ECORP Consulting, Inc.
ENVIRONMENTAL CONSULTANTS

September 10, 2020

Miguel Hernandez
Huitt-Zollars, Inc.
430 Exchange, Suite 200
Irvine, CA 92602

RE: Santa Ana Septic to Gravity Sewer Conversion – Noise Technical Memorandum

Dear Mr. Hernandez:

ECORP Consulting, Inc. has conducted a Noise Memorandum for the proposed Santa Ana Septic to Gravity Sewer Conversion Project (Project) located in City of Santa Ana, California. The purpose of this memorandum is to assess the Projects potential noise impacts within the Project area.

INTRODUCTION

The purpose of this technical memorandum is to assess the Projects potential noise impacts within the Project area. The memorandum will compare Project-generated noise and vibration to the City of Santa Ana standards for construction and operations.

PROJECT LOCATION & DESCRIPTION

The Project site is located in the City of Santa Ana (City), where it encompasses 2,970 linear feet on Medford Avenue, Pasadena Street, Deodar Street and 17th Street. The entire Project site is located in the public right-of-way. The site is generally bound by single-family residences on Medford Avenue, Pasadena Street and Deodar Street, while retail uses, multi-family residence and undeveloped land surround Ponderosa Street and 17th Street.

The Project proposes to install 670 linear feet of sewer mains and lateral connecters to transfer existing residences and businesses currently employing the use of septic systems to the City's sewer systems. Additionally, the Project would replace 2,300 linear feet of water main and laterals and transfer 50 properties from the City of Tustin water service to the City of Santa Ana.

Noise Analysis

Fundamentals of Sound and Environmental Noise

Addition of Decibels

The decibel (dB) scale is logarithmic, not linear; therefore, sound levels cannot be added or subtracted through ordinary arithmetic. Two sound levels 10 dB apart differ in acoustic energy by a factor of 10. When the standard logarithmic decibel is A-weighted (dBA), an increase of 10 dBA is generally perceived as a doubling in loudness. For example, a 70-dBA sound is half as loud as an 80-dBA sound and twice as loud as a 60-dBA sound. When two identical sources are each producing sound of the same loudness, the resulting sound level at a given distance would be 3 dB higher than one source under the same conditions (Federal Transit Administration [FTA] 2018). For example, a 65-dB source of sound, such as a truck, when joined by another 65-dB source results in a sound amplitude of 68 dB, not 130 dB (i.e., doubling the source strength increases the sound pressure by 3 dB). Under the dB scale, three sources of equal loudness together would produce an increase of 5 dB.

Sound Propagation and Attenuation

Noise can be generated by a number of sources, including mobile sources such as automobiles, trucks and airplanes, and stationary sources such as construction sites, machinery, and industrial operations. Sound spreads (propagates) uniformly outward in a spherical pattern, and the sound level decreases (attenuates) at a rate of approximately 6 dB (dBA) for each doubling of distance from a stationary or point source. Sound from a line source, such as a highway, propagates outward in a cylindrical pattern, often referred to as cylindrical spreading. Sound levels attenuate at a rate of approximately 3 dBA for each doubling of distance from a line source, such as a roadway, depending on ground surface characteristics (Federal Highway Administration [FHWA] 2011). No excess attenuation is assumed for hard surfaces like a parking lot or a body of water. Soft surfaces, such as soft dirt or grass, can absorb sound, so an excess ground-attenuation value of 1.5 dBA per doubling of distance is normally assumed.

Noise levels may also be reduced by intervening structures; generally, a single row of detached buildings between the receptor and the noise source reduces the noise level by about 5 dBA (FHWA 2008), while a solid wall or berm generally reduces noise levels by 10 to 20 dBA (FHWA 2011). However, noise barriers or enclosures specifically designed to reduce site-specific construction noise can provide a sound reduction of 35 dBA or greater (Western Electro-Acoustic Laboratory, Inc. 2000). To achieve the most potent noise-reducing effect, a noise enclosure/barrier must physically fit in the available space, must completely break the “line of sight” between the noise source and the receptors, must be free of degrading holes or gaps, and must not be flanked by nearby reflective surfaces. Noise barriers must be sizable enough to cover the entire noise source and extend length-wise and vertically as far as feasibly possible to be most effective. The limiting factor for a noise barrier is not the component of noise transmitted through the material, but rather the amount of noise flanking around and over the barrier. In general, barriers contribute to decreasing noise levels only when the structure breaks the line of sight between the source and the receiver.

The manner in which older structures in California were constructed generally provides a reduction of exterior-to-interior noise levels of about 20 to 25 dBA with closed windows (California Department of Transportation [Caltrans] 2002). The exterior-to-interior reduction of newer structures is generally 30 dBA or more (Harris Miller, Miller & Hanson Inc. [HMMH] 2006).

Noise Descriptors

The decibel scale alone does not adequately characterize how humans perceive noise. The dominant frequencies of a sound have a substantial effect on the human response to that sound. Several rating scales have been developed to analyze the adverse effect of community noise on people. Because environmental noise fluctuates over time, these scales consider that the effect of noise on people is largely dependent on the total acoustical energy content of the noise, as well as the time of day when the noise occurs. The L_{eq} is a measure of ambient noise, while the L_{dn} and CNEL (Community Noise Equivalent Level) are measures of community noise. Each is applicable to this analysis and defined as follows:

- **Equivalent Noise Level (L_{eq})** is the average acoustic energy content of noise for a stated period of time. Thus, the L_{eq} of a time-varying noise and that of a steady noise are the same if they deliver the same acoustic energy to the ear during exposure. For evaluating community impacts, this rating scale does not vary, regardless of whether the noise occurs during the day or the night.
- **Day-Night Average (L_{dn})** is a 24-hour average L_{eq} with a 10-dBA "weighting" added to noise during the hours of 10:00 p.m. to 7:00 a.m. to account for noise sensitivity in the nighttime. The logarithmic effect of these additions is that a 60 dBA 24-hour L_{eq} would result in a measurement of 66.4 dBA L_{dn}.
- **Community Noise Equivalent Level (CNEL)** is a 24-hour average L_{eq} with a 5-dBA weighting during the hours of 7:00 p.m. to 10:00 p.m. and a 10-dBA weighting added to noise during the hours of 10:00 p.m. to 7:00 a.m. to account for noise sensitivity in the evening and nighttime, respectively.

Human Response to Noise

The human response to environmental noise is subjective and varies considerably from individual to individual. Noise in the community has often been cited as a health problem, not in terms of actual physiological damage, such as hearing impairment, but in terms of inhibiting general well-being and contributing to undue stress and annoyance. The health effects of noise in the community arise from interference with human activities, including sleep, speech, recreation, and tasks that demand concentration or coordination. Hearing loss can occur at the highest noise intensity levels.

Noise environments and consequences of human activities are usually well represented by median noise levels during the day or night or over a 24-hour period. Environmental noise levels are generally considered low when the CNEL is below 60 dBA, moderate in the 60- to 70-dBA range, and high above 70 dBA. Examples of low daytime levels are isolated, natural settings with noise levels as low as 20 dBA and quiet, suburban, residential streets with noise levels around 40 dBA. Noise levels above 45 dBA at night can disrupt sleep. Examples of moderate-level noise environments are urban residential or semi-commercial areas (typically 55 to 60 dBA) and commercial locations (typically 60 dBA). People may consider louder environments adverse, but most will accept the higher levels associated with noisier urban residential or residential-commercial areas (60 to 75 dBA), or dense urban or industrial areas (65 to 80 dBA). Regarding increases in dBA noise levels, the following relationships should be noted in understanding this analysis:

- Except in carefully controlled laboratory experiments, a change of 1 dBA cannot be perceived by humans.
- Outside of the laboratory, a 3-dBA change is considered a just-perceivable difference.
- A change in level of at least 5 dBA is required before any noticeable change in community response would be expected.
- A 10-dBA change is subjectively heard as an approximate doubling in loudness and would almost certainly cause an adverse change in community response.

Noise-Sensitive Land Uses

Noise-sensitive land uses are generally considered to include those uses where noise exposure could result in health-related risks to individuals, as well as places where quiet is an essential element of their intended purpose. Residential dwellings are of primary concern because of the potential for increased and prolonged exposure of individuals to both interior and exterior noise levels. Additional land uses such as parks, historic sites, cemeteries, and recreation areas are considered sensitive to increases in exterior noise levels. Schools, churches, hotels, libraries, and other places where low interior noise levels are essential are also considered noise-sensitive land uses. The Project site spans Pasadena Avenue, Medford Avenue, Deodar Avenue and 17th Street. All, with the exclusion of 17th Street, traverse a residential neighborhood (less than 20 feet from residential dwelling units).

Vibration Fundamentals

Ground vibration can be measured several ways to quantify the amplitude of vibration produced. This can be through peak particle velocity or root mean square velocity. These velocity measurements measure maximum particle at one point or the average of the squared amplitude of the signal, respectively. Vibration impacts on people can be described as the level of annoyance and can vary depending on an individual's sensitivity. Generally, low-level vibrations may cause window rattling but do not pose any threats to the integrity of buildings or structures.

Existing Noise Environment

The City of Santa Ana is impacted by various noise sources. It is subject to typical urban noise such as noise generated by traffic, heavy machinery, and day-to-day outdoor activities as well as noise generated from the various land uses (i.e., residential, commercial, institutional, and recreational and parks activities) throughout Santa Ana that generate stationary source noise. Mobile sources of noise, especially cars and trucks, are the most common source of noise in the community. The major noise sources in the vicinity of the Project site includes roadway noise traffic from the Costa Mesa Freeway to the east, as well as typical noise sources associated with residential neighborhoods (e.g., mechanical equipment, dogs barking, and radios).

Methodology

This analysis of the existing and future noise environments is based on noise prediction modeling and empirical observations. Predicted construction noise levels were calculated utilizing the FHWA's Roadway Construction Model (2006). Operational noise levels are addressed qualitatively. Groundborne vibration levels associated with construction-related activities for the Project were evaluated utilizing typical groundborne vibration levels associated with construction equipment, obtained from Caltrans. Potential groundborne vibration impacts related to structural damage and human annoyance were evaluated, taking into account the distance from construction activities to nearby land uses.

NOISE CHECKLIST AND DISCUSSION

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?

Construction Noise Impacts

Construction noise associated with the Proposed Project would be temporary and would vary depending on the nature of the activities being performed. Noise generated would primarily be associated with the operation of off-road equipment for onsite construction activities as well as construction vehicle traffic on area roadways. Construction noise typically occurs intermittently and varies depending on the nature or phase of construction (e.g., grading, excavation, trenching, paving). Noise generated by construction equipment, including excavators, material handlers, and portable generators, can reach high levels. Typical operating cycles for these types of construction equipment may involve one or two minutes of full power operation followed by three to four minutes at lower power settings. Other primary sources of acoustical disturbance would be random incidents, which would last less than one minute (such as dropping large pieces of equipment or the hydraulic movement of machinery lifts). During construction, exterior noise levels could negatively affect sensitive land uses in the vicinity of the construction site. The nearest noise sensitive land uses to the Project site are residences located on Pasadena Street, Medford Avenue and Deodar Street in all directions. All residences are located directly adjacent (less than 20 feet) from the Project site.

Section 18-314, *Special Provisions*, of the City of Santa Ana Municipal Code prohibits construction between the hours of 8:00 p.m. and 7:00 a.m. on weekdays or Saturday, or any time on Sunday or federal holidays but does not promulgate a numeric threshold pertaining to the noise associated with construction. This is due to the fact that construction noise is temporary, short term, intermittent in nature, and would cease on completion of the Project. Furthermore, the City of Santa Ana is a developing urban community and construction noise is generally accepted as a reality within the urban environment. Additionally, construction would occur throughout the Project site and would not be concentrated at one point.

To estimate the worst-case onsite construction noise levels that may occur at the nearest noise-sensitive receptors in the Project vicinity, the construction equipment noise levels were calculated using the Roadway Noise Construction Model for the demolition, site preparation, trenching, paving and painting and compared against the construction-related noise level threshold established in the Criteria for a Recommended Standard: Occupational Noise Exposure prepared in 1998 by National Institute for Occupational Safety and Health (NIOSH). A division of the US Department of Health and Human Services, NIOSH identifies a noise level threshold based on the duration of exposure to the source. The NIOSH construction-related noise level threshold starts at 85 dBA for more than 8 hours per day; for every 3-dBA increase, the exposure time is cut in half. This reduction results in noise level thresholds of 88 dBA for more than 4 hours per day, 92 dBA for more than 1 hour per day, 96 dBA for more than 30 minutes per day, and up to 100 dBA for more than 15 minutes per day. For the purposes of this analysis, the lowest, more conservative threshold of 85 dBA L_{eq} is used as an acceptable threshold for construction noise at the nearby existing and future planned sensitive receptors.

The anticipated short-term construction noise levels generated for the necessary equipment is presented in Table 1**.** Consistent with FTA recommendations for calculating construction noise, construction noise was measured from the center of the Project site (FTA 2018). As previously stated, the nearest noise sensitive land uses to the Project site are residences located approximately 20 feet distant.

Table 1. Onsite Construction Average (dBA) Noise Levels by Receptor Distance and Construction Equipment

Equipment	Estimated Exterior Construction Noise Level @ Closest Residence	Construction Noise Standard (dBA L_{eq})	Exceeds Standards?
Demolition			
Scrapers(1)	87.6	85	**Yes**
Rubber Tired Dozers (1)	85.6	85	**Yes**
Tractors/Loaders/Backhoes (1)	88.0	85	**Yes**
Combined Demolition Equipment	**91.1**	85	**Yes**
Site Preparation			
Scrapers (1)	87.6	85	**Yes**
Graders (1)	89.0	85	**Yes**
Tractors/Loaders/Backhoes (1)	88.0	85	**Yes**
Combined Site Preparation Equipment	**93.0**	85	**Yes**
Trenching			
Dumpers/Tenders (1)	80.4	85	**No**
Excavators (1)	84.7	85	**No**
Tractors/Loaders/Backhoes (2)	88.0(each)	85	**Yes**
Concrete/Industrial Saws (1)	90.5	85	**Yes**
Combined Trenching Equipment	**94.5**	85	**Yes**
Paving & Painting			
Cement and Mortar Mixers (4)	82.6 (each)	85	**No**
Pavers (1)	82.2	85	**No**
Air Compressors (1)	81.6	85	**No**

Table 1. Onsite Construction Average (dBA) Noise Levels by Receptor Distance and Construction Equipment			
Equipment	**Estimated Exterior Construction Noise Level @ Closest Residence**	**Construction Noise Standard (dBA L_{eq})**	**Exceeds Standards?**
Rollers (1)	81.0	85	**No**
Tractors/Loaders/Backhoes(1)	88.0	85	**Yes**
Combined Paving & Painting Equipment	**92.6**	85	**Yes**

Source: Construction noise levels were calculated by ECORP Consulting using the FHWA Roadway Noise Construction Model (FHWA 2006). Refer to Attachment B for Model Data Outputs.
Notes: Construction equipment used during construction derived from CalEEMod 2016.3.2.
L_{eq} = The equivalent energy noise level, is the average acoustic energy content of noise for a stated period of time. Thus, the Leq of a time-varying noise and that of a steady noise are the same if they deliver the same acoustic energy to the ear during exposure. For evaluating community impacts, this rating scale does not vary, regardless of whether the noise occurs during the day or the night.

As shown in Table 1, a majority of the individual pieces of construction equipment and all cumulative construction equipment would exceed the NIOSH noise threshold of 85 dBA at the adjacent sensitive receptors. It is recommended that the implementation of temporary noise barriers be used during Project construction. Noise barriers or enclosures can provide a sound reduction of 35 dBA or greater (WEAL 2000). To be effective, a noise enclosure/barrier must physically fit in the available space, must completely break the line of sight between the noise source and the receptors, must be free of degrading holes or gaps, and must not be flanked by nearby reflective surfaces. Noise barriers must be sizable enough to cover the entire noise source and extend lengthwise and vertically as far as feasibly possible to be most effective. The limiting factor for a noise barrier is not the component of noise transmitted through the material, but rather the amount of noise flanking around and over the barrier. In the case of Project construction, an enclosure/barrier would only be necessary at the area of the construction site where noise producing activities are being performed.

The following mitigation is recommended.

NOI-1: The Project construction and improvement plans will include the following requirements for construction activities:

- Construction contracts must specify that all construction equipment, fixed or mobile, shall be equipped with properly operating and maintained mufflers and other state-required noise attenuation devices.
- A sign, legible at a distance of 50 feet, shall be posted at the Project construction site providing a contact name and a telephone number where residents can inquire about the construction process and register complaints. This sign shall indicate the dates and duration of construction activities. In conjunction with this required posting, a noise disturbance coordinator will be identified to address construction noise concerns received. The coordinator shall be responsible for responding to any local complaints about construction noise. When a complaint is received, the disturbance coordinator shall notify the City within 24 hours of the complaint and determine the cause of the noise complaint (starting too early, malfunctioning muffler, etc.) and shall

implement reasonable measures to resolve the complaint, as deemed acceptable by the City. All signs posted at the construction site shall include the contact name and the telephone number for the noise disturbance coordinator.

- Identification of construction noise reduction methods. These reduction methods may include shutting off idling equipment (5 minutes), installing temporary acoustic barriers around stationary construction noise sources, maximizing the distance between construction equipment staging areas and occupied residential areas, and using electric air compressors and similar power tools.
- During construction, stationary construction equipment shall be placed such that emitted noise is directed away from sensitive noise receivers.
- Per Section 18-314of the City's Municipal Code, construction shall be prohibited between the hours of 8:00 p.m. and 7:00 a.m. on weekdays or Saturday, or any time on Sunday or federal holidays

NOI-2: In order to reduce construction noise, during the demolition, site preparation, trenching, painting and paving phases, a temporary noise barrier or enclosure should be positioned between Project construction and the residences in a manner that breaks the line of sight between the construction equipment and these residences to the extent feasible. The composition, length, height, and location of temporary noise control barrier walls should be adequate to assure proper acoustical performance and withstand structural failure.

Implementation of mitigation measures **NOI-1** and **NOI-2** would substantially reduce construction-generated noise levels. As previously described, noise barriers or enclosures such as that recommended in mitigation measure **NOI-2** can provide a sound reduction 35 dBA or greater (WEAL 2000), which would be a reduction robust enough to maintain construction noise levels less than 85 dBA. Temporary noise barriers can consist of a solid plywood fence and/or flexible sound curtains, such as an 18-ounce tarp or a 2-inch-thick fiberglass blanket attached to chain link fencing. Therefore, Project construction activities would not expose persons to and generate noise levels in excess of County standards with implementation of **NOI-1** and **NOI-2**.

Operational Noise Impact

The Proposed Project consists of sewer and water infrastructure improvements. It would not be a source of mobile or stationary noise sources and thus would not be a source of operational noise.

Would the Project result generation of excessive groundborne vibration or groundborne noise levels?

Construction Vibration Impacts

Excessive groundborne vibration impacts result from continuously occurring vibration levels. Increases in groundborne vibration levels attributable to the Proposed Project would be primarily associated with short-term construction-related activities. Construction on the Project site would have the potential to result in varying degrees of temporary groundborne vibration, depending on the specific construction equipment used and the operations involved. Ground vibration generated by construction equipment spreads through the ground and diminishes in magnitude with increases in distance.

Construction-related ground vibration is normally associated with impact equipment such as pile drivers, jackhammers, and the operation of some heavy-duty construction equipment, such as dozers and trucks. It is not anticipated that pile drivers would be necessary during Project construction. Vibration decreases rapidly with distance and it is acknowledged that construction activities would occur throughout the Project site and would not be concentrated at the point closest to sensitive receptors. Groundborne vibration levels associated with construction equipment are summarized in **Table 2**.

Table 2. Vibration Source Amplitudes for Construction Equipment at 20 Feet

Equipment Type	Peak Particle Velocity at 20 Feet (inches per second)
Large Bulldozer	0.124
Caisson Drilling	0.124
Loaded Trucks	0.106
Rock Breaker	0.115
Jackhammer	0.049
Small Bulldozer/Tractor	0.004

Source: FTA 2018; Caltrans 2020

The City does not regulate vibration associated with construction. However, a discussion of construction vibration is included for full disclosure purposes. For comparison purposes, the Caltrans's (2020) recommended standard of 0.2 inches per second peak particle velocity with respect to the prevention of structural damage for normal residential buildings is used as a threshold. This is also the level at which vibrations may begin to annoy people in buildings.

It is acknowledged that construction activities would occur throughout the Project site and would not be concentrated at the point closest to the nearest structure. The nearest structures of concern to the construction site are residential structures located less than 20 feet away on Pasadena Avenue, Medford Avenue and Deodar Street. Based on the vibration levels presented in **Table 2**, ground vibration generated by heavy-duty equipment would not be anticipated to exceed approximately 0.124 inches per second peak particle velocity at 20 feet. Therefore, vibration from construction activities experienced at the nearest adjacent residences would be expected to be below the 0.2 inch per second peak particle velocity threshold.

Operational Vibration Impacts

Project operations would not include the use of any stationary equipment that would result in excessive groundborne vibration levels. Therefore, the Project would result in no groundborne vibration impacts during operations.

Would the Project expose people residing or working in the Project area to excessive airport noise levels?

The Project site is located approximately 6 miles south of the John Wayne International Airport. The Proposed Project is not located within an airport land use plan or within two miles of a public airport or public use airport. Implementation of the Proposed Project would not affect airport operations nor result in increased exposure of people working at or residing the Project site to aircraft noise.

Cumulative Noise Impact

Cumulative Construction Noise

Construction activities associated with the Proposed Project and other construction projects in the area may overlap, resulting in construction noise in the area. However, construction noise impacts primarily affect the areas immediately adjacent to the construction site. Construction noise for the Proposed Project was determined to be less than significant following compliance with Mitigation Measure **NOI-1** and **NOI-2**. Cumulative development in the vicinity of the Project site could result in elevated construction noise levels at sensitive receptors in the Project area. However, each project would be required to comply with the applicable limitations on construction. Therefore, the Project would not contribute to cumulative impacts during construction.

Cumulative Operational Noise

As previously discussed, once operational the Project would not be a source of operational noise.

REFERENCES

Caltrans (California Department of Transportation). 2002. California Airport Land Use Planning Handbook.

____. 2020. Transportation- and Construction-Induced Vibration Guidance Manual.

FHWA (Federal Highway Administration). 2006. Roadway Construction Noise Model.

FTA (Federal Transit Administration). 2018. Transit Noise and Vibration Impact Assessment.

HMMH. 2006. Transit Noise and Vibration Impact Assessment, Final Report.

Santa Ana, City of. 2009. *City of Santa Ana General Plan.* Updated 2009.

WEAL. 2000. Sound Transmission Sound Test Laboratory Report No. TL 96-186.

ATTACHMENT A

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 8/12/2020
Case Description: Demolition

Description	**Affected Land Use**
Demolition	Residential

Description	**Impact Device**	**Usage(%)**	**Equipment Spec Lmax (dBA)**	**Actual Lmax (dBA)**	**Receptor Distance (feet)**
Scraper	No	40		83.6	20
Dozer	No	40		81.7	20
Tractor	No	40	84		20

Calculated (dBA)

Equipment		***Lmax**	**Leq**
Scraper		91.5	87.6
Dozer		89.6	85.6
Tractor		92	88
	Total	**92**	**91.9**

*Calculated Lmax is the Loudest value.

Roadway Construction Noise Model (RCNM),Version 1.1

Report date:	8/12/2020
Case Description:	Site Preparation

Description	**Affected Land Use**
Site Preparation	Residential

Description	**Impact Device**	**Usage(%)**	**Equipment Spec Lmax (dBA)**	**Actual Lmax (dBA)**	**Receptor Distance (feet)**
Scraper	No	40		83.6	20
Grader	No	40	85		20
Tractor	No	40	84		20

Calculated (dBA)

Equipment		***Lmax**	**Leq**
Scraper		91.5	87.6
Grader		93	89
Tractor		92	88
	Total	**93**	**93**

*Calculated Lmax is the Loudest value.

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 8/12/2020
Case Description: Trenching

Description	**Affected Land Use**
Residential	Residential

Description	**Impact Device**	**Usage(%)**	**Equipment Spec Lmax (dBA)**	**Actual Lmax (dBA)**	**Receptor Distance (feet)**
Dump Truck	No	40		76.5	20
Excavator	No	40		80.7	20
Tractor	No	40	84		20
Tractor	No	40	84		20
Concrete Saw	No	20		89.6	20

Calculated (dBA)

Equipment		***Lmax**	**Leq**
Dump Truck		84.4	80.4
Excavator		88.7	84.7
Tractor		92	88
Tractor		92	88
Concrete Saw		97.5	90.5
	Total	**97.5**	**94.5**

*Calculated Lmax is the Loudest value.

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 8/12/2020
Case Description: Paving & Painting

Description	Affected Land Use
Paving & Painting	Residential

Description	Impact Device	Usage(%)	Equipment Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)
Concrete Mixer Truck	No	40		78.8	20
Concrete Mixer Truck	No	40		78.8	20
Concrete Mixer Truck	No	40		78.8	20
Concrete Mixer Truck	No	40		78.8	20
Paver	No	50		77.2	20
Compressor (air)	No	40		77.7	20
Roller	No	20		80	20
Tractor	No	40	84		20

Calculated (dBA)

Equipment	*Lmax	Leq
Concrete Mixer Truck	86.8	82.8
Concrete Mixer Truck	86.8	82.8
Concrete Mixer Truck	86.8	82.8
Concrete Mixer Truck	86.8	82.8
Paver	85.2	82.2
Compressor (air)	85.6	81.6
Roller	88	81
Tractor	92	88
Total	**92**	**92.6**

*Calculated Lmax is the Loudest value.