (Table 20.300-4)

Notes:

1. For single-family detached dwelling units, the "exterior noise level" is defined as the noise level measured at an outdoor living area which adjoins and is on the same lot as the dwelling, and which contains at least the following minimum net lot area: (i) for lots less than 4,000 square feet in area, the exterior area shall include 400 square feet, (ii) for lots between 4,000 square feet to 10 acres in area, the exterior area shall include 10 percent of the lot area; (iii) for lots over 10 acres in area, the exterior area shall include 1 acre.
2. For all other residential land uses, "exterior noise level" is defined as noise measured at exterior areas which are provided for private or group usable open space purposes. "Private Usable Open Space" is defined as usable open space intended for use of occupants of one dwelling unit, normally including yards, decks, and balconies. When the noise limit for Private Usable Open Space cannot be met, then a Group Usable Open Space that meets the exterior noise level standard shall be provided. "Group Usable Open Space" is defined as usable open space intended for common use by occupants of a development, either privately owned and maintained or dedicated to a public agency, normally including swimming pools, recreation courts, patios, open landscaped areas, and greenbelts with pedestrian walkways and equestrian and bicycle trails, but not including off-street parking and loading areas or driveways.
3. For non-residential noise sensitive land uses, exterior noise level is defined as noise measured at the exterior area provided for public use.

3 Existing Conditions

SPL measurements were conducted near the Project site on February 25, 2022, to quantify and characterize samples of the existing (a.k.a., baseline or pre-project) outdoor sound environment. Table 2 provides the location (and adjoining land use) and time at which these baseline noise level measurements were taken. The SPL measurements were performed by an attending Dudek field investigator using a Rion NL-52 sound level meter equipped with a 0.5-inch, pre-polarized condenser microphone with pre-amplifier. The sound level meter meets the current American National Standards Institute standard for a Type 1 (Precision Grade) sound level meter (SLM). The accuracy of the SLM was verified in the field using a reference sound signal (i.e., field calibrator) before and after the measurements, and the measurements were conducted with the microphone positioned approximately 5 feet above the ground.

Three short-term noise level measurement locations (ST1–ST3) are depicted on Exhibit B and include one of each receiving land use (multi-family, public-institutional, and light industrial). Table 2 presents L_{eq}, L_{max}, and L_{min} values for these surveyed positions, which were affected by the investigator-noted acoustical contributors as follows:

- ST1 – Heating, ventilating, and air-conditioning (HVAC) equipment on nearby building, birdsong, distant aircraft, distant conversations, yelling, distant industrial, distant roadway traffic;
- ST2 – Birdsong, distant aircraft, distant conversations, yelling, distant industrial, rustling leaves, backup alarms, HVAC;
- ST3 – roadway traffic, birdsong, construction saw across street, distant car wash tunnel.

As shown in Table 2, the measured sound levels ranged from approximately 43.1 dBA L_{eq} at ST1 to 64.0 dBA L_{eq} at ST2. Noise measurement data and photographs of the survey locations appear in Appendix A, Baseline Noise Measurement Field Data. These samples of daytime L_{eq} measured at the three representative receptor positions in Table 2 can be interpreted as approximations of CNEL, since evening SPL would likely be 5 dBA less, and nighttime SPL would be 10 dBA less than the daytime values (FTA 2018).

Table 2. February 25, 2022 Measured Outdoor Ambient Sound Environment Samples

Survey Position	Location/Address	Start and End Time (hh:mm)	L_{eq} (dBA)	L_{max} (dBA)	L_{min} (dBA)
ST1	Tennis and basketball courts near 501 Beverly Place	10:00 AM to 10:15 AM	43.1	47.7	39.3
ST2	542 S. Pacific Street (Hughes Circuits existing facility)	10:45 AM to 11:00 AM	64.0	79.7	51.4
ST3	Bradley Park baseball diamond across from 1520 Linda Vista Drive	10:30 AM to 10:45 AM	61.0	70.4	52.2

Source: Appendix A.
Notes: L_{eq} = equivalent continuous sound level (time-averaged sound level); L_{max} = maximum sound level during the measurement interval; dBA = A-weighted decibels; ST = short-term noise measurement locations.

Exhibit B. Baseline Outdoor Ambient Sound Level Measurement Positions

Sources: Google Earth 2022, Dudek 2022

4 Thresholds of Significance

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

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

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

- Construction noise – the City has adopted the County's construction noise threshold of not exceeding 75 dBA for an eight-hour period, between 7:00 a.m. and 7:00 p.m., when measured at any occupied property where the noise is being received.
- Off-site project-attributed transportation noise – For purposes for this analysis, a direct roadway noise impact would be considered significant if increases in roadway traffic noise levels attributed to the proposed project were greater than 3 dBA CNEL at an existing noise-sensitive land use.
- Off-site project-attributed stationary noise – For purposes for this analysis, a noise impact would be considered significant if noise from typical operation of heating, ventilation, and air conditioning and other electro-mechanical systems associated with the proposed Project exceeded 65 dBA hourly L_{eq} at the property line from 7:00 a.m. to 10:00 p.m., and 55 dBA hourly L_{eq} from 10:00 p.m. to 7:00 a.m.
- Construction vibration – A variety of thresholds are utilized herein for purposes of impact significance assessment:
  - Guidance from Caltrans indicates that a vibration velocity level of 0.2 ips PPV received at a structure would be considered annoying by occupants within residential buildings (Caltrans 2020), which for purposes of this analysis would apply during normal daytime hours. For occupants of office buildings, the criterion would be 80 VdB; and for occupants of workshops (or comparable uses, such as factories), the criterion would be 86 VdB. Both of these non-residential receiving land use types presume occupants only during normal daytime business hours.
  - If construction activity needed to occur during nighttime hours, such as to accommodate a concrete pour or other activity for which the City may permit at its discretion, for purposes of residential building occupant annoyance during such times (i.e., when occupants would normally be sleeping) an FTA guidance threshold of 78 VdB (or 0.033 ips PPV) would be applied.
  - For typical receiving residential structures, aforementioned Caltrans guidance from Section 3.11.2, Regulatory Setting, recommends that a vibration level of 0.2 ips PPV would represent the threshold

for building damage risk. For commercial and industrial buildings having more robust structure, Caltrans guidance recommends a threshold of 0.3 ips PPV.

5 Impact Discussion

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

Short-Term Construction

Construction noise and vibration are temporary phenomena, varying from hour to hour and day to day, depending on the equipment in use, the operations performed, and the distance between the source and receptor. Equipment that would be in use during construction would include, in part, graders, scrapers, backhoes, rubber-tired dozers, loaders, cranes, forklifts, cement mixers, pavers, rollers, and air compressors. The typical maximum noise levels for various pieces of construction equipment at a distance of 50 feet are presented in Table 3. Usually, construction equipment operates in alternating cycles of full power and low power, which the Federal Highway Administration (FHWA) Roadway Construction Noise Model (RCNM) User's Guide (FHWA 2006) characterizes as "acoustical usage factor" (AUF) and thereby produces energy-average noise levels over time (L_{eq}) that are less than the listed maximum noise level (L_{max}). The average sound level of construction activity also depends on the amount of time that the equipment actually operates onsite.

Table 3. Typical Construction Equipment Maximum Noise Levels

FHWA RCNM Equipment Type	Acoustical Usage Factor (%)	Typical Equipment L_{max} (dBA at 50 Feet)	Typical Equipment L_{eq} (dBA at 50 Feet)
all other equipment > 5 HP	50	85	82
backhoe	40	78	74
compressor (air)	40	78	74
concrete mixer truck	40	79	75
crane	16	81	73
dozer	40	82	78
generator	50	72	69
grader	40	85	81
man lift	20	75	68
paver	50	77	74
roller	20	80	73
scraper	40	84	80
welder / torch	40	73	69

Source: FHWA 2006.
Note: L_{max} = maximum sound level; where L_{eq} = energy-equivalent sound level and can be calculated here with $L_{eq} = L_{max} + 10*LOG(AUF)$; dBA = A-weighted decibels.

Aggregate noise emission from proposed Project construction activities, broken down by sequential phase, was predicted at the closest distance between the Project construction zone and the nearest occupied building—consistent with the City's adoption of the County of San Diego construction noise standard. In a manner comparable to the "general assessment" technique per Federal Transit Administration (FTA) guidance (FTA 2018), and because the exact positions of onsite equipment activity vary over the course of a typical construction day, all construction equipment for a given phase were treated as emitting noise from a common origin point located at the geographic "acoustic centroid" of the Project site. For purposes of this analysis, two noise source-to-receptor distance values were studied as follows:

- With respect to the existing Hughes Circuits buildings on the south side of South Pacific Street, the acoustical centroid of the Project site appears to be approximately 275 feet from the nearest existing building facade.
- To the north of the Project is an occupied commercial structure, apparently 345 feet from the Project acoustical centroid.

A Microsoft Excel–based noise prediction model emulating and using reference data from the Federal Highway Administration Roadway Construction Noise Model (RCNM) (FHWA 2008) was used to estimate construction noise levels at the nearest occupied structure. (Although the RCNM was funded and promulgated by the Federal Highway Administration, it is often used for non-roadway projects, because the same types of construction equipment used for roadway projects are often used for other types of construction.) Input variables for the predictive modeling consist of the equipment type and number of each, the afore-mentioned AUF, the expected duration (in hours) of onsite activity, and the distance from the receiver. Conservatively, no topographical or structural shielding was assumed in the modeling. Appendix B presents these input parameters that yield the summarized prediction results presented in Table 4.

Table 4. Predicted Construction Noise Levels per Activity Phase

Construction Phase (and Equipment Types Involved)	8-Hour L_{eq} at Nearest Existing Hughes Circuits Building (dBA)	8-Hour L_{eq} at Northern Offsite Occupied Structure (dBA)
Site preparation (scraper, backhoe, grader)	64.8	62.6
Grading (grader, dozer, backhoe)	64.5	62.3
Building construction (crane, man-lift, generator, backhoe, welder/torch)	59.9	57.7
Architectural finishes (air compressor)	53.6	51.4
Paving (paver, roller, concrete mixer truck, backhoe, other equipment)	65.3	63.1

Notes: L_{eq} = equivalent noise level; dBA = A-weighted decibels.

As presented in Table 4, the estimated construction noise exposure levels for each of the five expected sequential phases are not predicted to exceed 75 dBA L_{eq} over an 8-hour period at the nearest occupied properties to the north and south of the Project site. The predicted construction noise levels ranging from 54 to 65 dBA L_{eq} over an 8-hour period at the nearest Hughes Circuits existing building façade are also comparable to (or less than) the measured baseline outdoor sound level of 64 dBA at survey position "ST2" shown in Table 2. For these reasons, temporary construction-related noise impacts would be considered **less than significant.**

Long-Term Operational

Increase of Off-Site Roadway Traffic Noise

The proposed Project would result in the creation of additional vehicle trips on local roadways (i.e., Linda Vista Drive and South Pacific Street), which could result in increased traffic noise levels at adjacent noise-sensitive land uses. Appendix C, Traffic Noise Modeling Input and Output, contains a set of FHWA Traffic Noise Model (TNM, version 2.5 [FHWA 2004]) input/output spreadsheets showing studied traffic volume data (average daily traffic [ADT] expressed as vehicles per hour [veh/hr]) for the existing and existing-plus-Project modeled scenarios. Information used in the TNM model included the roadway geometry and posted traffic speeds.

According to acoustical principles, the increase in traffic noise level relates directly to the increase in volumes by the following expression: $10*LOG(V_f/V_e)$, where V_f is the future traffic volume, V_e is the existing traffic volume, and vehicle speeds and proportion of vehicle types are essentially unchanged. The Project would therefore have to roughly double the traffic volumes on nearby studied roadway segments in order to increase traffic by 3 dBA, which would be considered a barely perceptible increase (Caltrans 2013).

Traffic noise levels were modeled at the same geographic positions ST1, ST2, and ST3 as shown in Exhibit B. The receivers were modeled to be five feet above the local ground elevation. The traffic noise model results are summarized in Table 5, and represented by CNEL values. The predicted CNEL values for existing conditions shown in Table 5 for ST1 and ST3 are each within +/-3 dB of the measurement-based CNEL (approximated by the daytime L_{eq} value samples, per FTA guidance [FTA 2018]) listed in Table 2, which suggests good agreement between empirical data and the estimation model, since a 3 dB difference is barely perceptible to human hearing outdoors. Validated by this value agreement for existing conditions, the same TNM-based model was used to predict the future "existing plus Project" traffic noise level associated with the studied Project-attributed changes to local roadway traffic.

Table 5. Off-site Roadway Traffic Noise Modeling Results

Modeled Receiver Tag (and Location Description)	Existing (2022) Noise Level (dBA CNEL)	Existing Plus Project Noise Level (dBA CNEL)	Project-Related Noise Level Increase (dB)
ST1 (Tennis and basketball courts near 501 Beverly Place)	44.1	44.4	0.3
ST2 (542 S. Pacific Street [Hughes Circuits existing facility])	57.1	57.8	0.7
ST3 (Bradley Park baseball diamond across from 1520 Linda Vista Drive)	64.0	64.0	< 0.1

Notes: dBA = A-weighted decibel; CNEL = Community Noise Equivalent Level; dB = decibel.

Table 5 shows that at all three listed representative receivers, with particular attention to ST1 that adjoins noise-sensitive residential receptors, the addition of proposed Project traffic to the local roadway network would result in a CNEL increase of less than 1 dB, which is below the discernible level of change for the average healthy human ear. Thus, a **less-than-significant impact** is expected for proposed project-related off-site traffic noise increases affecting existing residences in the vicinity.

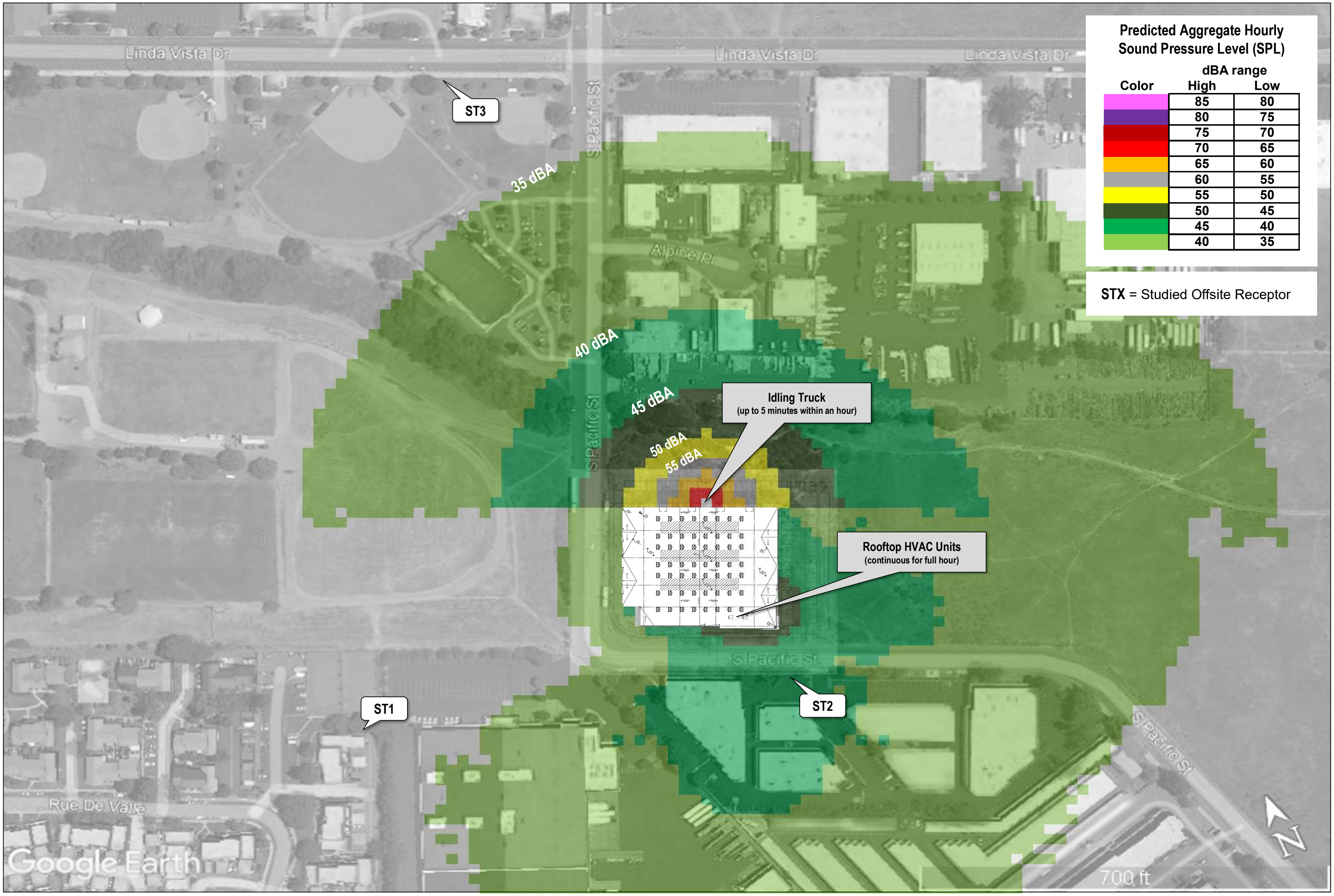
Stationary Project Operations Noise

The completion of a new manufacturing building on the Project site will add a variety of noise-producing mechanical equipment that include those presented and discussed in the following paragraphs. Most of these noise-producing equipment or sound sources would be considered stationary, or limited in mobility to a defined area. Using a Microsoft Excel–based outdoor sound propagation prediction model, Project-attributed operational noise at nearby community receptors was predicted on the assumption that noise-producing equipment are point-type sources with point-source geometric divergence (i.e., 6 dB noise reduction per doubling of distance) that conservatively ignores acoustical absorption from atmospheric and ground surface effects. Please see Appendix D for quantitative details of the modeling inputs.

The proposed Project building would be served by air-conditioning equipment that includes outdoor-exposed packaged air-handling units or—at a minimum—air-cooled condensers (ACC) that provide the expected cooling demand (expressed as refrigeration "tonnage") for the building. For a building of 67,410 total square feet that could be described as largely having a "factory-assembly area" intended interior usage, this cooling demand can be estimated with industry check figures (Loren Cook 1999). Based on the available architect plans of the proposed Project, the roof deck is expected to be 43 feet above grade and would feature a typical parapet (assumed to be 3 feet in height, measured from its top edge to the roof deck). The roof plan depicts two potential ACC equipment locations, which this analysis will treat as two point-source positions for rooftop noise emission behind the aforesaid parapet.

The operation noise model also includes noise emission from the idling engine of a single truck parked along the north façade of the proposed Project building. For this assessment, the analysis conservatively assumes that over the course of an hour onsite, an average of one truck would be present and idling for up to five minutes as allowed by California emission regulations. This noise emission contributor, described as a point-type source, was also considered a point-type source.

Sound propagation from these two rooftop HVAC noise emission sources and the idling truck engine near grade was predictively modeled with a three-dimensional technique based on pertinent International Organization of Standardization (ISO) 9613-2 algorithms and reference data. Assuming all the HVAC equipment is operating simultaneously for a minimum period of 1 hour, the predicted noise levels at each of three afore-studied locations are as follows: ST1 = 32.4 dBA, ST2 = 42.5 dBA, and ST3 = 33.1 dBA. These predicted levels are all less than the City's exterior noise limits per Table 1. Figure 3 displays predicted operation noise levels across a horizontal plane five feet above grade, and visually helps support the assertion of compliance with City standards. Hence, under such conditions, predicted Project stationary noise source emission would result in a **less-than-significant noise impact.**



SOURCE: Dudek 2022

DUDEK

0 189 378 Feet

FIGURE 3

Predicted Stationary Source Operations Noise - with Idling Truck

Hughes Circuits Project (Project No.: 13383)

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b) Would the project result in generation of excessive groundborne vibration or groundborne noise levels?

Construction activities may expose persons to excessive groundborne vibration or groundborne noise, causing a potentially significant impact. Caltrans has collected groundborne vibration information related to construction activities (Caltrans 2020). Information from Caltrans indicates that continuous vibrations with a PPV of approximately 0.2 ips generates a human response of annoyance. For context, heavier pieces of construction equipment, such as a bulldozer that may be expected on the project site, have peak particle velocities of approximately 0.089 ips or less at a reference distance of 25 feet (FTA 2018).

Groundborne vibration attenuates rapidly, even over short distances. The attenuation of groundborne vibration as it propagates from source to receptor through intervening soils and rock strata can be estimated with expressions found in FTA and Caltrans guidance. By way of example, for a vibratory roller operating on site and as close as the southern project boundary (i.e., 65 feet from the nearest occupied building) when involved in the paving phase of Project construction, the estimated vibration velocity level would be 0.05 ips PPV per the equation as follows (FTA 2018):

$PPV_{rcvr} = PPV_{ref} * (25/D)^{1.5} = 0.05 = 0.21 * (25/65)^{1.5}$

In the above equation, PPV_{rcvr} is the predicted vibration velocity at the receiver position, PPV_{ref} is the reference value at 25 feet from the vibration source (the roller), and D is the actual horizontal distance to the receiver. For purposes of assessing building damage risk, this estimated 0.05 ips PPV at the nearest commercial structure would be less than the 0.3 ips PPV limit for commercial buildings as presented in the preceding Section 3.11.3. Because the predicted vibration level at 65 feet is less than this guidance criterion, the risk of vibration damage to such nearby structures is considered **less than significant.**

To assess human annoyance for occupants of these nearest buildings, in which office functions are assumed, this 0.05 ips PPV value can be converted to an RMS-based L_v decibel value (VdB) per the following expression:

$L_v = 20 * LOG(PPV_{rcvr}/(4*V_{ref})) = 20 * LOG(0.05/0.000004) = 82$ VdB

In the above expression, V_{ref} is reference vibration amplitude of one micro-inch per second, and it is multiplied by a "crest factor" of 4 per FTA guidance (FTA 2018). The calculated RMS vibration velocity of 82 VdB is what impinges upon the foundation of the receiving building, after being attenuated via groundborne propagation through intervening soils and rock strata as estimated by the previous expression to calculate PPV exposure at the receptor distance from the source. Then, at the interface of the receiving building foundation, there is an additional "coupling loss" relating to further energy dissipation as the vibration transfers to the mass and form of the building foundation and connected structure. According to FTA guidance, this coupling loss is -5 VdB for wood-framed houses, -7 VdB for 1-2 story masonry structures, and -10 dB for 3-4 story masonry buildings (FTA 2018). Hence, with the receiving commercial building to the south being a representative of at least this 1-2 story masonry type, the predicted vibration velocity exposure to office occupants would only be 75 VdB (i.e., the difference of 7 from 82) and thus compliant with the afore-stated Caltrans-based guidance threshold of 80 VdB per Section 3.11.3. Therefore, the potential impact on nearby commercial building occupants would be considered **less than significant.**

Residential buildings are much further from the Project site than the buildings on these nearby commercial land uses, so their exposures to potential groundborne Project-attributed construction vibration would be much less than the 0.05 ips PPV and 82 VdB values discussed in the preceding paragraphs. For example, the closest multi-family residences near ST1 are over 450 feet from the Project boundary, which means the calculated PPV at this distance from a vibratory roller would 0.003 ips and yield only 57 VdB. Hence, daytime (or potential nighttime) vibration impacts at nearest receiving offsite residential buildings and their occupants would be **less than significant.**

Construction vibration, at sufficiently high levels, can also present a building damage risk. However, anticipated construction vibration associated with the proposed project would yield levels of 0.05 ips, which do not surpass the guidance limit of 0.2 to 0.3 ips PPV for preventing damage to residential structures (Caltrans 2020). Because the predicted vibration level at 65 feet is less than this guidance limit, the risk of vibration damage to nearby structures is considered **less than significant.**

Once operational, the proposed project would not be expected to feature major producers of groundborne vibration. Anticipated mechanical systems like heating, ventilation, and air-conditioning units are designed and manufactured to feature rotating (fans, motors) and reciprocating (compressors) components that are well-balanced with isolated vibration within or external to the equipment casings. On this basis, potential vibration impacts due to proposed project operation would be **less than significant.**

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

There are no private airstrips within the vicinity of the project site. The closest airport to the project site is the McClellan Palomar Airport, approximately 4 miles west of the site. According to the Comprehensive Land Use for McClellan-Palomar Airport (SDCRAA 2011) the Project site is not located within a noise exposure contour and would therefore not expose people residing or working in the project area to excessive noise levels. Impacts from aviation overflight noise exposure would be **less than significant**.

6 Mitigation Measures

The results indicate that potential impacts during construction and operation would be less than significant. No mitigation is required with proper implementation of the proposed project design features.

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7 Summary of Findings

This noise report was conducted for the proposed Project. The results indicate that potential noise and vibration impacts during construction would be less than significant, and no noise or vibration mitigation is required.

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Appendix A

Baseline Noise Measurement Field Data (Dudek Forms)

FORMS DUDEK FIELD DATA REPORT

Field Noise Measurement Data

Record: 1411

Project Name	*Hughes*
Observer(s)	*Connor Burke*
Date	*2022-02-25*

Monitoring

Record #	*1*
Site ID	*ST1*
Site Location Lat/Long	*33.135970, -117.201887*
Begin (Time)	*10:00:00*
End (Time)	*10:15:00*
Leq	*43.1*
Lmax	*47.7*
Lmin	*39.3*
Other Lx?	*L90, L50, L10*
L90	*41.7*
L50	*42.7*
L10	*44.7*
Other Lx (Specify Metric)	*L*
Primary Noise Source	*Hvac on nearby building*
Other Noise Sources (Background)	*Birds, Distant Aircraft, Distant Conversations / Yelling, Distant Industrial, Distant Traffic*
Is the same instrument and calibrator being used as previously noted?	*Yes*
Are the meteorological conditions the same as previously noted?	*Yes*

Description / Photos

Site Photos

FORMS FIELD DATA REPORT

Photo	

Monitoring

Record #	*2*
Site ID	*ST3*
Site Location Lat/Long	*33.139243, -117.203404*
Begin (Time)	*10:30:00*
End (Time)	*10:45:00*
Leq	*61*
Lmax	*70.4*
Lmin	*52.2*
Other Lx?	*L90, L50, L10*
L90	*56.2*
L50	*59.7*
L10	*62.4*
Other Lx (Specify Metric)	*L*
Primary Noise Source	*Traffic*
Other Noise Sources (Background)	*Birds, Distant Traffic*
Other Noise Sources Additional Description	*Construction saw across street. Car wash tunnel*
Is the same instrument and calibrator being used as previously noted?	*Yes*
Are the meteorological conditions the same as previously noted?	*Yes*

Description / Photos

FORMS DUDEK FIELD DATA REPORT

Site Photos

Photo	

Monitoring

Record #	*3*
Site ID	*ST2*
Site Location Lat/Long	*33.135450, -117.199590*
Begin (Time)	*10:45:00*
End (Time)	*11:00:00*
Leq	*64*
Lmax	*79.7*
Lmin	*51.4*
Other Lx?	*L90, L50, L10*
L90	*52.4*
L50	*55*
L10	*65.7*
Other Lx (Specify Metric)	*L*
Primary Noise Source	*Industrial*
Other Noise Sources (Background)	*Birds, Distant Aircraft, Distant Conversations / Yelling, Distant Industrial, Rustling Leaves*
Other Noise Sources Additional Description	*Backup alarms. Hvac*
Is the same instrument and calibrator being used as previously noted?	*Yes*
Are the meteorological conditions the same as previously noted?	*Yes*

Description / Photos

FORMS FIELD DATA REPORT

Site Photos

Photo	

Appendix B

Construction Noise Prediction Model Worksheet

To User: bordered cells are inputs, unbordered cells have formulae

noise level limit for construction phase at residential land use, County of San Diego = 75

allowable hours over which Leq is to be averaged = 8

= temporary barrier (TB) of input height inserted between source and receptor

Construction Activity	Equipment	Total Equipment Qty	AUF % (from FHWA RCNM)	Reference Lmax @ 50 ft. from FHWA RCNM	Client Equipment Description, Data Source and/or Notes	Source to NSR Distance (ft.)	*Temporary Barrier Insertion Loss (dB)*	*Additional Noise Reduction*	Distance-Adjusted Lmax	Allowable Operation Time (hours)	Allowable Operation Time (minutes)	Predicted 8-hour Leq
Site Preparation	grader	1	40	85		275	0.1		65.8	8	480	62
	scraper	1	40	84		275	0.1		64.8	8	480	61
	backhoe	1	40	78		275	0.1		58.8	7	420	54
											Total for Site Preparation Phase:	**64.8**
Grading	grader	1	40	85		275	0.1		65.8	8	480	62
	dozer	1	40	82		275	0.1		62.8	8	480	59
	backhoe	2	40	78		275	0.1		58.8	7	420	57
											Total for Grading Phase:	**64.5**
Building Construction	crane	1	16	81		275	0.1		61.8	8	480	54
	man lift	2	20	75	"forklift"	275	0.1		55.8	7	420	51
	generator	1	50	72		275	0.1		52.8	8	480	50
	backhoe	1	40	78		275	0.1		58.8	6	360	54
	welder / torch	3	40	73		275	0.1		53.8	8	480	55
											Total for Building Construction Phase:	**59.9**
Architectural Coating	compressor (air)	1	40	78		275	0.1		58.8	6	360	54
											Total for Architectural Coating Phase:	**53.6**
Paving	paver	1	50	77		275	0.1		57.8	8	480	55
	roller	2	20	80		275	0.1		60.8	8	480	57
	backhoe	1	40	78		275	0.1		58.8	8	480	55
	all other equipment > 5 HP	1	50	85	"paving equipment"	275	0.1		65.8	8	480	63
	concrete mixer truck	1	40	79		275	0.1		59.8	8	480	56
											Total for Paving Phase:	**65.3**

Construction Activity	Equipment	Source Elevation (ft)	Receiver Elevation (ft)	Barrier Height (ft)	Source to Barr. ("A") Horiz. (ft)	Rcvr. to Barr. ("B") Horiz. (ft)	Source to Rcvr. ("C") Horiz. (ft)	"A" (ft)	"B" (ft)	"C" (ft)	Path Length Diff. "P" (ft)	Abarr (dB)	Heff (with barrier)	Heff (wout barrier)	G (with barrier)	G (without barrier)	ILbarr (dB)
Site Preparation	grader	5	5	0	270	5	275	270.0	7.1	275.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1
	scraper	5	5	0	270	5	275	270.0	7.1	275.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1
	backhoe	5	5	0	270	5	275	270.0	7.1	275.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1
Grading	grader	5	5	0	270	5	275	270.0	7.1	275.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1
	dozer	5	5	0	270	5	275	270.0	7.1	275.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1
	backhoe	5	5	0	270	5	275	270.0	7.1	275.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1
Building Construction	crane	5	5	0	270	5	275	270.0	7.1	275.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1
	man lift	5	5	0	270	5	275	270.0	7.1	275.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1
	generator	5	5	0	270	5	275	270.0	7.1	275.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1
	backhoe	5	5	0	270	5	275	270.0	7.1	275.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1
	welder / torch	5	5	0	270	5	275	270.0	7.1	275.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1
Architectural Coating	compressor (air)	5	5	0	270	5	275	270.0	7.1	275.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1
Paving	paver	5	5	0	270	5	275	270.0	7.1	275.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1
	roller	5	5	0	270	5	275	270.0	7.1	275.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1
	backhoe	5	5	0	270	5	275	270.0	7.1	275.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1
	all other equipment > 5 HP	5	5	0	270	5	275	270.0	7.1	275.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1
	concrete mixer truck	5	5	0	270	5	275	270.0	7.1	275.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1

To User: bordered cells are inputs, unbordered cells have formulae

noise level limit for construction phase at residential land use, County of San Diego = 75

allowable hours over which Leq is to be averaged = 8

= temporary barrier (TB) of input height inserted between source and receptor

Construction Activity	Equipment	Total Equipment Qty	AUF % (from FHWA RCNM)	Reference Lmax @ 50 ft. from FHWA RCNM	Client Equipment Description, Data Source and/or Notes	Source to NSR Distance (ft.)	*Temporary Barrier Insertion Loss (dB)*	*Additional Noise Reduction*	Distance-Adjusted Lmax	Allowable Operation Time (hours)	Allowable Operation Time (minutes)	Predicted 8-hour Leq
Site Preparation	grader	1	40	85		345	0.1		63.6	8	480	60
	scraper	1	40	84		345	0.1		62.6	8	480	59
	backhoe	1	40	78		345	0.1		56.6	7	420	52
									Total for Site Preparation Phase:			**62.6**
Grading	grader	1	40	85		345	0.1		63.6	8	480	60
	dozer	1	40	82		345	0.1		60.6	8	480	57
	backhoe	2	40	78		345	0.1		56.6	7	420	55
									Total for Grading Phase:			**62.3**
Building Construction	crane	1	16	81		345	0.1		59.6	8	480	52
	man lift	2	20	75	"forklift"	345	0.1		53.6	7	420	49
	generator	1	50	72		345	0.1		50.6	8	480	48
	backhoe	1	40	78		345	0.1		56.6	6	360	51
	welder / torch	3	40	73		345	0.1		51.6	8	480	52
									Total for Building Construction Phase:			**57.7**
Architectural Coating	compressor (air)	1	40	78		345	0.1		56.6	6	360	51
									Total for Architectural Coating Phase:			**51.4**
Paving	paver	1	50	77		345	0.1		55.6	8	480	53
	roller	2	20	80		345	0.1		58.6	8	480	55
	backhoe	1	40	78		345	0.1		56.6	8	480	53
	all other equipment > 5 HP	1	50	85	"paving equipment"	345	0.1		63.6	8	480	61
	concrete mixer truck	1	40	79		345	0.1		57.6	8	480	54
									Total for Paving Phase:			**63.1**

Construction Activity	Equipment	Source Elevation (ft)	Receiver Elevation (ft)	Barrier Height (ft)	Source to Barr. ("A") Horiz. (ft)	Rcvr. to Barr. ("B") Horiz. (ft)	Source to Rcvr. ("C") Horiz. (ft)	"A" (ft)	"B" (ft)	"C" (ft)	Path Length Diff. "P" (ft)	Abarr (dB)	Heff (with barrier)	Heff (wout barrier)	G (with barrier)	G (without barrier)	ILbarr (dB)
Site Preparation	grader	5	5	0	340	5	345	340.0	7.1	345.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1
	scraper	5	5	0	340	5	345	340.0	7.1	345.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1
	backhoe	5	5	0	340	5	345	340.0	7.1	345.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1
Grading	grader	5	5	0	340	5	345	340.0	7.1	345.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1
	dozer	5	5	0	340	5	345	340.0	7.1	345.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1
	backhoe	5	5	0	340	5	345	340.0	7.1	345.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1
Building Construction	crane	5	5	0	340	5	345	340.0	7.1	345.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1
	man lift	5	5	0	340	5	345	340.0	7.1	345.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1
	generator	5	5	0	340	5	345	340.0	7.1	345.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1
	backhoe	5	5	0	340	5	345	340.0	7.1	345.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1
	welder / torch	5	5	0	340	5	345	340.0	7.1	345.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1
Architectural Coating	compressor (air)	5	5	0	340	5	345	340.0	7.1	345.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1
Paving	paver	5	5	0	340	5	345	340.0	7.1	345.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1
	roller	5	5	0	340	5	345	340.0	7.1	345.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1
	backhoe	5	5	0	340	5	345	340.0	7.1	345.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1
	all other equipment > 5 HP	5	5	0	340	5	345	340.0	7.1	345.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1
	concrete mixer truck	5	5	0	340	5	345	340.0	7.1	345.0	0.00	0.1	5.0	5.0	0.7	0.7	0.1

Appendix C

Traffic Noise Modeling Input and Output

Dudek				**24 March 2022**							
CB				**TNM 2.5**							
INPUT: ROADWAYS							**Average pavement type shall be used unless**				
PROJECT/CONTRACT:	**Hughes Circut**						**a State highway agency substantiates the use**				
RUN:	**Existing**						**of a different type with the approval of FHWA**				

Roadway		**Points**									
Name	**Width**	**Name**	**No.**	**Coordinates (pavement)**			**Flow Control**			**Segment**	
				X	**Y**	**Z**	**Control Device**	**Speed Constraint**	**Percent Vehicles Affected**	**Pvmt Type**	**On Struct?**
	ft			ft	ft	ft		mph	%		
Linda Vista Dr	60.0	point1	1	6,808,263.5	1,509,383.2	0.00				Average	
		point2	2	6,808,064.0	1,509,445.9	0.00				Average	
		point3	3	6,807,754.0	1,509,572.1	0.00				Average	
		point4	4	6,807,338.5	1,509,745.9	0.00				Average	
		point5	5	6,806,973.0	1,509,892.9	0.00					
S Pacific St	60.0	point9	9	6,807,552.5	1,507,752.0	0.00				Average	
		point10	10	6,807,484.0	1,507,948.1	0.00				Average	
		point11	11	6,807,367.5	1,508,320.9	0.00				Average	
		point12	12	6,807,316.5	1,508,445.9	0.00				Average	
		point13	13	6,807,289.0	1,508,500.9	0.00				Average	
		point14	14	6,807,238.0	1,508,538.6	0.00				Average	
		point15	15	6,807,166.5	1,508,569.9	0.00				Average	
		point16	16	6,806,967.5	1,508,649.1	0.00				Average	
		point17	17	6,806,759.0	1,508,737.9	0.00				Average	
		point18	18	6,806,588.0	1,508,811.2	0.00				Average	
		point19	19	6,806,553.0	1,508,829.2	0.00				Average	
		point20	20	6,806,539.5	1,508,847.5	0.00				Average	
		point21	21	6,806,539.5	1,508,872.0	0.00					
Linda Vista Dr-2	60.0	point24	24	6,806,973.0	1,509,892.9	0.00				Average	
		point6	6	6,806,453.5	1,510,109.2	0.00				Average	
		point7	7	6,805,995.5	1,510,306.0	0.00				Average	
		point8	8	6,805,634.5	1,510,456.2	0.00					
S Pacific St-2	60.0	point25	25	6,806,539.5	1,508,872.0	0.00				Average	
		point22	22	6,806,558.5	1,508,915.6	0.00				Average	
		point23	23	6,806,959.5	1,509,870.4	0.00					

Dudek **24 March 2022**
CB **TNM 2.5**

INPUT: TRAFFIC FOR LAeq1h Volumes
PROJECT/CONTRACT: **Hughes Circut**
RUN: **Existing**

Roadway	Points		Segment									
Name	Name	No.	Autos		MTrucks		HTrucks		Buses		Motorcycles	
			V	S	V	S	V	S	V	S	V	S
			veh/hr	mph	veh/hr	mph	veh/hr	mph	veh/hr	mph	veh/hr	mph
Linda Vista Dr	point1	1	1445	35	29	35	14	35	0	0	0	0
	point2	2	1445	35	29	35	14	35	0	0	0	0
	point3	3	1445	35	29	35	14	35	0	0	0	0
	point4	4	1445	35	29	35	14	35	0	0	0	0
	point5	5										
S Pacific St	point9	9	145	35	3	35	1	35	0	0	0	0
	point10	10	145	35	3	35	1	35	0	0	0	0
	point11	11	145	35	3	35	1	35	0	0	0	0
	point12	12	145	35	3	35	1	35	0	0	0	0
	point13	13	145	35	3	35	1	35	0	0	0	0
	point14	14	145	35	3	35	1	35	0	0	0	0
	point15	15	145	35	3	35	1	35	0	0	0	0
	point16	16	145	35	3	35	1	35	0	0	0	0
	point17	17	145	35	3	35	1	35	0	0	0	0
	point18	18	145	35	3	35	1	35	0	0	0	0
	point19	19	145	35	3	35	1	35	0	0	0	0
	point20	20	145	35	3	35	1	35	0	0	0	0
	point21	21										
Linda Vista Dr-2	point24	24	1880	35	38	35	19	35	0	0	0	0
	point6	6	1880	35	38	35	19	35	0	0	0	0
	point7	7	1880	35	38	35	19	35	0	0	0	0
	point8	8										
S Pacific St-2	point25	25	494	35	10	35	5	35	0	0	0	0

		point22	22	494	35	10	35	5	35	0	0	0	0
		point23	23										

Dudek						**24 March 2022**					
CB						**TNM 2.5**					
INPUT: RECEIVERS											
PROJECT/CONTRACT:	**Hughes Circut**										
RUN:	**Existing**										
Receiver											
Name	**No.**	**#DUs**	**Coordinates (ground)**			**Height**	**Input Sound Levels and Criteria**				**Active**
			X	**Y**	**Z**	**above**	**Existing**	**Impact Criteria**		**NR**	**in**
						Ground	**LAeq1h**	**LAeq1h**	**Sub'l**	**Goal**	**Calc.**
			ft	ft	ft	ft	dBA	dBA	dB	dB	
ST1	1	1	6,806,084.0	1,508,863.8	0.00	4.92	43.10	66	10.0	8.0	Y
ST2	2	1	6,806,794.5	1,508,676.8	0.00	4.92	64.00	66	10.0	8.0	Y
ST3	3	1	6,806,350.0	1,510,051.0	0.00	4.92	61.00	66	10.0	8.0	Y

Dudek							**24 March 2022**						
CB							**TNM 2.5**						
							Calculated with TNM 2.5						
RESULTS: SOUND LEVELS													
PROJECT/CONTRACT:		**Hughes Circut**											
RUN:		**Existing**											
BARRIER DESIGN:		**INPUT HEIGHTS**						**Average pavement type shall be used unless a State highway agency substantiates the use of a different type with approval of FHWA.**					
ATMOSPHERICS:		**68 deg F, 50% RH**											

Receiver													
Name	**No.**	**#DUs**	**Existing**	**No Barrier**					**With Barrier**				
			LAeq1h	**LAeq1h**		**Increase over existing**		**Type**	**Calculated**	**Noise Reduction**			
				Calculated	**Crit'n**	**Calculated**	**Crit'n**	**Impact**	**LAeq1h**	**Calculated**	**Goal**	**Calculated**	
							Sub'l Inc					**minus**	
												Goal	
			dBA	dBA	dBA	dB	dB		dBA	dB	dB	dB	
ST1	1	1	43.1	44.1	66	1.0	10	----	44.1	0.0	8	-8.0	
ST2	2	1	64.0	57.1	66	-6.9	10	----	57.1	0.0	8	-8.0	
ST3	3	1	61.0	64.0	66	3.0	10	----	64.0	0.0	8	-8.0	

Dwelling Units	**# DUs**	**Noise Reduction**		
		Min	**Avg**	**Max**
		dB	**dB**	**dB**
All Selected	3	0.0	0.0	0.0
All Impacted	0	0.0	0.0	0.0
All that meet NR Goal	0	0.0	0.0	0.0

Dudek					**24 March 2022**							
CB					**TNM 2.5**							
INPUT: ROADWAYS							**Average pavement type shall be used unless**					
PROJECT/CONTRACT:	**Hughes Circut**						**a State highway agency substantiates the use**					
RUN:	**Existing + Project**						**of a different type with the approval of FHWA**					
Roadway		**Points**										
Name	**Width**	**Name**	**No.**	**Coordinates (pavement)**			**Flow Control**			**Segment**		
				X	**Y**	**Z**	**Control Device**	**Speed Constraint**	**Percent Vehicles Affected**	**Pvmt Type**	**On Struct?**	
	ft			ft	ft	ft		mph	%			
Linda Vista Dr	60.0	point1	1	6,808,263.5	1,509,383.2	0.00				Average		
		point2	2	6,808,064.0	1,509,445.9	0.00				Average		
		point3	3	6,807,754.0	1,509,572.1	0.00				Average		
		point4	4	6,807,338.5	1,509,745.9	0.00				Average		
		point5	5	6,806,973.0	1,509,892.9	0.00						
S Pacific St	60.0	point9	9	6,807,552.5	1,507,752.0	0.00				Average		
		point10	10	6,807,484.0	1,507,948.1	0.00				Average		
		point11	11	6,807,367.5	1,508,320.9	0.00				Average		
		point12	12	6,807,316.5	1,508,445.9	0.00				Average		
		point13	13	6,807,289.0	1,508,500.9	0.00				Average		
		point14	14	6,807,238.0	1,508,538.6	0.00				Average		
		point15	15	6,807,166.5	1,508,569.9	0.00				Average		
		point16	16	6,806,967.5	1,508,649.1	0.00				Average		
		point17	17	6,806,759.0	1,508,737.9	0.00				Average		
		point18	18	6,806,588.0	1,508,811.2	0.00				Average		
		point19	19	6,806,553.0	1,508,829.2	0.00				Average		
		point20	20	6,806,539.5	1,508,847.5	0.00				Average		
		point21	21	6,806,539.5	1,508,872.0	0.00						
Linda Vista Dr-2	60.0	point24	24	6,806,973.0	1,509,892.9	0.00				Average		
		point6	6	6,806,453.5	1,510,109.2	0.00				Average		
		point7	7	6,805,995.5	1,510,306.0	0.00				Average		
		point8	8	6,805,634.5	1,510,456.2	0.00						
S Pacific St-2	60.0	point25	25	6,806,539.5	1,508,872.0	0.00				Average		
		point22	22	6,806,558.5	1,508,915.6	0.00				Average		
		point23	23	6,806,959.5	1,509,870.4	0.00						

Dudek 24 March 2022
CB TNM 2.5

INPUT: TRAFFIC FOR LAeq1h Volumes
PROJECT/CONTRACT: Hughes Circut
RUN: Existing + Project

Roadway Name	Points Name	No.	Segment Autos V veh/hr	Autos S mph	MTrucks V veh/hr	MTrucks S mph	HTrucks V veh/hr	HTrucks S mph	Buses V veh/hr	Buses S mph	Motorcycles V veh/hr	Motorcycles S mph
Linda Vista Dr	point1	1	1479	35	29	35	14	35	0	0	0	0
	point2	2	1479	35	29	35	14	35	0	0	0	0
	point3	3	1479	35	29	35	14	35	0	0	0	0
	point4	4	1479	35	29	35	14	35	0	0	0	0
	point5	5										
S Pacific St	point9	9	179	35	3	35	1	35	0	0	0	0
	point10	10	179	35	3	35	1	35	0	0	0	0
	point11	11	179	35	3	35	1	35	0	0	0	0
	point12	12	179	35	3	35	1	35	0	0	0	0
	point13	13	179	35	3	35	1	35	0	0	0	0
	point14	14	179	35	3	35	1	35	0	0	0	0
	point15	15	179	35	3	35	1	35	0	0	0	0
	point16	16	179	35	3	35	1	35	0	0	0	0
	point17	17	179	35	3	35	1	35	0	0	0	0
	point18	18	179	35	3	35	1	35	0	0	0	0
	point19	19	179	35	3	35	1	35	0	0	0	0
	point20	20	179	35	3	35	1	35	0	0	0	0
	point21	21										
Linda Vista Dr-2	point24	24	1914	35	38	35	19	35	0	0	0	0
	point6	6	1914	35	38	35	19	35	0	0	0	0
	point7	7	1914	35	38	35	19	35	0	0	0	0
	point8	8										
S Pacific St-2	point25	25	528	35	10	35	5	35	0	0	0	0

		point22	22	528	35	10	35	5	35	0	0	0	0
		point23	23										

Dudek						**24 March 2022**						
CB						**TNM 2.5**						
INPUT: RECEIVERS												
PROJECT/CONTRACT:	**Hughes Circut**											
RUN:	**Existing + Project**											
Receiver												
Name	**No.**	**#DUs**	**Coordinates (ground)**			**Height**	**Input Sound Levels and Criteria**					**Active**
			X	**Y**	**Z**	**above**	**Existing**	**Impact Criteria**		**NR**		**in**
						Ground	**LAeq1h**	**LAeq1h**	**Sub'l**	**Goal**		**Calc.**
			ft	ft	ft	ft	dBA	dBA	dB	dB		
ST1	1	1	6,806,084.0	1,508,863.8	0.00	4.92	43.10	66	10.0	8.0		Y
ST2	2	1	6,806,794.5	1,508,676.8	0.00	4.92	64.00	66	10.0	8.0		Y
ST3	3	1	6,806,350.0	1,510,051.0	0.00	4.92	61.00	66	10.0	8.0		Y

Dudek 24 March 2022
CB TNM 2.5
Calculated with TNM 2.5

RESULTS: SOUND LEVELS

PROJECT/CONTRACT: Hughes Circut
RUN: Existing + Project
BARRIER DESIGN: INPUT HEIGHTS
ATMOSPHERICS: 68 deg F, 50% RH

Average pavement type shall be used unless a State highway agency substantiates the use of a different type with approval of FHWA.

Receiver Name	No.	#DUs	Existing LAeq1h	No Barrier LAeq1h Calculated	No Barrier LAeq1h Crit'n	Increase over existing Calculated	Increase over existing Crit'n Sub'l Inc	Type Impact	With Barrier Calculated LAeq1h	Noise Reduction Calculated	Noise Reduction Goal	Calculated minus Goal
			dBA	dBA	dBA	dB	dB		dBA	dB	dB	dB
ST1	1	1	43.1	44.4	66	1.3	10	----	44.4	0.0	8	-8.0
ST2	2	1	64.0	57.8	66	-6.2	10	----	57.8	0.0	8	-8.0
ST3	3	1	61.0	64.0	66	3.0	10	----	64.0	0.0	8	-8.0

Dwelling Units	# DUs	Noise Reduction Min	Noise Reduction Avg	Noise Reduction Max
		dB	dB	dB
All Selected	3	0.0	0.0	0.0
All Impacted	0	0.0	0.0	0.0
All that meet NR Goal	0	0.0	0.0	0.0

Appendix D

Operational Noise Model Input Worksheets

grid scale	ft
x	18.9
y	18.9

Source	1	2	3	4	5	6	7	8	9	10	11
Source Tag	**York1**	**York2**	**Trk1**	**S4**	**S5**	**S6**	**S7**	**S8**	**S9**	**S10**	**S11**
Source X-coordinate	1305.405	1267.56757	1210.811	-18.91892	-18.91892	-18.91892	-18.91892	-18.91892	-18.91892	-18.91892	-18.91892
Source Y-coordinate	1172.973	1172.97297	964.8649	-18.91892	-18.91892	-18.91892	-18.91892	-18.91892	-18.91892	-18.91892	-18.91892
Source Z-coordinate	46	46	7	0	0	0	0	0	0	0	0
Source Type (enter abbrev.)	AGZE	AGZE	TRUCK								
Source Reference SPL	87	87	61	0	0	0	0	0	0	0	0
	87	87	61	0	0	0	0	0	0	0	0
Source Reference Distance (ft.)	3.28	3.28	50	3.28	3.28	3.28	3.28	3.28	3.28	3.28	3.28
Source Height Above Grade (ft.)	46	46	7	5	5	5	5	5	5	5	5

aside from "Custom" input series, below from FHWA RCNM User's Guide (2006)

Equipment Description	**Equipment Abbrev.**	**SPL (Leq, dBA)**	**Lesser of or available Lmax**	**Spec. 721 Lmax**	**Measured L_{max} @50ft (dBA, slow)**	**Impact Device?**	**Acoustical Use Factor (%)**
Custom #1 (user input)	**AGZE**	**87**	based on Daikin AGZ-E chiller--see "rooftopACC" worksheet, SPL at 1m				
Custom #2 (user input)	**TRUCK**	**61**	based on FHWA RCNM dump truck, but only 5 minutes idling in one hour (i.e., = 72+10*LOG[5/60])				
Custom #3 (user input)	**CUS3**	**1**					
Custom #4 (user input)	**CUS4**	**1**					
Custom #5 (user input)	**CUS5**	**1**					
Custom #6 (user input)	**CUS6**	**1**					

ACCs (air-cooled chillers on rooftops):

	tons	PWL
Bryant BH16 018	1.5	67
Bryant BH16 024	2	71
Trane CGA 040	4	72
Trane CGA 080	8	74
Trane Flex 155Z	16	79
Trane Flex 1110Z	30	86
Daikin AGZ-E 60 (w/out sound insulation)	60	91
Daikin AGZ-E 120 (w/out sound insulation)	120	95
Daikin AGZ-E 240 (w/out sound insulation)	241	100

Phase	Unit Tag	GSF	facility function	GSF per ton	tons of refrig.	Approx. Qty. of ACCs	tons per ACC	Approx. Total PWL (dBA)
Bldg	Rooftop Units	67410	"factory - assembly areas" ("lo" SQ per refrigeration ton, per Loren Cook "Engineering Cookbook" page 59)	240	280.9	2	140	**98**