# APPENDIX J

*Noise Measurement Data*

# NOISE ASSESSMENT TECHNICAL REPORT
# for the
# Palm Villas Saratoga Project
# Saratoga, California

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## ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| CFR | Code of Federal Regulation |
| CNEL | community noise equivalent level |
| dB | decibel |
| dBA | A-weighted decibel |
| DOT | U.S. Department of Transportation |
| FAA | Federal Aviation Administration |
| FHWA | Federal Highway Administration |
| Hz | hertz |
| Ldn | day-night sound level |
| Leq | equivalent sound level |
| Lmin | minimum sound level |
| Lmax | maximum sound level |
| Lxx | percentile exceeded sound level |
| RMS | root mean square |
| SR | State Route |
| VdB | vibration decibels |

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# 1 INTRODUCTION

## 1.1 Purpose

This technical noise report evaluates noise effects of the project, including noise and vibration generation potential associated with construction and operation. Noise generation sources from future implementation of the project include traffic, operation and mechanical equipment, EMS vehicles and short-term construction operations.

## 1.2 Project Location and Description

### 1.2.1 Location

The proposed project is located in a neighborhood with residential, institutional, and passive recreational uses approximately two miles from downtown Saratoga Nearby cultural attractions include the Montalvo Arts Center, Mountain Winery, and the Hakone Gardens. Please refer to Figure 1 for an illustration of the regional setting of the project. Primary access to the property is afforded via Cox Avenue which connects to Saratoga Avenue. Saratoga Avenue connects to Highway 85 delivering visitors to the site vicinity from surrounding City and County areas. Please refer to Figure 2 for an illustration of the proposed project area, including the relationship to the roadway system just described.

With respect to the project area illustrated on Figure 2, project site is located approximately 175 feet south of the intersection of Saratoga Creek Drive and Cox Ave. The project site is northeast of California State Route 85 (SR 85) and west of Saratoga Avenue. The Santa Clara County Assessor's Office identifies the project site as two adjacent parcels with Assessor Parcel Numbers (APN) 389-06-020 (Lot 1) and 389-06-021 (Lot 2).


SOURCE: USDA 2016

DUDEK

0 300 600 Feet

**FIGURE 1**

Project Location

Palm Villas Project

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SOURCE: USDA 2016

DUDEK

0 90 180 Feet

**FIGURE 2**

Property Boundaries and Associated Roads

Palm Villas Project

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### 1.2.2 Project Description

The project site is located in the City of Saratoga (City or Saratoga), in the western portion of Santa Clara County. The project would consist of the construction and operation of a Residential Care Facility for the Elderly (RCFE), consisting of two - buildings on two adjacent lots. The two buildings have been designed to function as a single complex. One building would be for individuals with mild stage Alzheimer's/Dementia, and the second for individuals with advanced stage Alzheimer's/Dementia. The project (including both buildings), would include a combined total of 78 beds, related support functions (such as food service, pharmacy, laundry, administration, etc.), 47 parking spaces, landscaping (including removal of some trees), utility connections, and an extension of Saratoga Creek Drive. The General Plan land use map designation for the project site is Professional Administrative (PA); the City's zoning map designates the site "Professional and Administrative (PA)". The Professional and Administrative zoning district permits uses such as professional, administrative, and medical offices, financial institutions, accessory structures, and parking lots. Conditional uses allowable in this district extend to community facilities, institutional facilities, police and fire stations, nursing homes and day care facilities among similar uses. Professional and administrative office buildings are located immediately to the north and east of the project site, and south of Cox Avenue. The area north of Cox Avenue is zoned Single Family Residential, R-1-10,000. Single-family residential uses are located to the west, across Saratoga Creek. Vacant parcels zoned for Professional and Administrative office uses bound the subject property to the south; the property south of the vacant properties is zoned -Multi Family Residential R-M 4,000.

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## 1.3 Noise Background and Terminology

**Fundamentals of Environmental Noise**

Vibrations, traveling as waves through air from a source, exert a force perceived by the human ear as sound. Sound pressure level (referred to as sound level) is measured on a logarithmic scale in decibels (dB) that represent the fluctuation of air pressure above and below atmospheric pressure. Frequency, or pitch, is a physical characteristic of sound and is expressed in units of cycles per second or hertz (Hz). The normal frequency range of hearing for most people extends from about 20 to 20,000 Hz. The human ear is more sensitive to middle and high frequencies, especially when the noise levels are quieter. As sound levels get louder, the human ear starts to hear the frequency spectrum more evenly. To accommodate for this phenomenon, a weighting system to evaluate how loud a sound level is to a human was developed. The frequency weighting called "A" weighting is typically used for quieter sound levels which de-emphasizes the low frequency components of the sound in a manner similar to the response of a human ear. This A-weighted sound level is referenced in units of dBA.

Since sound is measured on a logarithmic scale, a doubling of sound energy results in a 3 dBA increase in the noise level. Changes in a community noise level of less than 3 dBA are not typically noticed by the human ear (U.S. DOT 1980). Changes from 3 to 5 dBA may be noticed by some individuals who are extremely sensitive to changes in noise. A 5 dBA increase is readily noticeable (Caltrans 2013a). The human ear perceives a 10 dBA increase in sound level as a doubling of the sound level (i.e., 65 dBA sounds twice as loud as 55 dBA to a human ear).

An individual's noise exposure occurs over a period of time; however, noise level is a measure of noise at a given instant in time. Community noise sources vary continuously, being the product of many noise sources at various distances, all of which constitute a relatively stable background or ambient noise environment. The background, or ambient, noise level gradually changes throughout a typical day, corresponding to distant noise sources, such as traffic volume, as well as changes in atmospheric conditions.

Noise levels are generally higher during the daytime and early evening when traffic (including airplanes), commercial, and industrial activity is the greatest. However, noise sources experienced during nighttime hours when background levels are generally lower can be potentially more conspicuous and irritating to the receiver. In order to evaluate noise in a way that considers periodic fluctuations experienced throughout the day and night, a concept termed "community noise equivalent level" (CNEL) was developed, wherein noise measurements are weighted, added, and averaged over a 24-hour period to reflect magnitude, duration, frequency, and time of occurrence. A complete definition of CNEL is provided below.

Different types of measurements are used to characterize the time-varying nature of sound. These measurements include the equivalent sound level ($L_{eq}$), the minimum and maximum sound levels ($L_{min}$ and $L_{max}$), percentile-exceeded sound levels ($L_{xx}$), the day–night sound level ($L_{dn}$), and the CNEL. Below are brief definitions of these measurements and other terminology used in this report.

- *Decibel* (dB) is a unitless measure of sound on a logarithmic scale which indicates the squared ratio of sound pressure amplitude to a reference sound pressure amplitude. The reference pressure is 20 micropascals.
- *A-weighted decibel* (dBA) is an overall frequency-weighted sound level in decibels that approximates the frequency response of the human ear.
- *Equivalent sound level* ($L_{eq}$) is the constant level that, over a given time period, transmits the same amount of acoustic energy as the actual time-varying sound. Equivalent sound levels are the basis for both the day–night average sound levels ($L_{dn}$) and community noise equivalent level (CNEL) scales.
- *Maximum sound level* ($L_{max}$) is the maximum sound level measured during the measurement period.
- *Minimum sound level* ($L_{min}$) is the minimum sound level measured during the measurement period.
- *Percentile-exceeded sound level* ($L_{xx}$) is the sound level exceeded x percent of a specific time period. $L_{10}$ is the sound level exceeded 10% of the time.
- *Day–night average sound level* (DNL or $L_{dn}$) The City has historically described community noise levels in terms of the $L_{dn}$. The $L_{dn}$ is a 24-hour average A-weighted sound level with a 10 dB penalty added to the nighttime hours from 10:00 p.m. to 7:00 a.m. The 10 dB penalty is applied to account for increased noise sensitivity during the nighttime hours. In the City General Plan Update (City of Saratoga 2014), noise limits are described in terms of $L_{dn}$ ***or*** CNEL (see definition below); resulting values from application of $L_{dn}$ versus CNEL rarely differ by more than 1 dB, and therefore these two methods of describing average noise levels are often considered interchangeable.

**Exterior Noise Distance Attenuation**

Noise sources are classified in two forms: (1) point sources, such as stationary equipment or a group of construction vehicles and equipment working within a spatially limited area at a given time, and (2) line sources, such as a roadway with a large number of pass-by sources (motor vehicles). Sound generated by a point source typically diminishes (attenuates) at a rate of 6.0 dBA for each doubling of distance from the source to the receptor at acoustically "hard" sites and at a

rate of 7.5 dBA for each doubling of distance from source to receptor at acoustically "soft" sites. Sound generated by a line source (i.e., a roadway) typically attenuates at a rate of 3 dBA and 4.5 dBA per doubling distance, for hard and soft sites, respectively. Sound levels can also be attenuated by man-made or natural barriers. For the purpose of sound attenuation discussion, a "hard" or reflective site does not provide any excess ground-effect attenuation and is characteristic of asphalt or concrete ground surfaces, as well as very hard-packed soils. An acoustically "soft" or absorptive site is characteristic of unpaved loose soil or vegetated ground.

### Structural Noise Attenuation

Sound levels can also be attenuated by man-made or natural barriers. Solid walls or slopes associated with elevation differences typically reduce noise levels by 5 to 10 dBA (U.S. DOT 1980). Structures can also provide noise reduction by insulating interior spaces from outdoor noise. The outside-to-inside noise attenuation provided by typical structures in California ranges between 17 to 30 dBA with open and closed windows, respectively, as shown in Table 1.

**Table 1**
**Outside-to-Inside Noise Attenuation (dBA)**

| Building Type | Open Windows | Closed Windows[a] |
|---|---|---|
| Residences | 17 | 25 |
| Schools | 17 | 25 |
| Churches | 20 | 30 |
| Hospitals/Offices/Hotels | 17 | 25 |
| Theaters | 17 | 25 |

**Source:** Transportation Research Board, National Research Council, 2000.
[a] As shown, structures with closed windows can attenuate exterior noise by a minimum of 25 to 30 dBA.

### Fundamentals of Vibration

Vibration is an oscillatory motion that can be described in terms of displacement, velocity, or acceleration. The response of humans to vibration is very complex. However, it is generally accepted that human response is best approximated by the vibration velocity level associated with the vibration occurrence.

Heavy equipment operation, including stationary equipment that produces substantial oscillation or construction equipment that causes percussive action against the ground surface, may be perceived by building occupants as perceptible vibration. It is also common for ground-borne vibration to cause windows, pictures on walls, or items on shelves to rattle. Although the perceived vibration from such equipment operation can be intrusive to building occupants, the vibration is seldom of sufficient magnitude to cause even minor cosmetic damage to buildings.

When evaluating human response, ground-borne vibration is usually expressed in terms of root mean square (RMS) vibration velocity. RMS is defined as the average of the squared amplitude of the vibration signal. As for sound, it is common to express vibration amplitudes in terms of decibels defined as:

$$L_v = 20 \log \left( \frac{v_{rms}}{v_{ref}} \right)$$

where vrms is the RMS vibration velocity amplitude in inches/second and vref is the decibel reference of 1x10-6 inches/second.

To avoid confusion with sound decibels, the abbreviation VdB is used for vibration decibels. The vibration threshold of perception for most people is around 65 VdB. Vibration levels in the 70 to 75 VdB range are often noticeable but generally deemed acceptable, and levels in excess of 80 VdB are often considered unacceptable (FTA 2018).

## 1.4 Noise Regulation and Management

### 1.4.1 Federal

**Federal Transit Administration and Federal Railroad Administration Standards**

Although the U.S. Department of Transportation's Federal Transit Administration (FTA) standards were established for federally funded mass transit projects, the impact assessment procedures and criteria included in the Transit Noise and Vibration Impact Assessment Manual (FTA 2018) are routinely used for projects proposed by local jurisdictions. The FTA and Federal Railroad Administration (FRA) have published guidelines for assessing the impacts of ground-borne vibration associated with rail projects, which have been applied by other jurisdictions to other types of projects. The FTA measure of the threshold of architectural damage for conventional sensitive structures is 0.2 inch/second perturbation projection vector (PPV).

### 1.4.2 State

**California Noise Control Act of 1973**

Sections 46000 through 46080 of the California Health and Safety Code, known as the California Noise Control Act of 1973, declares that excessive noise is a serious hazard to the public health and welfare and that exposure to certain levels of noise can result in physiological, psychological, and economic damage. It also identifies a continuous and increasing bombardment of noise in the urban, suburban, and rural areas. The California Noise Control Act declares that the State of

California has a responsibility to protect the health and welfare of its citizens by the control, prevention, and abatement of noise. It is the policy of the State to provide an environment for all Californians free from noise that jeopardizes their health or welfare.

**California Noise Insulation Standards (CCR Title 24)**

In 1974, the California Commission on Housing and Community Development adopted noise insulation standards for hotels, motels, dormitories, and multi-family residential buildings (CCR Title 24, Part 2). Title 24 establishes standards for interior room noise (attributable to outside noise sources). The regulations also specify that acoustical studies must be prepared whenever a multi-family residential building or structure is proposed to be located in an area with CNEL (or $L_{dn}$) of 60 dBA or greater. Such acoustical analysis must demonstrate that the residence has been designed to limit intruding noise to an interior CNEL (or $L_{dn}$) of at least 45 dBA (California's Title 24 Noise Standards, Chap. 2-35). The City applies an interior noise criterion of $L_{dn}$ 45 dBA for single family residences, in addition to multi-family residential structures.

### 1.4.3 City of Saratoga

**Saratoga General Plan**

The City of Saratoga periodically updates portions of the General Plan, typically two to three sections at a time. The Noise Element was last updated in March 2014. The update contains new policy directives regarding noise, listed below.

**Policy 1.1** The City shall maintain an up-to-date Noise Element in accordance with State regulations.

*Implementation 1.1.1* The City should periodically measure monitor noise levels in the City to identify changes.

**Policy 1.2** The City shall use the planning and code enforcement process to discourage activities, practices or land uses that create or result in excessive noise exposure.

*Implementation 1.2.1* The City should review and revise the Noise Ordinance and enforcement process to appropriately reflect changing conditions and technological developments.

**Policy 1.3** The City shall require that all City-owned and operated equipment and equipment operated under contract with city meet City noise standards.

*Implementation 1.3.1* New purchases of City fleet equipment should be considered if there are significant advances in equipment noise reduction technology.

*Implementation 1.3.2* City Contracts should encourage use of equipment that incorporates the latest noise reduction techniques.

**Policy 1.4** The City shall encourage public awareness and education of noise issues and acoustical standards as key ingredients in controlling unwanted noise and its effects on the quality of life in Saratoga

*Implementation of 1.4.1* The City should provide a resource (e.g., a website) devoted to public awareness of City noise standards, policies and procedures.

**Policy 2.1** An acoustical analysis is to be conducted for proposed Residential and Quasi-Public development where the existing noise level exceeds Outdoor DNL 60 dB determine measures needed to reduce noise impacts to meet City noise standards.

**Policy 2.2** New residential development shall be designed and construction to provide an interior noise level of DNL 45 dB or less in habitable rooms (due to outdoor sources).

**Policy 2.3** Residential outdoor open space intended for use and enjoyment shall be designated to meet Outdoor DNL 60 dB. This policy does not apply to private exterior balconies. Where this level cannot feasibly be met by incorporating reasonable measures, such as strategic site layout and noise barriers, DNL 65 dB may be approved.

**Policy 2.4** New office/commercial development shall be designed and constructed to reduce daytime interior noise levels in accordance with Sate CALGreen standards prescribing an interior noise levels standards of $L_{eq(h)}$ 50 dB as the maximum allowable hourly average noise levels during any hour of operation.

**Policy 2.5** Parks and recreational areas should be protected from excessive noise to permit the enjoyment of sports and other leisure time activities. Parks and other recreational areas which are impacted by outside noise sources should be provided with noise protection devices, including barriers and landscaping. Park design should locate passive recreation areas away from noise sources.

**Policy 2.6** The City recognizes that certain community uses and events are inherent to a suburban environment.

*Implementation 2.6.1* Update City Noise Control Ordinance to specifically address sources that would have an impact on the community, such as noise generated by equipment, animals and amplified sound.

**Policy 2.7** Noise generated by equipment, animals and amplified sound shall meet adopted standards as amended from time to time.

*Implementation 2.7.1* The City should continue to enforce the restrictions in the Noise Ordinance of the Saratoga City Code.

**Policy 2.8** The City shall enforce regulations pertaining to home occupations and not permit those that create noise beyond the property boundaries

**Policy 3.1** Changes in use and development shall be reviewed for noise impacts to neighboring land uses.

**Policy 3.2** New development shall be required to utilize appropriate measures to reduce noise impacts to the adopted noise standards; and acoustical analysis may be required by the approving authority.

**Policy 4.1** The City should work with other agencies to mitigate the effect of existing and future transportation noise sources

**Policy 4.2** The City should consider the implementation of alternative transportation methods in order to reduce cumulative traffic levels and noise generation.

*Implementation 4.2.1* The City should continue traffic reduction programs outlined in the goals policies, and implementation actions in the Circulation Element.

**Policy 4.3** The City should design new or improved roads in Saratoga with careful consideration given to both long and short-term noise impacts.

*Implementation 4.3.1* Noise abatement measures should be considered in the design of new and improved roadways.

**Policy 4.4** The City should discourage through traffic in residential neighborhoods to reduce noise impacts.

**Policy 4.5** The City should continue to designate truck routes in order to direct truck traffic away from noise-sensitive land uses.

**Policy 4.6** Municipal speed limits and State of California Vehicle noise regulations are intended to reduce traffic noise in the City.

*Implementation 4.5.1* The City should continue to coordinate enforcement of speed limits and State regulations related to vehicles that generate unacceptable noise.

Based on the City of Saratoga General Plan Noise Element, the proposed project would have a significant impact on noise if it would result in in an exceedance of the Outdoor Day-Night Average Sound Level shown in Table 2.

**Table 2 City of Saratoga Significance Thresholds**

| Land Use Category | Outdoor Day-Night Average Sound Level (DNL), in dB | | |
|---|---|---|---|
| | Normally Acceptable[1] | Conditionally Acceptable[2] | Normally Unacceptable[3] |
| Residential – Single-family | Up to 60 | > 60 to 70 | >70 |
| Residential – Multi-family | Up to 65 | >65 to 70 | >70 |
| Open Space[4]/Parks | Up to 60 | >60 to 70 | >70 |
| Commercial/Office | Up to 65 | > 65 to 75 | >75 |
| Public and quasi-Public Facilities | Up to 60 | > 60 to 65 | >65 |

**Source City of Saratoga 2014**

**Notes:**

1 Normally Acceptable– Specified land use is satisfactory, based upon the assumption that any buildings involved are of normal conventional construction. There are no special noise insulation requirements

2 Conditionally Acceptable– New construction should be undertaken only after a detailed analysis of the noise reduction requirement is conducted and needed noise insulation features included in the design.

3 Normally Unacceptable– New construction should be discouraged and may be denied as inconsistent with the General Plan and City Code. If new construction or development does proceed, a detailed analysis of the noise reduction requirements must be made and needed noise insulation features included in the design.

4 Outdoor open space noise standards do not apply to private balconies/patios

## Saratoga Municipal Code

Noise impacts from construction are regulated through the City's Municipal Code (i.e., the City's Noise Ordinance). Chapter 7-30.060 of the Noise Ordinance (Exceptions For Specific Activities) includes guidelines applicable to the project's construction. Chapter 7-30.060(a) stipulates:

> "Construction activities. Construction, alteration, repair, and grading activities shall not exceed one hundred dBA measured at any point twenty-five feet or more from the source of noise. Such activities may be conducted between the hours of 7:30 A.M. and 6:00 P.M. Monday through Friday and between the hours of 9:00 A.M. and 5:00 P.M. on Saturday. Construction activities shall be prohibited on Sundays and weekday holidays.

Chapter 7.30.040 – *Nose Standards* - includes guidelines applicable to the project's exterior noise levels. Chapter 7.30.040 Section (a), stipulates:

> "Except as otherwise provided in Paragraph (b) of this Section, all uses and developments shall comply with the following noise standards for the various land uses and times of day as indicated below. No person shall cause, produce, or allow to be produced any noise that exceeds these noise standards at any point outside the property boundary on which the noise is generated."

**Table 3**
**Saratoga Exterior Noise Standards**

| Noise Zone[1] | Sound Level (dBA) | | Time Period |
|---|---|---|---|
| | $L_{eq}$ | $L_{max}$ | |
| Residential (Single and multi-family) | 55 | 65 | Daytime (7:00am to 7:00pm |
| | 45 | 55 | Evening (7:00pm to 10:00pm) |
| | 40 | 50 | Nighttime (10:00pm to 7:00am) |
| Open Space/Parks | 60 | 70 | Daytime (7:00am to 7:00pm |
| | 50 | 55 | Evening (7:00pm to 10:00pm) |
| | 45 | 50 | Nighttime (10:00pm to 7:00am) |
| Commercial/Office | 65 | 75 | Daytime (7:00am to 7:00pm |
| | 60 | 70 | Evening (7:00pm to 10:00pm) |
| | 55 | 60 | Nighttime (10:00pm to 7:00am) |
| Public and Quasi-Public Facilities | 60 | 70 | Daytime (7:00am to 7:00pm |
| | 66 | 60 | Evening (7:00pm to 10:00pm) |
| | 45 | 50 | Nighttime (10:00pm to 7:00am) |

**Source:** City of Saratoga 2014.

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# 2 EXISTING NOISE CONDITIONS

Noise measurements were taken on and near the project site in March 2019 to characterize the existing noise environment. The daytime, short-term (1 hour or less) attended sound level measurements were taken with a SoftdB Piccolo sound-level meter. This sound-level meter meets the current American National Standards Institute standard for a Type 2 general purpose sound-level meter. The calibration of the sound-level meter was verified before and after the measurements were taken, and the measurements were conducted with the microphone positioned approximately 5 feet above the ground.

Four noise measurement locations (ST1, ST2, ST3 and ST4) were selected within or adjacent to the project site with unobstructed exposure to the roadways immediately adjacent to the property, two along Cox avenue, one at the project site, and on the corner of De Havilland Drive. The measurement locations are shown in Figure 3, Noise Measurement and Modeling Locations. The selected locations are representative of the worst-case traffic noise exposure for the subject property, and were also used for calibrating the traffic noise model (which was used to predict existing and future traffic noise exposure levels at the property and along selected streets).

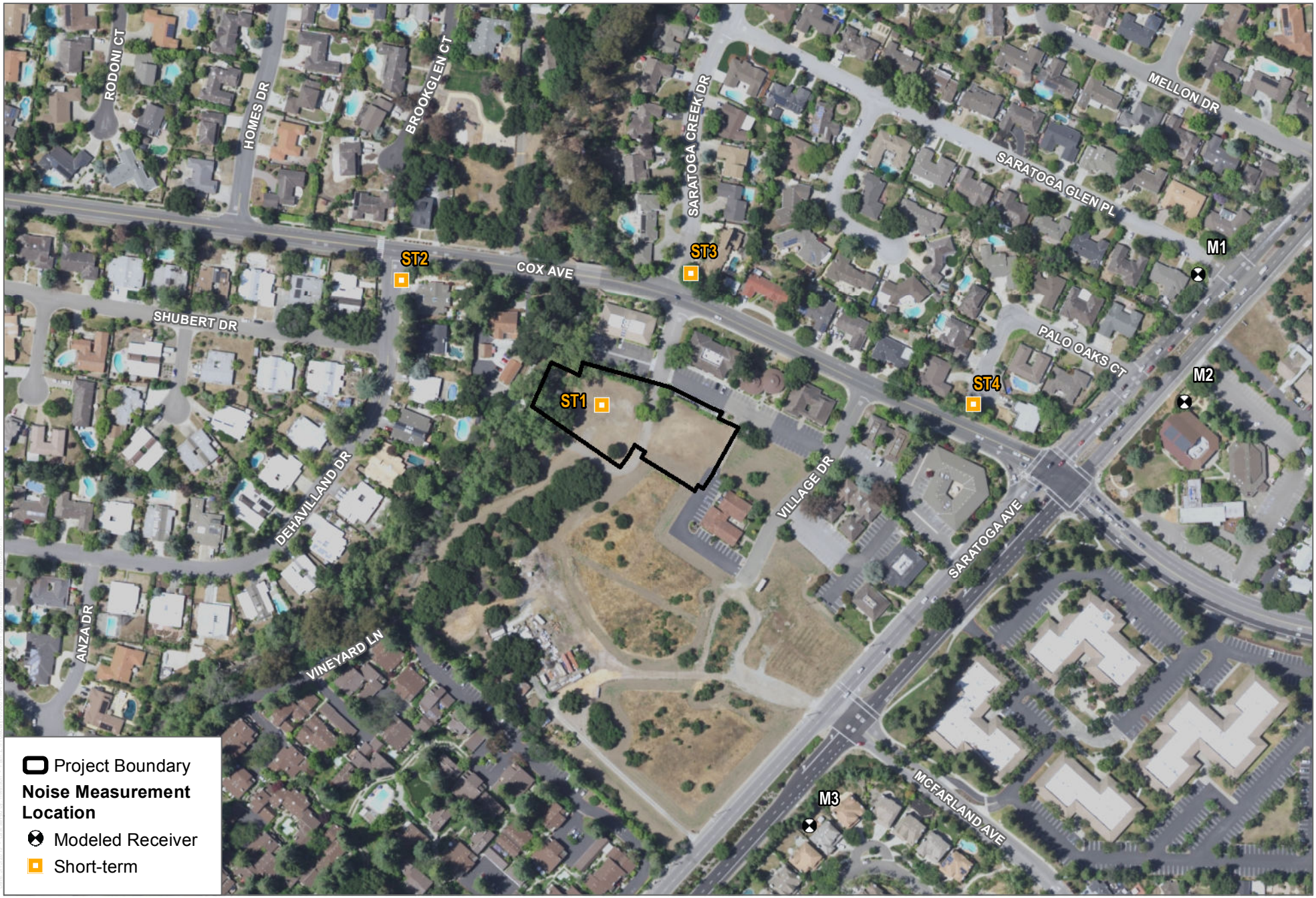
Manual traffic counts were also completed during the sound level measurements; measurement location descriptions, measured average noise levels, and traffic counts are provided in Table 4, Measured Noise Levels. Noise measurement data is also included in Appendix A, Ambient Noise Measurement Data. The primary noise sources at the measurement locations consisted of traffic along the adjacent roads.

**Table 4**
**Measured Noise Levels**

| Receptor | Location/Address | Date | Time | $L_{eq}$[1] (dBA) | Cars | MT[2] | HT[3] | Bus | MC[4] |
|---|---|---|---|---|---|---|---|---|---|
| ST1 | Project Site | March 19, 2019 | 11:50 Am to 12:05 PM | 64.9 | 118 | 4 | 0 | 0 | 2 |
| ST2 | De Havilland Drive and Cox Avenue | March 19, 2019 | 12:17 PM to 12:32 PM | 50.7 | 0 | 0 | 0 | 0 | 0 |
| ST3 | Saratoga Creek Drive and Cox Avenue | March 19, 2019 | 12:38 PM to 12:53 PM | 68.4 | 134 | 7 | 1 | 0 | 0 |
| ST4 | Cox Avenue | March 19, 2019 | 12:59 PM to 01:14 PM | 54.9 | 1 | 0 | 0 | 0 | 0 |

1 Equivalent continuous sound level (time-average sound level) in A-weighted decibels
2 Medium Truck
3 Heavy Truck
4 Motorcycle

The sound levels reported in Table 4 represent the average noise level across the measurement period at each of the four locations. Using the existing traffic volume data for Cox Avenue, and Saratoga Avenue from the Traffic Impact Analysis (TIA) (Fehr and Peers 2019), and employing the Federal Highway Administration (FHWA) Transportation Noise Model (TNM 2.5) (FHWA 2004), Dudek calculated the existing Day-Night Level (DNL) for the four short-term measurement points. Based on the traffic volume date provided by the TIA the calculated existing DNL at ST1 is 53 dBA; the calculated DNL at ST2 is 66 dBA; the calculated DNL at ST3 is 67 dBA; and the calculated DNL at ST4 is 59 dBA. The calculated sound levels at both ST2 and ST3 are above the "normally acceptable" limit of 60 dBA DNL for single-family residential land uses. The existing noise level at ST1 and ST4 falls within the exterior noise limit.




SOURCE: USDA 2016

DUDEK

0 130 260 Feet

**FIGURE 3**

Noise Measurement Locations

Palm Villas Project

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# 3 SIGNIFICANCE CRITERIA

Based on the criteria identified in Appendix G of the CEQA Guidelines, the proposed project would have a significant impact on noise if it would result in:

1. 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.
2. Generation of excessive groundborne vibration or groundborne noise levels.
3. 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.

## Vibration Significance Criteria

Impacts related to excessive ground-borne vibration would be significant if the project results in the exposure of persons to or generation of excessive ground-borne vibration equal to or in excess of 0.2 inches/second PPV. Construction activities within 200 feet and pile driving within 600 feet would be potentially disruptive to vibration-sensitive operations (Caltrans 2002).

# 4 IMPACTS AND MITIGATION

## 4.1 Traffic Noise

### 4.1.1 Impact Analysis

The primary noise-related effect that most non-industrial projects produce is a potential for on-site and off-site increases in traffic, which is the main source of noise in most urban areas. Acoustical calculations were performed for existing traffic levels (presented in *Section 2.1)* as traffic is often a major contributor to the ambient or community noise level, and it is helpful therefore to quantify existing traffic related noise levels. The vehicle trips associated with the proposed project were based on the trip generation estimated in the project's Traffic Impact Analysis (TIA). The project is expected to generate 21 AM peak hour trips and 28 PM peak hour trips.

Potential noise effects from vehicular traffic were assessed using the Federal Highway Administration's Traffic Noise Model version 2.5 (previously cited). Information used in the model included the roadway geometry, existing (year 2019), existing plus project, cumulative and cumulative plus project, and posted traffic speeds. Noise levels were modeled at representative noise-sensitive receivers ST1, ST2, ST3 and ST4 (discussed in Section 2); additionally, three modeled-only receivers (M1, M2, and M3) were used in the traffic noise model in order to provide additional information regarding potential traffic noise increases resulting from the proposed project. Receiver M1 was placed adjacent to residences along the west side of Saratoga Avenue, north of the intersection of Saratoga Avenue and Cox Avenue; receiver M2 was placed adjacent to a church along the east side of Saratoga Avenue, north of the intersection of Saratoga Avenue and Cox Avenue; and receiver M3 was placed adjacent to residences along the east side of Saratoga Avenue, south of the intersection of Saratoga Avenue and Cox Avenue. The measurement and modeling locations are shown in Figure 3.

The receivers were modeled to be 5 feet above the local ground elevation. The noise model results are summarized in Table 5, Off-Site Traffic Noise Modeling Results. The input and output files for the project are provided in Appendix B. The City does not have a specific noise criterion for evaluating off-site noise impacts to residences or noise-sensitive areas from project-related traffic. For the purposes of this noise analysis, such impacts are considered significant when they cause an increase of 3 dB from existing noise levels or cause an exceedance of the 65 dBA CNEL noise threshold. An increase or decrease in noise level of at least 3 dB is required before any noticeable change in community response would be expected (Caltrans 2013a).

The traffic noise modelling data summarized in Table 5 shows that the maximum noise level increase attributed to project-generated traffic would be 0 dB (when rounded to whole numbers).

Consequently, there would be no noticeable change in community response associated with the addition of project-generated traffic to the area roadway network, and the impact would be less than significant. No mitigation is required.

**Table 5**
**Off-Site Traffic Noise Modeling Results**

| Modeled Receiver # – Description | Existing (2019) Noise Level (dBA CNEL) | Existing (2019) Plus Project Noise Level (dBA CNEL) | Cumulative Noise Level (dBA CNEL) | Cumulative with Project Noise Level (dBA CNEL) | Maximum Project-Related Noise Level Increase (dB) |
|---|---|---|---|---|---|
| ST1 | 53 | 53 | 54 | 54 | 0 |
| ST2 | 66 | 66 | 67 | 67 | 0 |
| ST3 | 67 | 67 | 68 | 68 | 0 |
| ST4 | 59 | 59 | 60 | 60 | 0 |
| M1 | 67 | 67 | 68 | 68 | 0 |
| M2 | 68 | 68 | 69 | 69 | 0 |
| M3 | 61 | 61 | 62 | 62 | 0 |

**Notes:** See Appendix B for Details

During construction, workers and equipment will utilize the roadway network to access the project site. However, the number of worker vehicles and delivery trucks associated with the construction are not anticipated to represent more than a small percentage of the total daily trips related to normal project operations. The project would therefore result in less than significant traffic noise impacts.

## 4.2 Onsite Operations Noise Generation

### 4.2.1 Impact Analysis

The implementation of the project would also result in changes to existing noise levels on the project site by developing new stationary sources of noise. These sources may affect noise-sensitive vicinity land uses off the project site. The following analysis evaluates noise from exterior mechanical equipment.

**Outdoor Mechanical Equipment**

Important outdoor (exterior) mechanical equipment associated with the proposed project includes the following:

- (2) 5-ton Carrier(®) HVAC System

- (2) 3-ton Carrier(®) HVAC System
- (1) 45kW Generac(®) Standby Generator
- (1) 30 kW Generac(®) Standby Generator

The heating, ventilation, air conditioning (HVAC) units proposed for the project provide climate control for building interiors, and would run during operating hours for the facility; they were conservatively assumed to be in operation during daytime, evening and nighttime hours. All of the mechanical equipment are relatively close to one another, and would therefore tend to be additive with respect to noise effects upon adjacent properties. Dudek assessed the noise level associated with the proposed 5-ton, and 3-ton HVAC systems and the 30 kW and 45 kW generators as proposed under the project.

Dudek used sound ratings published by the manufacturer for each of the proposed new HVAC systems and generators. In order to assess noise levels from mechanical equipment operations along the common property boundary of the proposed project and neighboring residential properties, distance measurements were completed from the mechanical equipment locations to the nearest property line. Standard acoustic calculations were then performed to determine the distance attenuated noise level at the property line location for each of the mechanical noise sources. The proposed HVAC equipment and generators are located close to one another and would have a combined noise effect at the closest neighboring property lines, located to the west. The noise levels ($L_{eq}$) from the individual equipment, and the combined noise levels of all of the equipment, are shown in Table 6. The noise calculations and equipment specifications are provided in Appendix C.

**Table 6**
**Mechanical Equipment Operation Noise Summary of Results**

| Equipment | Noise Level at Property Boundary | |
|---|---|---|
| | *Distance to Property Line* | *Noise Level (dBA $L_{eq}$)* |
| 3-ton HVAC System[1] | 126 | 14.6 |
| 5-ton HVAC System[1] | 300 | 14.6 |

| | | |
|---|---|---|
| 30 kW Generator | 126 | *34.5* |
| 45 kW Generator | 300 | 34.5 |
| **Combined Mechanical Equipment Noise[2]** | | 34.5 |

1 Assumes continuous operation of mechanical equipment (daytime, evening and nighttime hours).
2 Assumes simultaneous operation of all mechanical equipment.

The results of the mechanical equipment operations noise analysis indicate that the project operations would comply with the City of Saratoga Noise Ordinance standards. Project operations would result in noise at residential property boundaries that are in each case below the applicable noise standards of 55 dBA daytime (7 a.m. to 7 p.m), 45 dBA evening (7 p.m. to 10 p.m.) and 40 dBA nighttime (10 p.m. to 7 a.m.)

**Parking Lot Activity**

Noise sources from parking lots include car alarms, door slams, radios, and tire squeals. These sources typically range from about 30 to 66 dBA at a distance of 100 feet (Gordon Bricken & Associates 1996), and are generally short-term and intermittent. Parking lots have the potential to generate noise levels that exceed 60 dBA depending on the location of the source; however, noise sources from the parking lot would be different from each other in kind, duration, and location, so that the overall effects would be separate and in most cases would not affect noise-sensitive receptors at the same time.

Parking lot operation, per se, is not regulated by the City of Saratoga Noise Ordinance. There are not noise regulations which restrict the hours of operation for a parking lot; noise sensitivity is at the highest for residents in the period between 10 PM and 7 AM (where sleep disruption could occur), and noise from any source should be avoided in this overnight period. Based on low number of vehicles that the project would generate even during peak AM and PM hours, it is anticipated that nighttime parking lot noise would be negligible.

*Emergency Response Vehicles*

The proposed senior assisted-living facility may, on occasion require emergency vehicle assistance, which may include the use of a siren. At a distance of approximately 50 feet, sirens could reach levels of 92 to 94 dBA $L_{max}$. The nearest residences would be located approximately 100 feet from the entrance driveway of the project site, and at this distance the maximum instantaneous noise levels would reach 88 to 90 dBA $L_{max}$. While these levels could be considered to be excessive, they would occur in short time spans and would be in response to emergencies. According to Chapter 7-30.030 of the City's Municipal Code, this type of noise

source is exempt from the established noise regulations. Additionally, based upon information provided by the applicant based upon similar facilities, the number of emergency response calls are anticipated to be quite small, averaging 3 to 6 such calls per year. Therefore, noise generated by emergency response vehicles would be less than significant.

### 4.2.2 Mitigation Measures

Implementation of the proposed project would not result in a significant operational noise impact; therefore, no mitigation is required.

**Significance after Mitigation**

Mitigation is not required because impacts would be less than significant without mitigation.

## 4.3 Construction Noise

Construction of the proposed project would generate noise that could expose nearby receptors to elevated noise levels that may disrupt communication and routine activities. The magnitude of the impact would depend on the type of construction activity, equipment, duration of the construction, distance between the noise source and receiver, and intervening structures. This section of the report discusses the noise levels calculated to result from construction of the project at nearby sensitive receptors (i.e., residences).

### 4.3.1 Construction – Equipment and Activity Description

The construction activities for the proposed project would include grading of the project site, building construction of the proposed Residential Care Facility for the Elderly, paving of the onsite roads and parking areas, and application of architectural coatings. Noise impacts from construction activities associated with the proposed project would be a function of the noise generated by construction equipment, equipment location, and sensitivity of nearby land uses, and the timing and duration of the construction activities. The nearest sensitive receptors to the project site are single-family homes located as close as 120 feet west of the project site. Other residential land uses are located further to the north, east, and south of the project site.

Construction noise is difficult to quantify because of the many variables involved, including the specific equipment types, size of equipment used, percentage of time, condition of each piece of equipment, and number of pieces of equipment that will actually operate on site. The range of maximum noise levels for various types of construction equipment at a distance of 50 feet is depicted in Table 7 Construction Equipment Noise Levels. The noise values represent maximum noise generation, or full-power operation of the equipment. As an example, a loader and two

dozers, all operating at full power and relatively close together, would generate a maximum sound level of approximately 90 dBA at 50 feet from their operations. As one increases the distance between equipment, and/or the separation of areas with simultaneous construction activity, dispersion and distance attenuation reduce the effects of separate noise sources added together. In addition, typical operating cycles may involve two minutes of full-power operation, followed by three or four minutes at lower levels. The average noise level during construction activity is generally lower, since maximum noise generation may only occur up to 50% of the time. Noise levels from construction operations decrease at a rate of approximately 6 dBA per doubling of distance from the source.

**Table 7**
**Construction Equipment Noise Emission Levels**

| Equipment | Typical Sound Level (dBA) 50 Feet from Source |
|---|---|
| Roller | 74 |
| Concrete vibrator | 76 |
| Pump | 76 |
| Saw | 76 |
| Backhoe | 80 |
| Air compressor | 81 |
| Generator | 81 |
| Compactor | 82 |
| Concrete pump | 82 |
| Crane, mobile | 83 |
| Concrete mixer | 85 |
| Dozer | 85 |
| Grader | 85 |
| Impact wrench | 85 |
| Loader | 85 |
| Pneumatic tool | 85 |
| Jackhammer | 88 |
| Truck | 88 |
| Paver | 89 |

**Source:** FTA 2018

The nearest point of construction activities to the closest noise-sensitive receivers (single-family residence located to the west) would be approximately 120 feet and the furthest would be approximately 445 feet. For construction noise, a concept called the “acoustic center” is useful in describing average noise levels across the entire construction period for adjacent receivers. The acoustic center is the idealized point from which the energy sum of all construction activity noise near and far would originate, and it is derived by taking the square root of the product of the

shortest distance multiplied by the furthest distance. For this project construction, the acoustic center is calculated to be 230 feet from the closest receiver. Thus, the distance to the nearest construction activities would be approximately 120 feet, but the typical or average construction sound exposure at these residences from distribution of construction activity across the site would be represented by modelling construction activities to be located the acoustic center, approximately 230 feet away from the closest noise-sensitive receivers.

### 4.3.1 Construction Noise Assessment

With the noise sources identified above, a noise analysis was performed using a model developed under the auspices of the Federal Highway Administration (FHWA) called the Roadway Construction Noise Model (RCNM) (FHWA 2008). Input variables for RCNM consist of the receiver / land use types, the equipment type (i.e., backhoe, crane, truck, etc.), the number of equipment pieces, the duty cycle for each piece of equipment (i.e., percentage of hours the equipment typically works per day), and the distance from the sensitive noise. The reader is referred to Appendix D for the inputs used in the RCNM model, as well as results.

The various construction equipment types and quantities (as described above) were used for this analysis. The RCNM has default duty cycle values for the various pieces of equipment, which were derived from an extensive study of typical construction activity patterns. Those default duty cycle values were utilized for this analysis.

No topographical or structural shielding was assumed in the modeling of construction noise (i.e., the receivers are modelled with no obstacles to the travel of sound between the construction activity and receiver location, a worst-case assumption). The noise levels from the proposed construction activities are summarized in Table 8 (Construction Noise Model Results Summary). The complete set of RCNM input and output data for construction noise is provided in Appendix D.

**Table 8**
**Construction Noise Model Results Summary**

| Receiver | Source / Receiver Distances (feet) | Construction Phase Noise Levels (dBA $L_{EQ}$) | | | | |
|---|---|---|---|---|---|---|
| | | *Site Preparation* | *Grading* | *Paving* | *Building Construction* | *Archit. Coating* |
| Nearest Residences (West of Project Site) | Nearest: 120 | 74 | 78 | 75 | 76 | 66 |
| | Acoustic Center: 230 | 69 | 72 | 70 | 71 | 60 |
| | | Construction Phase Noise Levels (dBA $L_{MAX}$) | | | | |

| Criteria | Reference Distance (feet) | *Site Preparation* | *Grading* | *Paving* | *Building Construction* | *Archit. Coating* |
|---|---|---|---|---|---|---|
| City Ordinance | 25 | 91 | 96 | 86 | 89 | 84 |

**Notes:** dBA = A-weighted decibels; $L_{EQ}$ = equivalent sound level, $L_{MAX}$ = maximum sound level

As shown in Table 8, at the nearest residences, noise levels would range from approximately 66 to 78 dBA $L_{EQ}$ when construction is taking place at or near the project boundary. More typical construction noise levels (represented by the acoustic center distance noise levels) at the residences to the west would range from approximately 60 to 72 dBA $L_{EQ.}$

The City regulates construction noise by establishing a maximum allowable noise level and restricting the allowable hours of construction. Section 7-30.060 of the City's Municipal Code states: "Construction, alteration, repair, and grading activities shall not exceed one hundred dBA measured at any point twenty-five feet or more from the source of noise. Such activities may be conducted between the hours of 7:30 A.M. and 6:00 P.M. Monday through Friday and between the hours of 9:00 A.M. and 5:00 P.M. on Saturday. Construction activities shall be prohibited on Sundays and weekday holidays." The ordinance limit described as maximum noise would equate to the RCNM $L_{MAX}$ values as displayed in Table 8

Based on the calculated results in the RCNM model using the applied City noise ordinance distance (i.e. 25 feet), the calculated dBA $L_{MAX}$ values would range from approximately 84 to 96 dBA $L_{MAX}$ and would therefore not exceed the City's significance threshold of 100 dBA at 25 feet.

Existing average noise levels associated with roadways in the vicinity of the project site range from 61 to 68 dBA $L_{EQ}$. Construction noise levels at the closest residence would range from 66 to 78 dBA $L_{EQ.}$ Thus construction noise levels at the closest residence could be up to 17 dBA above ambient noise levels, which would be clearly noticeable. With standard residential construction achieving an exterior to interior attenuation of approximately 25 dBA (with doors and windows closed), construction noise levels would not be expected to exceed 53 dBA $L_{EQ}$ in the interior of homes adjacent to the project site, which is well below the level at which normal conservational levels or dialogue from television or radio would be interfered with.

Average noise levels from construction activities may be annoying since levels are expected to be higher than the ambient noise level in the site vicinity. This is particularly true for the closest single family homes to the west of the project site. However, restricting construction activities to the daytime period (in accordance with noise ordinance requirements) will avoid disruption of evening relaxation and overnight sleep periods. Based upon the above discussion, short-term construction noise would be considered less than significant.

### 4.3.2 Mitigation Measures

The Palm Villas project is required to comply with the City of Saratoga construction noise ordinance. With adherence to the Ordinance the project would not result in a significant construction-related noise impact; therefore, no mitigation is required.

**Significance After Mitigation**

Mitigation is not required because impacts would be less than significant without mitigation.

## 4.4 Ground-borne Vibration

### 4.4.1 Impact Analysis

The main concern associated with ground-borne vibration is annoyance; however, in extreme cases, vibration can cause damage to buildings, particularly those that are old or otherwise fragile. Some common sources of ground-borne vibration are trains, and construction activities such as blasting, pile-driving, and heavy earth-moving equipment. The primary source of ground-borne vibration occurring as part of the proposed project is construction activity.

Groundborne vibration information related to construction activities has been collected by Caltrans (Caltrans 2013b). Information from Caltrans indicates that transient vibrations (such as construction activity) of approximately 0.035 inch per second PPV may be characterized as barely perceptible, and vibration levels of 0.24 inch per second PPV may be characterized as distinctly perceptible.

Groundborne vibration is typically attenuated over short distances. The heavier pieces of construction equipment, such as bulldozers, would have peak particle velocities of approximately 0.089 inches per second or less at a distance of 25 feet (FTA 2018). At the distance from the nearest residence to major construction activities (approximately 120 feet) and with the anticipated construction equipment, the peak particle velocity would be approximately 0.0103 inches per second. This vibration level would be below the level considered barely perceptible, and well below the level considered distinctly perceptible.

The major concern with regard to construction vibration is related to building damage. Pile driving, blasting, or other special construction techniques would not be necessary for construction of the proposed project; therefore, excessive groundborne vibration and groundborne noise are not anticipated. In particular, construction vibration as a result of the proposed project would not result in structural building damage, which typically occurs at vibration levels of 0.5 inches per second or greater for buildings of reinforced-concrete, steel, or timber construction, or 0.2 inches per second for typical residential construction. At the distance from the nearest residence to major construction activities (approximately 120 feet) and with the anticipated construction equipment, the peak particle velocity would be approximately 0.0085 inches per second, which is well below the damage threshold. Groundborne vibration would not be associated with the proposed project following construction activities. Ground vibrations from construction activities do not often reach the levels that can damage structures or affect activities that are not vibration-sensitive, although the vibrations may be felt by nearby persons in close proximity and result in annoyance (FTA 2018).Impacts related to groundborne vibration would be less than significant. No mitigation is required.

### 4.4.2 Mitigation Measures

The Palm Villas Project implementation would not result in a significant ground-borne vibration impact; therefore, no mitigation is required.

**Significance After Mitigation**

Mitigation is not required because impacts would be less than significant without mitigation.

# 5 REFERENCES

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# APPENDIX A

*Ambient Noise*
*Measurement Data*

DUDEK
CREATOR OF KERATA TECHNOLOGY

# FIELD DATA REPORT

## Field Noise Measurement Data

| Record: 1139 | |
|---|---|
| **Project Name** | *Palm Villas* |
| **Project #** | *10738* |
| **Observer(s)** | |
| **Date** | *2019-03-19* |

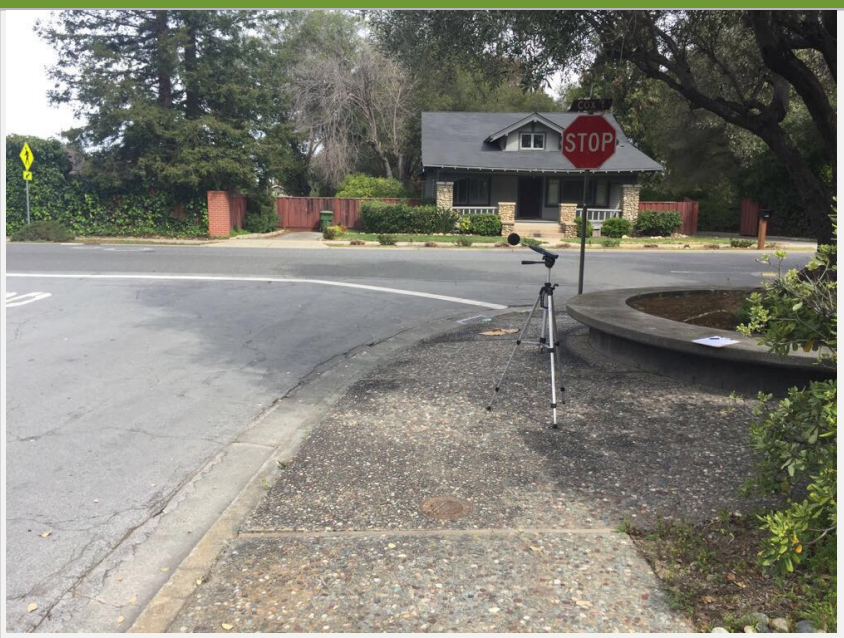
| Instrument and Calibrator Information | |
|---|---|
| **Instrument Name List** | *(SB) LD 820* |
| **Instrument Name** | *(SB) LD 820* |
| **Instrument Name Lookup Key** | *(SB) LD 820* |
| **Manufacturer** | *Larson Davis* |
| **Model** | *LD 820* |
| **Serial Number** | *1534* |
| **Calibration Date** | *03/19/19* |
| **Calibrator Name** | *(SB) LD CAL200* |
| **Calibrator Name** | *(SB) LD CAL200* |
| **Calibrator Name Lookup Key** | *(SB) LD CAL200* |
| **Calibrator Manufacturer** | *Larson Davis* |
| **Calibrator Model** | *LD CAL200* |
| **Calibrator Serial #** | *4496* |
| **GPS Assistance Used** | *No* |

| Monitoring | |
|---|---|
| **Record #** | *1* |
| **Site ID** | *ST2* |
| **Site Location Lat/Long** | *37.282222, -122.007515* |
| **Begin (Time)** | *11:50:00* |
| **End (Time)** | *12:05:00* |
| **Leq** | *64.9* |
| **Lmax** | *74.8* |
| **Lmin** | *39.6* |
| **Other Lx (Specify Metric)** | *L* |
| **Primary Noise Source** | *Traffic* |
| **Other Noise Sources (Background)** | *Birds, Distant Traffic, Rustling Leaves* |
| **Other Noise Sources Additional Description** | |
| **Is the same instrument and calibrator being used as previously noted?** | *Yes* |
| **Are the meteorological conditions the same as previously noted?** | *No* |

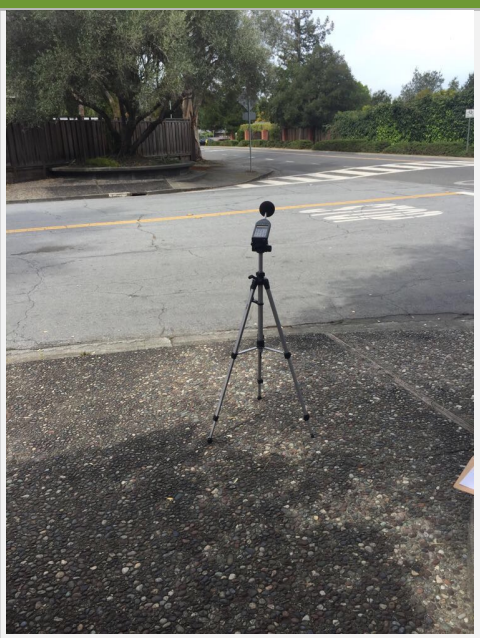
| Source Info and Traffic Counts | |
|---|---|
| **Number of Lanes** | *2* |
| **Lane Width (feet)** | *10* |
| **Roadway Width (feet)** | *20* |
| **Roadway Width (m)** | *6.1* |
| **Distance to Roadway (feet)** | *10* |
| **Distance to Roadway (m)** | *3* |
| **Distance Measured to Centerline or Edge of Pavement?** | *Edge of Pavement* |
| **Roadway Type** | *Arterial* |
| **Estimated Vehicle Speed (MPH)** | *35* |
| **Speeds Estimated by:** | *Driving the Pace* |
| **Posted Speed Limit Sign (MPH)** | *35* |

| Traffic Counts | |
|---|---|
| **Vehicle Count Summary** | *A 118, MT 4, HT 0, B 0, MC 2* |
| **Select Method for Recording Count Duration** | *Enter Manually* |
| **Counting Both Directions?** | *Yes* |
| **Count Duration (minutes)** | *15* |
| **Vehicle Count Tally** | |
| **Select Method for Vehicle Counts** | *Use Counter (+/-)* |
| **Number of Vehicles - Autos** | *118* |
| **Number of Vehicles - Medium Trucks** | *4* |
| **Number of Vehicles - Heavy Trucks** | *0* |
| **Number of Vehicles - Buses** | *0* |
| **Number of Vehicles - Motorcyles** | *2* |

| Description / Photos | |
|---|---|
| **Terrain** | *Hard* |

| Site Photos | |
|---|---|
| **Photo** |  |
| **Comments / Description** | *Side angle* |

## Site Photos

| | |
|---|---|
| **Photo** |  |
| **Comments / Description** | *Front angle view* |

## Meteorological Conditions

| | |
|---|---|
| **Temp (F)** | *77* |
| **Humidity % (R.H.)** | *36* |
| **Wind** | *Calm* |
| **Wind Speed (MPH)** | *0.1* |
| **Sky** | *Partly Cloudy* |

## Monitoring

| | |
|---|---|
| **Record #** | *2* |
| **Site ID** | *ST1* |
| **Site Location Lat/Long** | *37.281519, -122.006017* |
| **Begin (Time)** | *12:17:00* |
| **End (Time)** | *12:32:00* |
| **Leq** | *50.7* |
| **Lmax** | *57.6* |
| **Lmin** | *45.8* |
| **Other Lx (Specify Metric)** | *L* |
| **Primary Noise Source** | *Traffic* |
| **Other Noise Sources (Background)** | *Birds, Distant Conversations / Yelling, Distant Dog Barking, Distant Traffic, Rustling Leaves* |
| **Other Noise Sources Additional Description** | *Birds chirping loudly in area* |
| **Is the same instrument and calibrator being used as previously noted?** | *Yes* |
| **Are the meteorological conditions the same as previously noted?** | *No* |

| Description / Photos | |
|---|---|
| **Terrain** | *Soft* |

| Site Photos | |
|---|---|
| **Photo** |  |

| Meteorological Conditions | |
|---|---|
| **Temp (F)** | *71* |
| **Humidity % (R.H.)** | *30* |
| **Wind** | *Light* |
| **Wind Speed (MPH)** | *4* |
| **Sky** | *Partly Cloudy* |

| Monitoring | |
|---|---|
| **Record #** | *3* |
| **Site ID** | *ST3* |
| **Site Location Lat/Long** | *37.282041, -122.005342* |
| **Begin (Time)** | *12:38:00* |
| **End (Time)** | *12:53:00* |
| **Leq** | *68.4* |
| **Lmax** | *79.9* |
| **Lmin** | *49.1* |
| **Other Lx (Specify Metric)** | *L* |
| **Primary Noise Source** | *Traffic* |
| **Other Noise Sources (Background)** | *Birds, Distant Conversations / Yelling, Distant Traffic, Rustling Leaves* |
| **Is the same instrument and calibrator being used as previously noted?** | *Yes* |
| **Are the meteorological conditions the same as previously noted?** | *No* |

| Source Info and Traffic Counts | |
|---|---|
| **Number of Lanes** | *2* |
| **Lane Width (feet)** | *10* |
| **Roadway Width (feet)** | *20* |
| **Roadway Width (m)** | *6.1* |
| **Distance to Roadway (feet)** | *7* |
| **Distance to Roadway (m)** | *2.1* |
| **Distance Measured to Centerline or Edge of Pavement?** | *Edge of Pavement* |
| **Roadway Type** | *Arterial* |
| **Estimated Vehicle Speed (MPH)** | *35* |
| **Speeds Estimated by:** | *Driving the Pace* |
| **Posted Speed Limit Sign (MPH)** | *35* |

| Traffic Counts | |
|---|---|
| **Vehicle Count Summary** | *A 134, MT 7, HT 0, B 0, MC 0* |
| **Select Method for Recording Count Duration** | *Enter Manually* |
| **Counting Both Directions?** | *Yes* |
| **Count Duration (minutes)** | *15* |
| **Vehicle Count Tally** | |
| **Select Method for Vehicle Counts** | *Use Counter (+/-)* |
| **Number of Vehicles - Autos** | *134* |
| **Number of Vehicles - Medium Trucks** | *7* |
| **Number of Vehicles - Heavy Trucks** | *0* |
| **Number of Vehicles - Buses** | *0* |
| **Number of Vehicles - Motorcyles** | *0* |

| Description / Photos | |
|---|---|
| **Terrain** | *Soft* |

| Site Photos | |
|---|---|
| **Photo** |  |

| Meteorological Conditions | |
|---|---|
| **Temp (F)** | *77* |
| **Humidity % (R.H.)** | *53* |
| **Wind** | *Calm* |
| **Wind Speed (MPH)** | *0.1* |
| **Sky** | *Partly Cloudy* |

| Monitoring | |
|---|---|
| **Record #** | *4* |
| **Site ID** | *ST4* |
| **Site Location Lat/Long** | *37.281765, -122.003538* |
| **Begin (Time)** | *12:59:00* |
| **End (Time)** | *13:14:00* |
| **Leq** | *54.9* |
| **Lmax** | *64.2* |
| **Lmin** | *43.2* |
| **Other Lx (Specify Metric)** | *L* |
| **Primary Noise Source** | *Traffic* |
| **Other Noise Sources (Background)** | *Birds, Distant Conversations / Yelling, Distant Traffic, Rustling Leaves* |
| **Other Noise Sources Additional Description** | *Intermittent fence behind monitor with openings to cox ave* |
| **Is the same instrument and calibrator being used as previously noted?** | *Yes* |
| **Are the meteorological conditions the same as previously noted?** | *No* |

| Source Info and Traffic Counts | |
|---|---|
| **Number of Lanes** | *2* |
| **Lane Width (feet)** | *8* |
| **Roadway Width (feet)** | *16* |
| **Roadway Width (m)** | *4.9* |
| **Distance to Roadway (feet)** | *5* |
| **Distance to Roadway (m)** | *1.5* |
| **Distance Measured to Centerline or Edge of Pavement?** | *Centerline* |
| **Roadway Type** | *Residential* |
| **Estimated Vehicle Speed (MPH)** | *10* |
| **Speeds Estimated by:** | *Driving the Pace* |
| **Posted Speed Limit Sign (MPH)** | *25* |

| Traffic Counts | |
|---|---|
| **Vehicle Count Summary** | *A 1, MT 0, HT 0, B 0, MC 0* |
| **Select Method for Recording Count Duration** | *Enter Manually* |
| **Counting Both Directions?** | *Yes* |
| **Count Duration (minutes)** | *15* |
| **Vehicle Count Tally** | |
| **Select Method for Vehicle Counts** | *Use Counter (+/-)* |
| **Number of Vehicles - Autos** | *1* |
| **Number of Vehicles - Medium Trucks** | *0* |
| **Number of Vehicles - Heavy Trucks** | *0* |
| **Number of Vehicles - Buses** | *0* |
| **Number of Vehicles - Motorcyles** | *0* |

| Description / Photos | |
|---|---|
| **Terrain** | *Hard* |

| Site Photos | |
|---|---|
| **Photo** |  |

| Meteorological Conditions | |
|---|---|
| **Temp (F)** | *77* |
| **Humidity % (R.H.)** | *31* |
| **Wind** | *Light* |
| **Wind Speed (MPH)** | *2* |
| **Sky** | *Partly Cloudy* |

# APPENDIX B

*FHWA Traffic Model*
*Noise Calculation Worksheets*

Dudek 28 May 2019
MG NL TNM 2.5

INPUT: ROADWAYS
PROJECT/CONTRACT: 10738
RUN: Palm Villas - Existing

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

| Roadway Name | Width | Points Name | No. | Coordinates (pavement) X | Y | Z | Flow Control Control Device | Speed Constraint | Percent Vehicles Affected | Segment Pvmt Type | On Struct? |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | ft | | | ft | ft | ft | | mph | % | | |
| Cox Avenue west of Saratoga Creek Dr | 46.0 | point1 | 1 | 1,157.1 | 2,443.9 | 300.00 | | | | Average | |
| | | point3 | 3 | 1,509.8 | 2,422.5 | 300.00 | | | | Average | |
| | | point4 | 4 | 1,832.8 | 2,397.7 | 300.00 | | | | Average | |
| | | point5 | 5 | 2,178.6 | 2,370.2 | 300.00 | | | | Average | |
| | | point6 | 6 | 2,313.6 | 2,355.0 | 300.00 | | | | Average | |
| | | point7 | 7 | 2,426.9 | 2,334.4 | 300.00 | | | | | |
| Roadway1-2-2 | 12.0 | point34 | 34 | 1,731.6 | 1,948.0 | 300.00 | | | | Average | |
| | | point31 | 31 | 1,820.1 | 2,092.1 | 300.00 | | | | Average | |
| | | point32 | 32 | 1,828.8 | 2,182.4 | 300.00 | | | | Average | |
| | | point2 | 2 | 1,828.8 | 2,380.2 | 300.00 | | | | | |
| Roadway1-2-2 | 12.0 | point36 | 36 | 2,588.9 | 1,779.7 | 300.00 | | | | Average | |
| | | point26 | 26 | 2,616.3 | 1,858.4 | 300.00 | | | | Average | |
| | | point27 | 27 | 2,681.9 | 1,938.3 | 300.00 | | | | Average | |
| | | point28 | 28 | 2,748.6 | 2,038.9 | 300.00 | | | | Average | |
| | | point29 | 29 | 2,795.6 | 2,152.6 | 300.00 | | | | | |
| Saratoga Avenue south of Cox Avenue | 95.0 | point38 | 38 | 2,212.6 | 805.3 | 300.00 | | | | Average | |
| | | point19 | 19 | 2,299.3 | 900.4 | 300.00 | | | | Average | |
| | | point20 | 20 | 2,424.7 | 1,052.0 | 300.00 | | | | Average | |
| | | point21 | 21 | 2,547.3 | 1,199.4 | 300.00 | | | | Average | |
| | | point22 | 22 | 2,788.4 | 1,503.8 | 300.00 | | | | Average | |
| | | point23 | 23 | 3,204.9 | 2,005.8 | 300.00 | | | | | |
| Saratoga Avenue north of Cox Avenue | 95.0 | point39 | 39 | 3,207.6 | 2,008.9 | 300.00 | | | | Average | |
| | | point24 | 24 | 3,594.7 | 2,461.6 | 300.00 | | | | | |
| Cox Avenue west of Saratoga Avenue | 46.0 | point40 | 40 | 2,432.7 | 2,332.5 | 300.00 | | | | Average | |
| | | point8 | 8 | 2,542.3 | 2,282.0 | 300.00 | | | | Average | |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | point9 | 9 | 2,630.0 | 2,246.0 | 300.00 | | | | Average | |
| | | point10 | 10 | 2,800.5 | 2,178.2 | 300.00 | | | | Average | |
| | | point11 | 11 | 3,093.0 | 2,055.2 | 300.00 | | | | Average | |
| | | point12 | 12 | 3,157.0 | 2,032.3 | 300.00 | | | | Average | |
| | | point13 | 13 | 3,206.8 | 2,007.1 | 300.00 | | | | | |
| Cox Avenue east of Saratoga Avenue | 46.0 | point41 | 41 | 3,206.8 | 2,007.1 | 300.00 | | | | Average | |
| | | point14 | 14 | 3,241.8 | 1,986.3 | 300.00 | | | | Average | |
| | | point15 | 15 | 3,393.0 | 1,871.2 | 300.00 | | | | Average | |
| | | point16 | 16 | 3,482.6 | 1,824.4 | 300.00 | | | | Average | |
| | | point17 | 17 | 3,569.4 | 1,784.4 | 300.00 | | | | | |
| Saratoga Creek Drive south of Cox Ave | 24.0 | point42 | 42 | 2,362.8 | 2,120.8 | 300.00 | | | | Average | |
| | | point43 | 43 | 2,436.2 | 2,317.9 | 300.00 | | | | | |
| Roadway12 | 24.0 | point44 | 44 | 2,444.9 | 2,338.2 | 0.00 | | | | Average | |
| | | point45 | 45 | 2,500.0 | 2,460.9 | 0.00 | | | | | |

**Dudek** **28 May 2019**
**MG NL** **TNM 2.5**

**INPUT: TRAFFIC FOR LAeq1h Volumes**
**PROJECT/CONTRACT:** 10738
**RUN:** Palm Villas - 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 |
| Cox Avenue west of Saratoga Creek Dr | point1 | 1 | 975 | 35 | 20 | 35 | 10 | 35 | 0 | 0 | 0 | 0 |
| | point3 | 3 | 975 | 35 | 20 | 35 | 10 | 35 | 0 | 0 | 0 | 0 |
| | point4 | 4 | 975 | 35 | 20 | 35 | 10 | 35 | 0 | 0 | 0 | 0 |
| | point5 | 5 | 975 | 35 | 20 | 35 | 10 | 35 | 0 | 0 | 0 | 0 |
| | point6 | 6 | 975 | 35 | 20 | 35 | 10 | 35 | 0 | 0 | 0 | 0 |
| | point7 | 7 | | | | | | | | | | |
| Roadway1-2-2 | point34 | 34 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | point31 | 31 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | point32 | 32 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | point2 | 2 | | | | | | | | | | |
| Roadway1-2-2 | point36 | 36 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | point26 | 26 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | point27 | 27 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | point28 | 28 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | point29 | 29 | | | | | | | | | | |
| Saratoga Avenue south of Cox Avenue | point38 | 38 | 2815 | 40 | 58 | 40 | 29 | 40 | 0 | 0 | 0 | 0 |
| | point19 | 19 | 2815 | 40 | 58 | 40 | 29 | 40 | 0 | 0 | 0 | 0 |
| | point20 | 20 | 2815 | 40 | 58 | 40 | 29 | 40 | 0 | 0 | 0 | 0 |
| | point21 | 21 | 2815 | 40 | 58 | 40 | 29 | 40 | 0 | 0 | 0 | 0 |
| | point22 | 22 | 2815 | 40 | 58 | 40 | 29 | 40 | 0 | 0 | 0 | 0 |
| | point23 | 23 | | | | | | | | | | |
| Saratoga Avenue north of Cox Avenue | point39 | 39 | 2443 | 40 | 50 | 40 | 25 | 40 | 0 | 0 | 0 | 0 |
| | point24 | 24 | | | | | | | | | | |

**INPUT: TRAFFIC FOR LAeq1h Volumes** **10738**

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cox Avenue west of Saratoga Avenue | point40 | 40 | 1018 | 35 | 21 | 35 | 10 | 35 | 0 | 0 | 0 | 0 |
| | point8 | 8 | 1018 | 35 | 21 | 35 | 10 | 35 | 0 | 0 | 0 | 0 |
| | point9 | 9 | 1018 | 35 | 21 | 35 | 10 | 35 | 0 | 0 | 0 | 0 |
| | point10 | 10 | 1018 | 35 | 21 | 35 | 10 | 35 | 0 | 0 | 0 | 0 |
| | point11 | 11 | 1018 | 35 | 21 | 35 | 10 | 35 | 0 | 0 | 0 | 0 |
| | point12 | 12 | 1018 | 35 | 21 | 35 | 10 | 35 | 0 | 0 | 0 | 0 |
| | point13 | 13 | | | | | | | | | | |
| Cox Avenue east of Saratoga Avenue | point41 | 41 | 830 | 40 | 17 | 40 | 9 | 40 | 0 | 0 | 0 | 0 |
| | point14 | 14 | 830 | 40 | 17 | 40 | 9 | 40 | 0 | 0 | 0 | 0 |
| | point15 | 15 | 830 | 40 | 17 | 40 | 9 | 40 | 0 | 0 | 0 | 0 |
| | point16 | 16 | 830 | 40 | 17 | 40 | 9 | 40 | 0 | 0 | 0 | 0 |
| | point17 | 17 | | | | | | | | | | |
| Saratoga Creek Drive south of Cox Ave | point42 | 42 | 10 | 25 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | point43 | 43 | | | | | | | | | | |
| Roadway12 | point44 | 44 | 52 | 25 | 1 | 25 | 1 | 25 | 0 | 0 | 0 | 0 |
| | point45 | 45 | | | | | | | | | | |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Dudek** | | | | | | **28 May 2019** | | | | | |
| **MG NL** | | | | | | **TNM 2.5** | | | | | |
| **INPUT: RECEIVERS** | | | | | | | | | | | |
| **PROJECT/CONTRACT:** | **10738** | | | | | | | | | | |
| **RUN:** | **Palm Villas - 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 | 2,274.7 | 2,099.0 | 300.00 | 5.00 | 0.00 | 66 | 10.0 | 8.0 | Y |
| ST2 | 2 | 1 | 1,852.1 | 2,361.9 | 300.00 | 5.00 | 0.00 | 66 | 10.0 | 8.0 | Y |
| ST3 | 3 | 1 | 2,398.5 | 2,367.7 | 300.00 | 5.00 | 0.00 | 66 | 10.0 | 8.0 | Y |
| ST4 | 4 | 1 | 3,044.2 | 2,130.5 | 300.00 | 5.00 | 0.00 | 66 | 10.0 | 8.0 | Y |
| M1 | 5 | 1 | 3,314.1 | 2,267.0 | 300.00 | 5.00 | 0.00 | 66 | 10.0 | 8.0 | |
| M2 | 6 | 1 | 3,367.0 | 2,049.1 | 300.00 | 5.00 | 0.00 | 66 | 10.0 | 8.0 | |
| M3 | 7 | 1 | 2,706.2 | 1,247.8 | 300.00 | 5.00 | 0.00 | 66 | 10.0 | 8.0 | |

Dudek 28 May 2019
MG NL TNM 2.5

INPUT: BARRIERS
PROJECT/CONTRACT: 10738
RUN: Palm Villas - Existing

| Barrier | | | | | | | | | Points | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Name | Type | Height | | If Wall | If Berm | | | Add'tnl | Name | No. | Coordinates (bottom) | | | Height | Segment | | | | |
| | | Min | Max | $ per Unit Area | $ per Unit Vol. | Top Width | Run:Rise | $ per Unit Length | | | X | Y | Z | at Point | Seg Ht Incre-ment | Perturbs #Up | #Dn | On Struct? | Important Reflec-tions? |
| | | ft | ft | $/sq ft | $/cu yd | ft | ft:ft | $/ft | | | ft | ft | ft | ft | ft | | | | |
| Barrier1 | W | 0.00 | 99.99 | 0.00 | | | | 0.00 | point1 | 1 | 2,254.3 | 2,249.1 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point3 | 3 | 2,263.0 | 2,309.0 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point4 | 4 | 2,373.2 | 2,281.2 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point5 | 5 | 2,361.1 | 2,222.2 | 300.00 | 12.00 | | | | | |
| Barrier1-2-2 | W | 0.00 | 99.99 | 0.00 | | | | 0.00 | point37 | 37 | 1,875.0 | 2,097.1 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point26 | 26 | 1,879.2 | 2,325.1 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point27 | 27 | 1,948.1 | 2,326.5 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point28 | 28 | 1,938.4 | 2,090.9 | 300.00 | 12.00 | | | | | |
| Barrier1-2-2-2-2 | W | 0.00 | 99.99 | 0.00 | | | | 0.00 | point39 | 39 | 2,996.5 | 2,207.0 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point30 | 30 | 2,970.3 | 2,151.2 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point31 | 31 | 2,527.4 | 2,336.0 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point32 | 32 | 2,555.9 | 2,398.9 | 300.00 | 12.00 | | | | | |
| Barrier1-2-2-2-2-2-2 | W | 0.00 | 99.99 | 0.00 | | | | 0.00 | point41 | 41 | 3,118.8 | 2,265.1 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point34 | 34 | 3,262.0 | 2,210.0 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point35 | 35 | 3,215.2 | 2,138.4 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point2 | 2 | 3,082.9 | 2,188.0 | 300.00 | 12.00 | | | | | |
| Barrier1-2-2 | W | 0.00 | 99.99 | 0.00 | | | | 0.00 | point43 | 43 | 2,011.5 | 2,185.3 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point20 | 20 | 2,040.4 | 2,184.6 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point21 | 21 | 2,041.8 | 2,225.2 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point22 | 22 | 2,067.9 | 2,223.8 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point23 | 23 | 2,068.6 | 2,279.6 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point24 | 24 | 2,011.5 | 2,282.4 | 300.00 | 12.00 | | | | | |
| Barrier1-2-2 | W | 0.00 | 99.99 | 0.00 | | | | 0.00 | point45 | 45 | 2,432.3 | 2,215.3 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point7 | 7 | 2,449.6 | 2,262.2 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point8 | 8 | 2,548.6 | 2,224.0 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point9 | 9 | 2,533.8 | 2,176.2 | 300.00 | 12.00 | | | | | |
| Barrier1-2-2-2-2 | W | 0.00 | 99.99 | 0.00 | | | | 0.00 | point47 | 47 | 2,550.3 | 2,167.6 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point11 | 11 | 2,611.0 | 2,191.0 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point12 | 12 | 2,640.6 | 2,182.3 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point13 | 13 | 2,641.4 | 2,148.5 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point14 | 14 | 2,626.7 | 2,136.3 | 300.00 | 12.00 | | | | | |
| Barrier1-2-2-2-2-2-2 | W | 0.00 | 99.99 | 0.00 | | | | 0.00 | point49 | 49 | 2,663.1 | 2,121.6 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point16 | 16 | 2,676.2 | 2,171.9 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point17 | 17 | 2,749.0 | 2,142.4 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point18 | 18 | 2,737.8 | 2,085.1 | 300.00 | 12.00 | | | | | |

| | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Barrier16 | W | 0.00 | 99.99 | 0.00 | | | | 0.00 | point50 | 50 | 2,483.3 | 998.8 | 300.00 | 6.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point51 | 51 | 2,976.3 | 1,624.8 | 300.00 | 6.00 | | | | | |
| Barrier17 | W | 0.00 | 99.99 | 0.00 | | | | 0.00 | point52 | 52 | 2,956.5 | 2,151.9 | 300.00 | 7.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point53 | 53 | 3,165.1 | 2,057.3 | 300.00 | 7.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point54 | 54 | 3,270.8 | 2,211.3 | 300.00 | 7.00 | | | | | |

Dudek
MG NL
28 May 2019
TNM 2.5
Calculated with TNM 2.5

RESULTS: SOUND LEVELS
PROJECT/CONTRACT: 10738
RUN: Palm Villas - Existing
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 | Crit'n | Increase over existing Calculated | Crit'n Sub'l Inc | Type Impact | With Barrier Calculated LAeq1h | Noise Reduction Calculated | Goal | Calculated minus Goal |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | dBA | dBA | dBA | dB | dB | | dBA | dB | dB | dB |
| ST1 | 1 | 1 | 0.0 | 52.5 | 66 | 52.5 | 10 | ---- | 52.5 | 0.0 | 8 | -8.0 |
| ST2 | 2 | 1 | 0.0 | 66.3 | 66 | 66.3 | 10 | Snd Lvl | 66.3 | 0.0 | 8 | -8.0 |
| ST3 | 3 | 1 | 0.0 | 67.2 | 66 | 67.2 | 10 | Snd Lvl | 67.2 | 0.0 | 8 | -8.0 |
| ST4 | 4 | 1 | 0.0 | 58.7 | 66 | 58.7 | 10 | ---- | 58.7 | 0.0 | 8 | -8.0 |
| M1 | 5 | 1 | 0.0 | 67.2 | 66 | 67.2 | 10 | Snd Lvl | 67.2 | 0.0 | 8 | -8.0 |
| M2 | 6 | 1 | 0.0 | 67.5 | 66 | 67.5 | 10 | Snd Lvl | 67.5 | 0.0 | 8 | -8.0 |
| M3 | 7 | 1 | 0.0 | 60.9 | 66 | 60.9 | 10 | ---- | 60.9 | 0.0 | 8 | -8.0 |

| Dwelling Units | # DUs | Noise Reduction Min | Avg | Max |
|---|---|---|---|---|
| | | dB | dB | dB |
| All Selected | 7 | 0.0 | 0.0 | 0.0 |
| All Impacted | 4 | 0.0 | 0.0 | 0.0 |
| All that meet NR Goal | 0 | 0.0 | 0.0 | 0.0 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Dudek** | | | | | **28 May 2019** | | | | | | |
| **MG NL** | | | | | **TNM 2.5** | | | | | | |
| **INPUT: ROADWAYS** | | | | | | | **Average pavement type shall be used unless** | | | | |
| **PROJECT/CONTRACT:** | **10738** | | | | | | **a State highway agency substantiates the use** | | | | |
| **RUN:** | **Palm Villas - Existing with 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 | % | | |
| Cox Avenue west of Saratoga Creek Dr | 46.0 | point1 | 1 | 1,157.1 | 2,443.9 | 300.00 | | | | Average | |
| | | point3 | 3 | 1,509.8 | 2,422.5 | 300.00 | | | | Average | |
| | | point4 | 4 | 1,832.8 | 2,397.7 | 300.00 | | | | Average | |
| | | point5 | 5 | 2,178.6 | 2,370.2 | 300.00 | | | | Average | |
| | | point6 | 6 | 2,313.6 | 2,355.0 | 300.00 | | | | Average | |
| | | point7 | 7 | 2,426.9 | 2,334.4 | 300.00 | | | | | |
| Roadway1-2-2 | 12.0 | point34 | 34 | 1,731.6 | 1,948.0 | 300.00 | | | | Average | |
| | | point31 | 31 | 1,820.1 | 2,092.1 | 300.00 | | | | Average | |
| | | point32 | 32 | 1,828.8 | 2,182.4 | 300.00 | | | | Average | |
| | | point2 | 2 | 1,828.8 | 2,380.2 | 300.00 | | | | | |
| Roadway1-2-2 | 12.0 | point36 | 36 | 2,588.9 | 1,779.7 | 300.00 | | | | Average | |
| | | point26 | 26 | 2,616.3 | 1,858.4 | 300.00 | | | | Average | |
| | | point27 | 27 | 2,681.9 | 1,938.3 | 300.00 | | | | Average | |
| | | point28 | 28 | 2,748.6 | 2,038.9 | 300.00 | | | | Average | |
| | | point29 | 29 | 2,795.6 | 2,152.6 | 300.00 | | | | | |
| Saratoga Avenue south of Cox Avenue | 95.0 | point38 | 38 | 2,212.6 | 805.3 | 300.00 | | | | Average | |
| | | point19 | 19 | 2,299.3 | 900.4 | 300.00 | | | | Average | |
| | | point20 | 20 | 2,424.7 | 1,052.0 | 300.00 | | | | Average | |
| | | point21 | 21 | 2,547.3 | 1,199.4 | 300.00 | | | | Average | |
| | | point22 | 22 | 2,788.4 | 1,503.8 | 300.00 | | | | Average | |
| | | point23 | 23 | 3,204.9 | 2,005.8 | 300.00 | | | | | |
| Saratoga Avenue north of Cox Avenue | 95.0 | point39 | 39 | 3,207.6 | 2,008.9 | 300.00 | | | | Average | |
| | | point24 | 24 | 3,594.7 | 2,461.6 | 300.00 | | | | | |
| Cox Avenue west of Saratoga Avenue | 46.0 | point40 | 40 | 2,432.7 | 2,332.5 | 300.00 | | | | Average | |
| | | point8 | 8 | 2,542.3 | 2,282.0 | 300.00 | | | | Average | |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | point9 | 9 | 2,630.0 | 2,246.0 | 300.00 | | | | Average | |
| | | point10 | 10 | 2,800.5 | 2,178.2 | 300.00 | | | | Average | |
| | | point11 | 11 | 3,093.0 | 2,055.2 | 300.00 | | | | Average | |
| | | point12 | 12 | 3,157.0 | 2,032.3 | 300.00 | | | | Average | |
| | | point13 | 13 | 3,206.8 | 2,007.1 | 300.00 | | | | | |
| Cox Avenue east of Saratoga Avenue | 46.0 | point41 | 41 | 3,206.8 | 2,007.1 | 300.00 | | | | Average | |
| | | point14 | 14 | 3,241.8 | 1,986.3 | 300.00 | | | | Average | |
| | | point15 | 15 | 3,393.0 | 1,871.2 | 300.00 | | | | Average | |
| | | point16 | 16 | 3,482.6 | 1,824.4 | 300.00 | | | | Average | |
| | | point17 | 17 | 3,569.4 | 1,784.4 | 300.00 | | | | | |
| Saratoga Creek Drive south of Cox Ave | 24.0 | point42 | 42 | 2,362.8 | 2,120.8 | 300.00 | | | | Average | |
| | | point43 | 43 | 2,436.2 | 2,317.9 | 300.00 | | | | | |
| Roadway12 | 24.0 | point44 | 44 | 2,444.9 | 2,338.2 | 0.00 | | | | Average | |
| | | point45 | 45 | 2,500.0 | 2,460.9 | 0.00 | | | | | |

**Dudek** **28 May 2019**
**MG NL** **TNM 2.5**

**INPUT: TRAFFIC FOR LAeq1h Volumes**
**PROJECT/CONTRACT:** **10738**
**RUN:** **Palm Villas - Existing with Project**

| 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 |
| Cox Avenue west of Saratoga Creek Dr | point1 | 1 | 979 | 35 | 20 | 35 | 10 | 35 | 0 | 0 | 0 | 0 |
| | point3 | 3 | 979 | 35 | 20 | 35 | 10 | 35 | 0 | 0 | 0 | 0 |
| | point4 | 4 | 979 | 35 | 20 | 35 | 10 | 35 | 0 | 0 | 0 | 0 |
| | point5 | 5 | 979 | 35 | 20 | 35 | 10 | 35 | 0 | 0 | 0 | 0 |
| | point6 | 6 | 979 | 35 | 20 | 35 | 10 | 35 | 0 | 0 | 0 | 0 |
| | point7 | 7 | | | | | | | | | | |
| Roadway1-2-2 | point34 | 34 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | point31 | 31 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | point32 | 32 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | point2 | 2 | | | | | | | | | | |
| Roadway1-2-2 | point36 | 36 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | point26 | 26 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | point27 | 27 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | point28 | 28 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | point29 | 29 | | | | | | | | | | |
| Saratoga Avenue south of Cox Avenue | point38 | 38 | 2830 | 40 | 58 | 40 | 29 | 40 | 0 | 0 | 0 | 0 |
| | point19 | 19 | 2830 | 40 | 58 | 40 | 29 | 40 | 0 | 0 | 0 | 0 |
| | point20 | 20 | 2830 | 40 | 58 | 40 | 29 | 40 | 0 | 0 | 0 | 0 |
| | point21 | 21 | 2830 | 40 | 58 | 40 | 29 | 40 | 0 | 0 | 0 | 0 |
| | point22 | 22 | 2830 | 40 | 58 | 40 | 29 | 40 | 0 | 0 | 0 | 0 |
| | point23 | 23 | | | | | | | | | | |
| Saratoga Avenue north of Cox Avenue | point39 | 39 | 2448 | 40 | 50 | 40 | 25 | 40 | 0 | 0 | 0 | 0 |
| | point24 | 24 | | | | | | | | | | |

**INPUT: TRAFFIC FOR LAeq1h Volumes** **10738**

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cox Avenue west of Saratoga Avenue | point40 | 40 | 1041 | 35 | 21 | 35 | 11 | 35 | 0 | 0 | 0 | 0 |
| | point8 | 8 | 1041 | 35 | 21 | 35 | 11 | 35 | 0 | 0 | 0 | 0 |
| | point9 | 9 | 1041 | 35 | 21 | 35 | 11 | 35 | 0 | 0 | 0 | 0 |
| | point10 | 10 | 1041 | 35 | 21 | 35 | 11 | 35 | 0 | 0 | 0 | 0 |
| | point11 | 11 | 1041 | 35 | 21 | 35 | 11 | 35 | 0 | 0 | 0 | 0 |
| | point12 | 12 | 1041 | 35 | 21 | 35 | 11 | 35 | 0 | 0 | 0 | 0 |
| | point13 | 13 | | | | | | | | | | |
| Cox Avenue east of Saratoga Avenue | point41 | 41 | 833 | 40 | 17 | 40 | 9 | 40 | 0 | 0 | 0 | 0 |
| | point14 | 14 | 833 | 40 | 17 | 40 | 9 | 40 | 0 | 0 | 0 | 0 |
| | point15 | 15 | 833 | 40 | 17 | 40 | 9 | 40 | 0 | 0 | 0 | 0 |
| | point16 | 16 | 833 | 40 | 17 | 40 | 9 | 40 | 0 | 0 | 0 | 0 |
| | point17 | 17 | | | | | | | | | | |
| Saratoga Creek Drive south of Cox Ave | point42 | 42 | 37 | 25 | 1 | 25 | 0 | 0 | 0 | 0 | 0 | 0 |
| | point43 | 43 | | | | | | | | | | |
| Roadway12 | point44 | 44 | 52 | 25 | 1 | 25 | 1 | 25 | 0 | 0 | 0 | 0 |
| | point45 | 45 | | | | | | | | | | |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Dudek** | | | | | | **28 May 2019** | | | | | |
| **MG NL** | | | | | | **TNM 2.5** | | | | | |
| **INPUT: RECEIVERS** | | | | | | | | | | | |
| **PROJECT/CONTRACT:** | **10738** | | | | | | | | | | |
| **RUN:** | **Palm Villas - Existing with 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 | 2,274.7 | 2,099.0 | 300.00 | 5.00 | 0.00 | 66 | 10.0 | 8.0 | Y |
| ST2 | 2 | 1 | 1,852.1 | 2,361.9 | 300.00 | 5.00 | 0.00 | 66 | 10.0 | 8.0 | Y |
| ST3 | 3 | 1 | 2,398.5 | 2,367.7 | 300.00 | 5.00 | 0.00 | 66 | 10.0 | 8.0 | Y |
| ST4 | 4 | 1 | 3,044.2 | 2,130.5 | 300.00 | 5.00 | 0.00 | 66 | 10.0 | 8.0 | Y |
| M1 | 5 | 1 | 3,314.1 | 2,267.0 | 300.00 | 5.00 | 0.00 | 66 | 10.0 | 8.0 | |
| M2 | 6 | 1 | 3,367.0 | 2,049.1 | 300.00 | 5.00 | 0.00 | 66 | 10.0 | 8.0 | |
| M3 | 7 | 1 | 2,706.2 | 1,247.8 | 300.00 | 5.00 | 0.00 | 66 | 10.0 | 8.0 | |

Dudek 28 May 2019
MG NL TNM 2.5

INPUT: BARRIERS
PROJECT/CONTRACT: 10738
RUN: Palm Villas - Existing with Project

| Barrier | | | | | | | | | Points | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Name | Type | Height | | If Wall | If Berm | | | Add'tnl | Name | No. | Coordinates (bottom) | | | Height | Segment | | | | |
| | | Min | Max | $ per Unit Area | $ per Unit Vol. | Top Width | Run:Rise | $ per Unit Length | | | X | Y | Z | at Point | Seg Ht Incre-ment | Perturbs #Up | #Dn | On Struct? | Important Reflec-tions? |
| | | ft | ft | $/sq ft | $/cu yd | ft | ft:ft | $/ft | | | ft | ft | ft | ft | ft | | | | |
| Barrier1 | W | 0.00 | 99.99 | 0.00 | | | | 0.00 | point1 | 1 | 2,254.3 | 2,249.1 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point3 | 3 | 2,263.0 | 2,309.0 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point4 | 4 | 2,373.2 | 2,281.2 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point5 | 5 | 2,361.1 | 2,222.2 | 300.00 | 12.00 | | | | | |
| Barrier1-2-2 | W | 0.00 | 99.99 | 0.00 | | | | 0.00 | point37 | 37 | 1,875.0 | 2,097.1 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point26 | 26 | 1,879.2 | 2,325.1 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point27 | 27 | 1,948.1 | 2,326.5 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point28 | 28 | 1,938.4 | 2,090.9 | 300.00 | 12.00 | | | | | |
| Barrier1-2-2-2-2 | W | 0.00 | 99.99 | 0.00 | | | | 0.00 | point39 | 39 | 2,996.5 | 2,207.0 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point30 | 30 | 2,970.3 | 2,151.2 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point31 | 31 | 2,527.4 | 2,336.0 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point32 | 32 | 2,555.9 | 2,398.9 | 300.00 | 12.00 | | | | | |
| Barrier1-2-2-2-2-2-2 | W | 0.00 | 99.99 | 0.00 | | | | 0.00 | point41 | 41 | 3,118.8 | 2,265.1 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point34 | 34 | 3,262.0 | 2,210.0 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point35 | 35 | 3,215.2 | 2,138.4 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point2 | 2 | 3,082.9 | 2,188.0 | 300.00 | 12.00 | | | | | |
| Barrier1-2-2 | W | 0.00 | 99.99 | 0.00 | | | | 0.00 | point43 | 43 | 2,011.5 | 2,185.3 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point20 | 20 | 2,040.4 | 2,184.6 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point21 | 21 | 2,041.8 | 2,225.2 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point22 | 22 | 2,067.9 | 2,223.8 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point23 | 23 | 2,068.6 | 2,279.6 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point24 | 24 | 2,011.5 | 2,282.4 | 300.00 | 12.00 | | | | | |
| Barrier1-2-2 | W | 0.00 | 99.99 | 0.00 | | | | 0.00 | point45 | 45 | 2,432.3 | 2,215.3 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point7 | 7 | 2,449.6 | 2,262.2 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point8 | 8 | 2,548.6 | 2,224.0 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point9 | 9 | 2,533.8 | 2,176.2 | 300.00 | 12.00 | | | | | |
| Barrier1-2-2-2-2 | W | 0.00 | 99.99 | 0.00 | | | | 0.00 | point47 | 47 | 2,550.3 | 2,167.6 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point11 | 11 | 2,611.0 | 2,191.0 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point12 | 12 | 2,640.6 | 2,182.3 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point13 | 13 | 2,641.4 | 2,148.5 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point14 | 14 | 2,626.7 | 2,136.3 | 300.00 | 12.00 | | | | | |
| Barrier1-2-2-2-2-2-2 | W | 0.00 | 99.99 | 0.00 | | | | 0.00 | point49 | 49 | 2,663.1 | 2,121.6 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point16 | 16 | 2,676.2 | 2,171.9 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point17 | 17 | 2,749.0 | 2,142.4 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point18 | 18 | 2,737.8 | 2,085.1 | 300.00 | 12.00 | | | | | |

| | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Barrier16 | W | 0.00 | 99.99 | 0.00 | | | | 0.00 | point50 | 50 | 2,483.3 | 998.8 | 300.00 | 6.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point51 | 51 | 2,976.3 | 1,624.8 | 300.00 | 6.00 | | | | | |
| Barrier17 | W | 0.00 | 99.99 | 0.00 | | | | 0.00 | point52 | 52 | 2,956.5 | 2,151.9 | 300.00 | 7.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point53 | 53 | 3,165.1 | 2,057.3 | 300.00 | 7.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point54 | 54 | 3,270.8 | 2,211.3 | 300.00 | 7.00 | | | | | |

Dudek
MG NL
28 May 2019
TNM 2.5
Calculated with TNM 2.5

RESULTS: SOUND LEVELS
PROJECT/CONTRACT: 10738
RUN: Palm Villas - Existing with 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 | Crit'n | Increase over existing Calculated | Crit'n Sub'l Inc | Type Impact | With Barrier Calculated LAeq1h | Noise Reduction Calculated | Goal | Calculated minus Goal |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | dBA | dBA | dBA | dB | dB | | dBA | dB | dB | dB |
| ST1 | 1 | 1 | 0.0 | 52.6 | 66 | 52.6 | 10 | ---- | 52.6 | 0.0 | 8 | -8.0 |
| ST2 | 2 | 1 | 0.0 | 66.3 | 66 | 66.3 | 10 | Snd Lvl | 66.3 | 0.0 | 8 | -8.0 |
| ST3 | 3 | 1 | 0.0 | 67.3 | 66 | 67.3 | 10 | Snd Lvl | 67.3 | 0.0 | 8 | -8.0 |
| ST4 | 4 | 1 | 0.0 | 58.8 | 66 | 58.8 | 10 | ---- | 58.8 | 0.0 | 8 | -8.0 |
| M1 | 5 | 1 | 0.0 | 67.2 | 66 | 67.2 | 10 | Snd Lvl | 67.2 | 0.0 | 8 | -8.0 |
| M2 | 6 | 1 | 0.0 | 67.5 | 66 | 67.5 | 10 | Snd Lvl | 67.5 | 0.0 | 8 | -8.0 |
| M3 | 7 | 1 | 0.0 | 61.0 | 66 | 61.0 | 10 | ---- | 61.0 | 0.0 | 8 | -8.0 |

| Dwelling Units | # DUs | Noise Reduction Min | Avg | Max |
|---|---|---|---|---|
| | | dB | dB | dB |
| All Selected | 7 | 0.0 | 0.0 | 0.0 |
| All Impacted | 4 | 0.0 | 0.0 | 0.0 |
| All that meet NR Goal | 0 | 0.0 | 0.0 | 0.0 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Dudek** | | | | | **28 May 2019** | | | | | | |
| **MG NL** | | | | | **TNM 2.5** | | | | | | |
| **INPUT: ROADWAYS** | | | | | | | **Average pavement type shall be used unless** | | | | |
| **PROJECT/CONTRACT:** | **10738** | | | | | | **a State highway agency substantiates the use** | | | | |
| **RUN:** | **Palm Villas - Cumulative** | | | | | | **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 | % | | |
| Cox Avenue west of Saratoga Creek Dr | 46.0 | point1 | 1 | 1,157.1 | 2,443.9 | 300.00 | | | | Average | |
| | | point3 | 3 | 1,509.8 | 2,422.5 | 300.00 | | | | Average | |
| | | point4 | 4 | 1,832.8 | 2,397.7 | 300.00 | | | | Average | |
| | | point5 | 5 | 2,178.6 | 2,370.2 | 300.00 | | | | Average | |
| | | point6 | 6 | 2,313.6 | 2,355.0 | 300.00 | | | | Average | |
| | | point7 | 7 | 2,426.9 | 2,334.4 | 300.00 | | | | | |
| Roadway1-2-2 | 12.0 | point34 | 34 | 1,731.6 | 1,948.0 | 300.00 | | | | Average | |
| | | point31 | 31 | 1,820.1 | 2,092.1 | 300.00 | | | | Average | |
| | | point32 | 32 | 1,828.8 | 2,182.4 | 300.00 | | | | Average | |
| | | point2 | 2 | 1,828.8 | 2,380.2 | 300.00 | | | | | |
| Roadway1-2-2 | 12.0 | point36 | 36 | 2,588.9 | 1,779.7 | 300.00 | | | | Average | |
| | | point26 | 26 | 2,616.3 | 1,858.4 | 300.00 | | | | Average | |
| | | point27 | 27 | 2,681.9 | 1,938.3 | 300.00 | | | | Average | |
| | | point28 | 28 | 2,748.6 | 2,038.9 | 300.00 | | | | Average | |
| | | point29 | 29 | 2,795.6 | 2,152.6 | 300.00 | | | | | |
| Saratoga Avenue south of Cox Avenue | 95.0 | point38 | 38 | 2,212.6 | 805.3 | 300.00 | | | | Average | |
| | | point19 | 19 | 2,299.3 | 900.4 | 300.00 | | | | Average | |
| | | point20 | 20 | 2,424.7 | 1,052.0 | 300.00 | | | | Average | |
| | | point21 | 21 | 2,547.3 | 1,199.4 | 300.00 | | | | Average | |
| | | point22 | 22 | 2,788.4 | 1,503.8 | 300.00 | | | | Average | |
| | | point23 | 23 | 3,204.9 | 2,005.8 | 300.00 | | | | | |
| Saratoga Avenue north of Cox Avenue | 95.0 | point39 | 39 | 3,207.6 | 2,008.9 | 300.00 | | | | Average | |
| | | point24 | 24 | 3,594.7 | 2,461.6 | 300.00 | | | | | |
| Cox Avenue west of Saratoga Avenue | 46.0 | point40 | 40 | 2,432.7 | 2,332.5 | 300.00 | | | | Average | |
| | | point8 | 8 | 2,542.3 | 2,282.0 | 300.00 | | | | Average | |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | point9 | 9 | 2,630.0 | 2,246.0 | 300.00 | | | | Average | |
| | | point10 | 10 | 2,800.5 | 2,178.2 | 300.00 | | | | Average | |
| | | point11 | 11 | 3,093.0 | 2,055.2 | 300.00 | | | | Average | |
| | | point12 | 12 | 3,157.0 | 2,032.3 | 300.00 | | | | Average | |
| | | point13 | 13 | 3,206.8 | 2,007.1 | 300.00 | | | | | |
| Cox Avenue east of Saratoga Avenue | 46.0 | point41 | 41 | 3,206.8 | 2,007.1 | 300.00 | | | | Average | |
| | | point14 | 14 | 3,241.8 | 1,986.3 | 300.00 | | | | Average | |
| | | point15 | 15 | 3,393.0 | 1,871.2 | 300.00 | | | | Average | |
| | | point16 | 16 | 3,482.6 | 1,824.4 | 300.00 | | | | Average | |
| | | point17 | 17 | 3,569.4 | 1,784.4 | 300.00 | | | | | |
| Saratoga Creek Drive south of Cox Ave | 24.0 | point42 | 42 | 2,362.8 | 2,120.8 | 300.00 | | | | Average | |
| | | point43 | 43 | 2,436.2 | 2,317.9 | 300.00 | | | | | |
| Roadway12 | 24.0 | point44 | 44 | 2,444.9 | 2,338.2 | 0.00 | | | | Average | |
| | | point45 | 45 | 2,500.0 | 2,460.9 | 0.00 | | | | | |

**Dudek** **28 May 2019**
**MG NL** **TNM 2.5**

**INPUT: TRAFFIC FOR LAeq1h Volumes**
**PROJECT/CONTRACT:** **10738**
**RUN:** **Palm Villas - Cumulative**

| Roadway | Points | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Name | Name | No. | Segment | | | | | | | | | |
| | | | 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 |
| Cox Avenue west of Saratoga Creek Dr | point1 | 1 | 1213 | 35 | 25 | 35 | 13 | 35 | 0 | 0 | 0 | 0 |
| | point3 | 3 | 1213 | 35 | 25 | 35 | 13 | 35 | 0 | 0 | 0 | 0 |
| | point4 | 4 | 1213 | 35 | 25 | 35 | 13 | 35 | 0 | 0 | 0 | 0 |
| | point5 | 5 | 1213 | 35 | 25 | 35 | 13 | 35 | 0 | 0 | 0 | 0 |
| | point6 | 6 | 1213 | 35 | 25 | 35 | 13 | 35 | 0 | 0 | 0 | 0 |
| | point7 | 7 | | | | | | | | | | |
| Roadway1-2-2 | point34 | 34 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | point31 | 31 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | point32 | 32 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | point2 | 2 | | | | | | | | | | |
| Roadway1-2-2 | point36 | 36 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | point26 | 26 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | point27 | 27 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | point28 | 28 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | point29 | 29 | | | | | | | | | | |
| Saratoga Avenue south of Cox Avenue | point38 | 38 | 3610 | 40 | 74 | 40 | 37 | 40 | 0 | 0 | 0 | 0 |
| | point19 | 19 | 3610 | 40 | 74 | 40 | 37 | 40 | 0 | 0 | 0 | 0 |
| | point20 | 20 | 3610 | 40 | 74 | 40 | 37 | 40 | 0 | 0 | 0 | 0 |
| | point21 | 21 | 3610 | 40 | 74 | 40 | 37 | 40 | 0 | 0 | 0 | 0 |
| | point22 | 22 | 3610 | 40 | 74 | 40 | 37 | 40 | 0 | 0 | 0 | 0 |
| | point23 | 23 | | | | | | | | | | |
| Saratoga Avenue north of Cox Avenue | point39 | 39 | 3149 | 40 | 65 | 40 | 32 | 40 | 0 | 0 | 0 | 0 |
| | point24 | 24 | | | | | | | | | | |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cox Avenue west of Saratoga Avenue | point40 | 40 | 1267 | 35 | 26 | 35 | 13 | 35 | 0 | 0 | 0 | 0 |
| | point8 | 8 | 1267 | 35 | 26 | 35 | 13 | 35 | 0 | 0 | 0 | 0 |
| | point9 | 9 | 1267 | 35 | 26 | 35 | 13 | 35 | 0 | 0 | 0 | 0 |
| | point10 | 10 | 1267 | 35 | 26 | 35 | 13 | 35 | 0 | 0 | 0 | 0 |
| | point11 | 11 | 1267 | 35 | 26 | 35 | 13 | 35 | 0 | 0 | 0 | 0 |
| | point12 | 12 | 1267 | 35 | 26 | 35 | 13 | 35 | 0 | 0 | 0 | 0 |
| | point13 | 13 | | | | | | | | | | |
| Cox Avenue east of Saratoga Avenue | point41 | 41 | 1034 | 40 | 21 | 40 | 11 | 40 | 0 | 0 | 0 | 0 |
| | point14 | 14 | 1034 | 40 | 21 | 40 | 11 | 40 | 0 | 0 | 0 | 0 |
| | point15 | 15 | 1034 | 40 | 21 | 40 | 11 | 40 | 0 | 0 | 0 | 0 |
| | point16 | 16 | 1034 | 40 | 21 | 40 | 11 | 40 | 0 | 0 | 0 | 0 |
| | point17 | 17 | | | | | | | | | | |
| Saratoga Creek Drive south of Cox Ave | point42 | 42 | 12 | 25 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | point43 | 43 | | | | | | | | | | |
| Roadway12 | point44 | 44 | 65 | 25 | 1 | 25 | 1 | 25 | 0 | 0 | 0 | 0 |
| | point45 | 45 | | | | | | | | | | |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Dudek** | | | | | | **28 May 2019** | | | | | |
| **MG NL** | | | | | | **TNM 2.5** | | | | | |
| **INPUT: RECEIVERS** | | | | | | | | | | | |
| **PROJECT/CONTRACT:** | **10738** | | | | | | | | | | |
| **RUN:** | **Palm Villas - Cumulative** | | | | | | | | | | |
| **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 | 2,274.7 | 2,099.0 | 300.00 | 5.00 | 0.00 | 66 | 10.0 | 8.0 | Y |
| ST2 | 2 | 1 | 1,852.1 | 2,361.9 | 300.00 | 5.00 | 0.00 | 66 | 10.0 | 8.0 | Y |
| ST3 | 3 | 1 | 2,398.5 | 2,367.7 | 300.00 | 5.00 | 0.00 | 66 | 10.0 | 8.0 | Y |
| ST4 | 4 | 1 | 3,044.2 | 2,130.5 | 300.00 | 5.00 | 0.00 | 66 | 10.0 | 8.0 | Y |
| M1 | 5 | 1 | 3,314.1 | 2,267.0 | 300.00 | 5.00 | 0.00 | 66 | 10.0 | 8.0 | |
| M2 | 6 | 1 | 3,367.0 | 2,049.1 | 300.00 | 5.00 | 0.00 | 66 | 10.0 | 8.0 | |
| M3 | 7 | 1 | 2,706.2 | 1,247.8 | 300.00 | 5.00 | 0.00 | 66 | 10.0 | 8.0 | |

Dudek 28 May 2019
MG NL TNM 2.5

INPUT: BARRIERS
PROJECT/CONTRACT: 10738
RUN: Palm Villas - Cumulative

| Barrier | | | | | | | | | Points | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Name | Type | Height | | If Wall | If Berm | | | Add'tnl | Name | No. | Coordinates (bottom) | | | Height | Segment | | | | |
| | | Min | Max | $ per Unit Area | $ per Unit Vol. | Top Width | Run:Rise | $ per Unit Length | | | X | Y | Z | at Point | Seg Ht Increment | Perturbs #Up | #Dn | On Struct? | Important Reflections? |
| | | ft | ft | $/sq ft | $/cu yd | ft | ft:ft | $/ft | | | ft | ft | ft | ft | ft | | | | |
| Barrier1 | W | 0.00 | 99.99 | 0.00 | | | | 0.00 | point1 | 1 | 2,254.3 | 2,249.1 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point3 | 3 | 2,263.0 | 2,309.0 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point4 | 4 | 2,373.2 | 2,281.2 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point5 | 5 | 2,361.1 | 2,222.2 | 300.00 | 12.00 | | | | | |
| Barrier1-2-2 | W | 0.00 | 99.99 | 0.00 | | | | 0.00 | point37 | 37 | 1,875.0 | 2,097.1 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point26 | 26 | 1,879.2 | 2,325.1 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point27 | 27 | 1,948.1 | 2,326.5 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point28 | 28 | 1,938.4 | 2,090.9 | 300.00 | 12.00 | | | | | |
| Barrier1-2-2-2-2 | W | 0.00 | 99.99 | 0.00 | | | | 0.00 | point39 | 39 | 2,996.5 | 2,207.0 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point30 | 30 | 2,970.3 | 2,151.2 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point31 | 31 | 2,527.4 | 2,336.0 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point32 | 32 | 2,555.9 | 2,398.9 | 300.00 | 12.00 | | | | | |
| Barrier1-2-2-2-2-2-2 | W | 0.00 | 99.99 | 0.00 | | | | 0.00 | point41 | 41 | 3,118.8 | 2,265.1 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point34 | 34 | 3,262.0 | 2,210.0 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point35 | 35 | 3,215.2 | 2,138.4 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point2 | 2 | 3,082.9 | 2,188.0 | 300.00 | 12.00 | | | | | |
| Barrier1-2-2 | W | 0.00 | 99.99 | 0.00 | | | | 0.00 | point43 | 43 | 2,011.5 | 2,185.3 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point20 | 20 | 2,040.4 | 2,184.6 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point21 | 21 | 2,041.8 | 2,225.2 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point22 | 22 | 2,067.9 | 2,223.8 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point23 | 23 | 2,068.6 | 2,279.6 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point24 | 24 | 2,011.5 | 2,282.4 | 300.00 | 12.00 | | | | | |
| Barrier1-2-2 | W | 0.00 | 99.99 | 0.00 | | | | 0.00 | point45 | 45 | 2,432.3 | 2,215.3 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point7 | 7 | 2,449.6 | 2,262.2 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point8 | 8 | 2,548.6 | 2,224.0 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point9 | 9 | 2,533.8 | 2,176.2 | 300.00 | 12.00 | | | | | |
| Barrier1-2-2-2-2 | W | 0.00 | 99.99 | 0.00 | | | | 0.00 | point47 | 47 | 2,550.3 | 2,167.6 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point11 | 11 | 2,611.0 | 2,191.0 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point12 | 12 | 2,640.6 | 2,182.3 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point13 | 13 | 2,641.4 | 2,148.5 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point14 | 14 | 2,626.7 | 2,136.3 | 300.00 | 12.00 | | | | | |
| Barrier1-2-2-2-2-2-2 | W | 0.00 | 99.99 | 0.00 | | | | 0.00 | point49 | 49 | 2,663.1 | 2,121.6 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point16 | 16 | 2,676.2 | 2,171.9 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point17 | 17 | 2,749.0 | 2,142.4 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point18 | 18 | 2,737.8 | 2,085.1 | 300.00 | 12.00 | | | | | |

| | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Barrier16 | W | 0.00 | 99.99 | 0.00 | | | | 0.00 | point50 | 50 | 2,483.3 | 998.8 | 300.00 | 6.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point51 | 51 | 2,976.3 | 1,624.8 | 300.00 | 6.00 | | | | | |
| Barrier17 | W | 0.00 | 99.99 | 0.00 | | | | 0.00 | point52 | 52 | 2,956.5 | 2,151.9 | 300.00 | 7.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point53 | 53 | 3,165.1 | 2,057.3 | 300.00 | 7.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point54 | 54 | 3,270.8 | 2,211.3 | 300.00 | 7.00 | | | | | |

Dudek
MG NL
28 May 2019
TNM 2.5
Calculated with TNM 2.5

RESULTS: SOUND LEVELS
PROJECT/CONTRACT: 10738
RUN: Palm Villas - Cumulative
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 | Crit'n | Increase over existing Calculated | Crit'n Sub'l Inc | Type Impact | With Barrier Calculated LAeq1h | Noise Reduction Calculated | Goal | Calculated minus Goal |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | dBA | dBA | dBA | dB | dB | | dBA | dB | dB | dB |
| ST1 | 1 | 1 | 0.0 | 53.5 | 66 | 53.5 | 10 | ---- | 53.5 | 0.0 | 8 | -8.0 |
| ST2 | 2 | 1 | 0.0 | 67.2 | 66 | 67.2 | 10 | Snd Lvl | 67.2 | 0.0 | 8 | -8.0 |
| ST3 | 3 | 1 | 0.0 | 68.2 | 66 | 68.2 | 10 | Snd Lvl | 68.2 | 0.0 | 8 | -8.0 |
| ST4 | 4 | 1 | 0.0 | 59.7 | 66 | 59.7 | 10 | ---- | 59.7 | 0.0 | 8 | -8.0 |
| M1 | 5 | 1 | 0.0 | 68.3 | 66 | 68.3 | 10 | Snd Lvl | 68.3 | 0.0 | 8 | -8.0 |
| M2 | 6 | 1 | 0.0 | 68.6 | 66 | 68.6 | 10 | Snd Lvl | 68.6 | 0.0 | 8 | -8.0 |
| M3 | 7 | 1 | 0.0 | 62.0 | 66 | 62.0 | 10 | ---- | 62.0 | 0.0 | 8 | -8.0 |

| Dwelling Units | # DUs | Noise Reduction Min | Avg | Max |
|---|---|---|---|---|
| | | dB | dB | dB |
| All Selected | 7 | 0.0 | 0.0 | 0.0 |
| All Impacted | 4 | 0.0 | 0.0 | 0.0 |
| All that meet NR Goal | 0 | 0.0 | 0.0 | 0.0 |

Dudek 28 May 2019
MG NL TNM 2.5

INPUT: ROADWAYS
PROJECT/CONTRACT: 10738
RUN: Palm Villas - Cumulative with Project

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

| Roadway Name | Width | Points Name | No. | Coordinates (pavement) X | Y | Z | Flow Control Control Device | Speed Constraint | Percent Vehicles Affected | Segment Pvmt Type | On Struct? |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | ft | | | ft | ft | ft | | mph | % | | |
| Cox Avenue west of Saratoga Creek Dr | 46.0 | point1 | 1 | 1,157.1 | 2,443.9 | 300.00 | | | | Average | |
| | | point3 | 3 | 1,509.8 | 2,422.5 | 300.00 | | | | Average | |
| | | point4 | 4 | 1,832.8 | 2,397.7 | 300.00 | | | | Average | |
| | | point5 | 5 | 2,178.6 | 2,370.2 | 300.00 | | | | Average | |
| | | point6 | 6 | 2,313.6 | 2,355.0 | 300.00 | | | | Average | |
| | | point7 | 7 | 2,426.9 | 2,334.4 | 300.00 | | | | | |
| Roadway1-2-2 | 12.0 | point34 | 34 | 1,731.6 | 1,948.0 | 300.00 | | | | Average | |
| | | point31 | 31 | 1,820.1 | 2,092.1 | 300.00 | | | | Average | |
| | | point32 | 32 | 1,828.8 | 2,182.4 | 300.00 | | | | Average | |
| | | point2 | 2 | 1,828.8 | 2,380.2 | 300.00 | | | | | |
| Roadway1-2-2 | 12.0 | point36 | 36 | 2,588.9 | 1,779.7 | 300.00 | | | | Average | |
| | | point26 | 26 | 2,616.3 | 1,858.4 | 300.00 | | | | Average | |
| | | point27 | 27 | 2,681.9 | 1,938.3 | 300.00 | | | | Average | |
| | | point28 | 28 | 2,748.6 | 2,038.9 | 300.00 | | | | Average | |
| | | point29 | 29 | 2,795.6 | 2,152.6 | 300.00 | | | | | |
| Saratoga Avenue south of Cox Avenue | 95.0 | point38 | 38 | 2,212.6 | 805.3 | 300.00 | | | | Average | |
| | | point19 | 19 | 2,299.3 | 900.4 | 300.00 | | | | Average | |
| | | point20 | 20 | 2,424.7 | 1,052.0 | 300.00 | | | | Average | |
| | | point21 | 21 | 2,547.3 | 1,199.4 | 300.00 | | | | Average | |
| | | point22 | 22 | 2,788.4 | 1,503.8 | 300.00 | | | | Average | |
| | | point23 | 23 | 3,204.9 | 2,005.8 | 300.00 | | | | | |
| Saratoga Avenue north of Cox Avenue | 95.0 | point39 | 39 | 3,207.6 | 2,008.9 | 300.00 | | | | Average | |
| | | point24 | 24 | 3,594.7 | 2,461.6 | 300.00 | | | | | |
| Cox Avenue west of Saratoga Avenue | 46.0 | point40 | 40 | 2,432.7 | 2,332.5 | 300.00 | | | | Average | |
| | | point8 | 8 | 2,542.3 | 2,282.0 | 300.00 | | | | Average | |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | point9 | 9 | 2,630.0 | 2,246.0 | 300.00 | | | | Average | |
| | | point10 | 10 | 2,800.5 | 2,178.2 | 300.00 | | | | Average | |
| | | point11 | 11 | 3,093.0 | 2,055.2 | 300.00 | | | | Average | |
| | | point12 | 12 | 3,157.0 | 2,032.3 | 300.00 | | | | Average | |
| | | point13 | 13 | 3,206.8 | 2,007.1 | 300.00 | | | | | |
| Cox Avenue east of Saratoga Avenue | 46.0 | point41 | 41 | 3,206.8 | 2,007.1 | 300.00 | | | | Average | |
| | | point14 | 14 | 3,241.8 | 1,986.3 | 300.00 | | | | Average | |
| | | point15 | 15 | 3,393.0 | 1,871.2 | 300.00 | | | | Average | |
| | | point16 | 16 | 3,482.6 | 1,824.4 | 300.00 | | | | Average | |
| | | point17 | 17 | 3,569.4 | 1,784.4 | 300.00 | | | | | |
| Saratoga Creek Drive south of Cox Ave | 24.0 | point42 | 42 | 2,362.8 | 2,120.8 | 300.00 | | | | Average | |
| | | point43 | 43 | 2,436.2 | 2,317.9 | 300.00 | | | | | |
| Roadway12 | 24.0 | point44 | 44 | 2,444.9 | 2,338.2 | 0.00 | | | | Average | |
| | | point45 | 45 | 2,500.0 | 2,460.9 | 0.00 | | | | | |

**Dudek** **28 May 2019**
**MG NL** **TNM 2.5**

**INPUT: TRAFFIC FOR LAeq1h Volumes**
**PROJECT/CONTRACT:** 10738
**RUN:** Palm Villas - Cumulative with Project

| 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 |
| Cox Avenue west of Saratoga Creek Dr | point1 | 1 | 1217 | 35 | 25 | 35 | 13 | 35 | 0 | 0 | 0 | 0 |
| | point3 | 3 | 1217 | 35 | 25 | 35 | 13 | 35 | 0 | 0 | 0 | 0 |
| | point4 | 4 | 1217 | 35 | 25 | 35 | 13 | 35 | 0 | 0 | 0 | 0 |
| | point5 | 5 | 1217 | 35 | 25 | 35 | 13 | 35 | 0 | 0 | 0 | 0 |
| | point6 | 6 | 1217 | 35 | 25 | 35 | 13 | 35 | 0 | 0 | 0 | 0 |
| | point7 | 7 | | | | | | | | | | |
| Roadway1-2-2 | point34 | 34 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | point31 | 31 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | point32 | 32 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | point2 | 2 | | | | | | | | | | |
| Roadway1-2-2 | point36 | 36 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | point26 | 26 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | point27 | 27 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | point28 | 28 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | point29 | 29 | | | | | | | | | | |
| Saratoga Avenue south of Cox Avenue | point38 | 38 | 3626 | 40 | 75 | 40 | 37 | 40 | 0 | 0 | 0 | 0 |
| | point19 | 19 | 3626 | 40 | 75 | 40 | 37 | 40 | 0 | 0 | 0 | 0 |
| | point20 | 20 | 3626 | 40 | 75 | 40 | 37 | 40 | 0 | 0 | 0 | 0 |
| | point21 | 21 | 3626 | 40 | 75 | 40 | 37 | 40 | 0 | 0 | 0 | 0 |
| | point22 | 22 | 3626 | 40 | 75 | 40 | 37 | 40 | 0 | 0 | 0 | 0 |
| | point23 | 23 | | | | | | | | | | |
| Saratoga Avenue north of Cox Avenue | point39 | 39 | 3153 | 40 | 65 | 40 | 32 | 40 | 0 | 0 | 0 | 0 |
| | point24 | 24 | | | | | | | | | | |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cox Avenue west of Saratoga Avenue | point40 | 40 | 1290 | 35 | 27 | 35 | 13 | 35 | 0 | 0 | 0 | 0 |
| | point8 | 8 | 1290 | 35 | 27 | 35 | 13 | 35 | 0 | 0 | 0 | 0 |
| | point9 | 9 | 1290 | 35 | 27 | 35 | 13 | 35 | 0 | 0 | 0 | 0 |
| | point10 | 10 | 1290 | 35 | 27 | 35 | 13 | 35 | 0 | 0 | 0 | 0 |
| | point11 | 11 | 1290 | 35 | 27 | 35 | 13 | 35 | 0 | 0 | 0 | 0 |
| | point12 | 12 | 1290 | 35 | 27 | 35 | 13 | 35 | 0 | 0 | 0 | 0 |
| | point13 | 13 | | | | | | | | | | |
| Cox Avenue east of Saratoga Avenue | point41 | 41 | 1037 | 40 | 21 | 40 | 11 | 40 | 0 | 0 | 0 | 0 |
| | point14 | 14 | 1037 | 40 | 21 | 40 | 11 | 40 | 0 | 0 | 0 | 0 |
| | point15 | 15 | 1037 | 40 | 21 | 40 | 11 | 40 | 0 | 0 | 0 | 0 |
| | point16 | 16 | 1037 | 40 | 21 | 40 | 11 | 40 | 0 | 0 | 0 | 0 |
| | point17 | 17 | | | | | | | | | | |
| Saratoga Creek Drive south of Cox Ave | point42 | 42 | 39 | 25 | 1 | 25 | 0 | 0 | 0 | 0 | 0 | 0 |
| | point43 | 43 | | | | | | | | | | |
| Roadway12 | point44 | 44 | 65 | 25 | 1 | 25 | 1 | 25 | 0 | 0 | 0 | 0 |
| | point45 | 45 | | | | | | | | | | |

Dudek 28 May 2019
MG NL TNM 2.5

INPUT: RECEIVERS
PROJECT/CONTRACT: 10738
RUN: Palm Villas - Cumulative with Project

| Receiver Name | No. | #DUs | Coordinates (ground) X | Y | Z | Height above Ground | Input Sound Levels and Criteria: Existing LAeq1h | Impact Criteria LAeq1h | Impact Criteria Sub'l | NR Goal | Active in Calc. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | ft | ft | ft | ft | dBA | dBA | dB | dB | |
| ST1 | 1 | 1 | 2,274.7 | 2,099.0 | 300.00 | 5.00 | 0.00 | 66 | 10.0 | 8.0 | Y |
| ST2 | 2 | 1 | 1,852.1 | 2,361.9 | 300.00 | 5.00 | 0.00 | 66 | 10.0 | 8.0 | Y |
| ST3 | 3 | 1 | 2,398.5 | 2,367.7 | 300.00 | 5.00 | 0.00 | 66 | 10.0 | 8.0 | Y |
| ST4 | 4 | 1 | 3,044.2 | 2,130.5 | 300.00 | 5.00 | 0.00 | 66 | 10.0 | 8.0 | Y |
| M1 | 5 | 1 | 3,314.1 | 2,267.0 | 300.00 | 5.00 | 0.00 | 66 | 10.0 | 8.0 | |
| M2 | 6 | 1 | 3,367.0 | 2,049.1 | 300.00 | 5.00 | 0.00 | 66 | 10.0 | 8.0 | |
| M3 | 7 | 1 | 2,706.2 | 1,247.8 | 300.00 | 5.00 | 0.00 | 66 | 10.0 | 8.0 | |

Dudek 28 May 2019
MG NL TNM 2.5

INPUT: BARRIERS
PROJECT/CONTRACT: 10738
RUN: Palm Villas - Cumulative with Project

| Barrier | | | | | | | | | Points | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Name | Type | Height | | If Wall | If Berm | | | Add'tnl | Name | No. | Coordinates (bottom) | | | Height | Segment | | | | |
| | | Min | Max | $ per Unit Area | $ per Unit Vol. | Top Width | Run:Rise | $ per Unit Length | | | X | Y | Z | at Point | Seg Ht Incre-ment | Perturbs #Up | #Dn | On Struct? | Important Reflec-tions? |
| | | ft | ft | $/sq ft | $/cu yd | ft | ft:ft | $/ft | | | ft | ft | ft | ft | ft | | | | |
| Barrier1 | W | 0.00 | 99.99 | 0.00 | | | | 0.00 | point1 | 1 | 2,254.3 | 2,249.1 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point3 | 3 | 2,263.0 | 2,309.0 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point4 | 4 | 2,373.2 | 2,281.2 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point5 | 5 | 2,361.1 | 2,222.2 | 300.00 | 12.00 | | | | | |
| Barrier1-2-2 | W | 0.00 | 99.99 | 0.00 | | | | 0.00 | point37 | 37 | 1,875.0 | 2,097.1 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point26 | 26 | 1,879.2 | 2,325.1 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point27 | 27 | 1,948.1 | 2,326.5 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point28 | 28 | 1,938.4 | 2,090.9 | 300.00 | 12.00 | | | | | |
| Barrier1-2-2-2-2 | W | 0.00 | 99.99 | 0.00 | | | | 0.00 | point39 | 39 | 2,996.5 | 2,207.0 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point30 | 30 | 2,970.3 | 2,151.2 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point31 | 31 | 2,527.4 | 2,336.0 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point32 | 32 | 2,555.9 | 2,398.9 | 300.00 | 12.00 | | | | | |
| Barrier1-2-2-2-2-2-2 | W | 0.00 | 99.99 | 0.00 | | | | 0.00 | point41 | 41 | 3,118.8 | 2,265.1 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point34 | 34 | 3,262.0 | 2,210.0 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point35 | 35 | 3,215.2 | 2,138.4 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point2 | 2 | 3,082.9 | 2,188.0 | 300.00 | 12.00 | | | | | |
| Barrier1-2-2 | W | 0.00 | 99.99 | 0.00 | | | | 0.00 | point43 | 43 | 2,011.5 | 2,185.3 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point20 | 20 | 2,040.4 | 2,184.6 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point21 | 21 | 2,041.8 | 2,225.2 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point22 | 22 | 2,067.9 | 2,223.8 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point23 | 23 | 2,068.6 | 2,279.6 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point24 | 24 | 2,011.5 | 2,282.4 | 300.00 | 12.00 | | | | | |
| Barrier1-2-2 | W | 0.00 | 99.99 | 0.00 | | | | 0.00 | point45 | 45 | 2,432.3 | 2,215.3 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point7 | 7 | 2,449.6 | 2,262.2 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point8 | 8 | 2,548.6 | 2,224.0 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point9 | 9 | 2,533.8 | 2,176.2 | 300.00 | 12.00 | | | | | |
| Barrier1-2-2-2-2 | W | 0.00 | 99.99 | 0.00 | | | | 0.00 | point47 | 47 | 2,550.3 | 2,167.6 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point11 | 11 | 2,611.0 | 2,191.0 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point12 | 12 | 2,640.6 | 2,182.3 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point13 | 13 | 2,641.4 | 2,148.5 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point14 | 14 | 2,626.7 | 2,136.3 | 300.00 | 12.00 | | | | | |
| Barrier1-2-2-2-2-2-2 | W | 0.00 | 99.99 | 0.00 | | | | 0.00 | point49 | 49 | 2,663.1 | 2,121.6 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point16 | 16 | 2,676.2 | 2,171.9 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point17 | 17 | 2,749.0 | 2,142.4 | 300.00 | 12.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point18 | 18 | 2,737.8 | 2,085.1 | 300.00 | 12.00 | | | | | |

| | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Barrier16 | W | 0.00 | 99.99 | 0.00 | | | | 0.00 | point50 | 50 | 2,483.3 | 998.8 | 300.00 | 6.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point51 | 51 | 2,976.3 | 1,624.8 | 300.00 | 6.00 | | | | | |
| Barrier17 | W | 0.00 | 99.99 | 0.00 | | | | 0.00 | point52 | 52 | 2,956.5 | 2,151.9 | 300.00 | 7.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point53 | 53 | 3,165.1 | 2,057.3 | 300.00 | 7.00 | 0.00 | 0 | 0 | | |
| | | | | | | | | | point54 | 54 | 3,270.8 | 2,211.3 | 300.00 | 7.00 | | | | | |

Dudek
MG NL
28 May 2019
TNM 2.5
Calculated with TNM 2.5

RESULTS: SOUND LEVELS
PROJECT/CONTRACT: 10738
RUN: Palm Villas - Cumulative with 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 | Crit'n | Increase over existing Calculated | Crit'n Sub'l Inc | Type Impact | With Barrier Calculated LAeq1h | Noise Reduction Calculated | Goal | Calculated minus Goal |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | dBA | dBA | dBA | dB | dB | | dBA | dB | dB | dB |
| ST1 | 1 | 1 | 0.0 | 53.6 | 66 | 53.6 | 10 | ---- | 53.6 | 0.0 | 8 | -8.0 |
| ST2 | 2 | 1 | 0.0 | 67.2 | 66 | 67.2 | 10 | Snd Lvl | 67.2 | 0.0 | 8 | -8.0 |
| ST3 | 3 | 1 | 0.0 | 68.2 | 66 | 68.2 | 10 | Snd Lvl | 68.2 | 0.0 | 8 | -8.0 |
| ST4 | 4 | 1 | 0.0 | 59.8 | 66 | 59.8 | 10 | ---- | 59.8 | 0.0 | 8 | -8.0 |
| M1 | 5 | 1 | 0.0 | 68.3 | 66 | 68.3 | 10 | Snd Lvl | 68.3 | 0.0 | 8 | -8.0 |
| M2 | 6 | 1 | 0.0 | 68.6 | 66 | 68.6 | 10 | Snd Lvl | 68.6 | 0.0 | 8 | -8.0 |
| M3 | 7 | 1 | 0.0 | 62.0 | 66 | 62.0 | 10 | ---- | 62.0 | 0.0 | 8 | -8.0 |

| Dwelling Units | # DUs | Noise Reduction Min | Avg | Max |
|---|---|---|---|---|
| | | dB | dB | dB |
| All Selected | 7 | 0.0 | 0.0 | 0.0 |
| All Impacted | 4 | 0.0 | 0.0 | 0.0 |
| All that meet NR Goal | 0 | 0.0 | 0.0 | 0.0 |

# APPENDIX C

*Mechanical Equipment Calculations and Specifications*

**Palm Villas EIR Project**

**On-Site Noise Calculations**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Distance from mechanical equipment to nearest NSLU (residence to the west)** | | | | 126 feet - Lot 1 | **Lw (dBA)** | **Distance (Ft)** | **SPL Lp (dBA)** | |
| | | | | 300 feet - Lot 2 | | | | |
| **HVAC Equipment - Neglecting Building Shielding Effects** | | | **PWL** | | | | | |
| **Unabated Noise Levels - neglecting structure shielding** | | | | | | | | |
| 2 5-ton HVAC units - lot 1 | 2* | 75.0 dBA | 78.0 dBA | | 78.0 | 126.0 | 38.5 dBA | |
| 3 3-ton HVAC units - lot 2 | 2* | 72.0 dBA | 75.0 dBA | | 75.0 | 300.0 | 28.0 dBA | |
| | | | | | **Total** | | **38.9** dBA | |

**Standby Generator - Neglecting Building Shielding Effects**

| | | | | |
|---|---|---|---|---|
| Generac Protector Series | **SPL** | | | |
| RG045 - Lot 1 | 73 dBA at 7 meters (23 feet) | | 58.2 dBA | SPL at 126 feet |
| RG030 - Lot 2 | 73 dBA at 7 meters (23 feet) | | 50.7 dBA | SPL at 300 feet |
| | | **Total** | **58.9** | |

**Building Shielding Effects - Parapet Wall**

From Fresnel Equation Spreadsheet: 24.2 dB - Lot 1
24.5 dB - Lot 2

**Resulting Noise Level with Building Shielding Effects** — **For nearest NSLU - residences to the west**

| | |
|---|---|
| **HVAC Units** | **14.6 dBA - from Lot 1** |
| **Generators** | **34.5 dBA - from Lot 2** |
| **Combined** | 34.5 dBA |

## SHIELDING ATTENUATION CALCULATIONS: RAY-TRACE PROGRAM (FOR A POINT-SOURCE)

**Uses the Equation:** $(A_{c4})_{point}=20*\log[(2*pi*N)^{1/2}/\tanh(2*pi*N)^{1/2}]+5dB$

**(Ref. Pg.174, Noise and Vibration Control, L.L. Beranek Editor, 1971 Ed.**

**Project:** Palm Villas EIR Project
**Date:** 9-May-19
**By:** MG

**Please Enter: Using English (E) units** E

| Ray Trace Number/Description | Source-Receiver Distance (ft. or m) | Source Base Elev. (ft. or m) | Source Height above Ground (ft. or m) | Receiver Base Elev. (ft. or m) | Receiver Height above Ground (ft. or m) | Horizontal Barrier Dist. (in ref. to source) (ft. or m) | Barrier Base Elev. (ft. or m) | Barrier Height (ft. or m) | Dominant Freq.(Hz) | Source-Rcvr Straight-Line Dist. (ft. or m) | Source-Top-of-Barrier Dist. (ft. or m) | Receiver-Top-of-Barrier Dist. (ft. or m) | Lambda | $N_{max}$ | $AE_{(barriers)}$ (dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mecahnical Equipment - Lot 1 to nearest residential P/L | 126.0 | 320.0 | 5.0 | 300.0 | 5.0 | 121.0 | 320.0 | **6.0** | 500.0 | 127.6 | 121.0 | 21.6 | 2.3 | 13.3 | **24.2** |
| Mecahnical Equipment - Lot 1 to nearest residential P/L | 300.0 | 321.0 | 5.0 | 300.0 | 5.0 | 295.0 | 321.0 | **5.0** | 500.0 | 300.7 | 295.0 | 21.6 | 2.3 | 14.1 | **24.5** |

# Comfort™ 13 Packaged Gas Furnace / Air Conditioner System

Carrier®

Turn to the Experts.℠

Comfort™ SERIES




Comfort and Efficiency in One System

## Efficiency

Because the system provides both heating and cooling, its efficiency is measured with two distinct ratings. Seasonal Energy Efficiency Ratio or SEER is used to measure cooling efficiency, while Annual Fuel Utilization Efficiency or AFUE measures heating efficiency.

13.0 SEER RATING

- SEER and AFUE are like gas mileage. The higher the miles per gallon rating, the more efficient the automobile or system is. The Comfort 13 system has a 13.0 SEER rating and up to 81% AFUE.

# Things to Consider Before You Buy

## Puron® Refrigerant

Puron refrigerant is environmentally sound and won't deplete the ozone layer. Carrier introduced Puron refrigerant a full six years ahead of the competition, paving the way for the future. The Clean Air Act of 1990 prohibits the production of HCFC-based air conditioners and heat pumps by 2010, and bans Freon®-22* production by 2020. As Freon® production declines, its cost may increase. Freon®-12 in the automotive industry increased by a whopping 800% in a short seven years! Ensure your cooling costs by investing in systems with Puron refrigerant – the environmentally sound, efficient and dependable refrigerant designed for the future. The Carrier® Comfort™ 13 packaged gas furnace / air conditioner with Puron refrigerant meets the requirements of the Clean Air Act while providing excellent energy efficiency, reliability and proven performance.

Puron® the environmentally sound refrigerant

## Durability

*Outside*

- We've engineered the top for good looks and performance – its rigid build and large fan opening help ensure reduced vibration for quiet operation.
- Galvanized steel cabinet protects against corrosion, keeping your outdoor unit looking good for years to come.
- Wire grille protects the coil against potential hazards often associated with outdoor installation.
- Innovative base combines a high-tech composite interior for light weight and corrosion resistance with outer base rails for structural integrity and easier handling and rigging for your installing dealer.
- Three separate access panels make installation and routine maintenance easier.

*Inside*

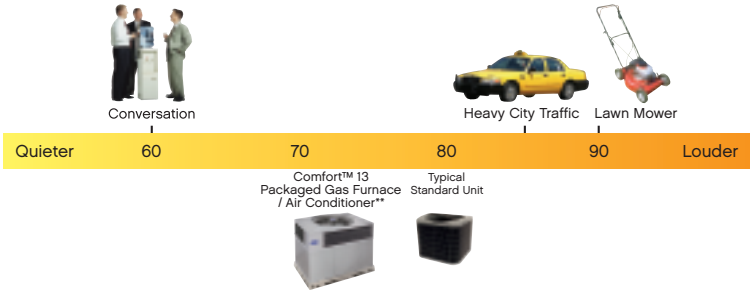
- Liquid refrigerant strainers help keep the refrigerant system free from excess debris.
- Indoor and outdoor fan motors help reduce energy consumption and provide for trouble-free operation.

## Sound

Carrier believes home comfort systems should work quietly, letting you relax without a lot of background noise. The Comfort 13 system has sound ratings as low as 72 dBA.** At Carrier, we believe home comfort shouldn't be at your ears' expense.

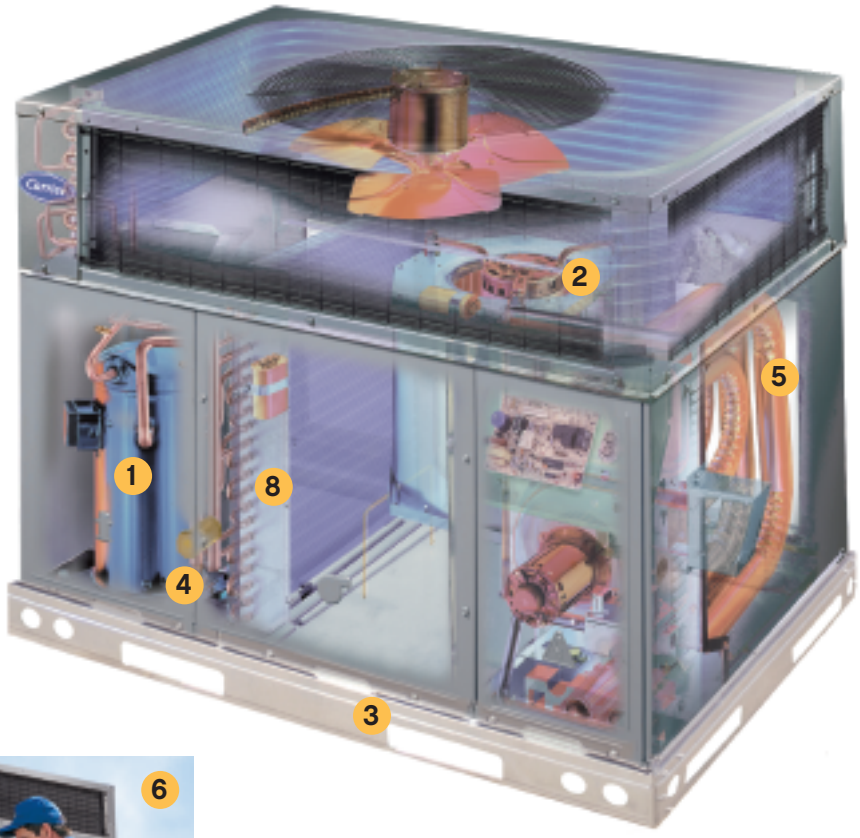
### Comparative Sound Ratings

(decibels)




** Freon is a registered trademark of E. I. Dupont de Nemours & Co.*

*** Per standard testing as described by ARI 270-95. Other sound levels, mentioned for comparison, as published at http://www.nidcd.nih.gov/health/hearing.ruler.asp.*






## Specifications

| Small Packaged | Infinity™ Controls Capable | Standard Variable Speed Fan | Humidity Management | Thermostatic Expansion Valve | Puron® Refrigerant | SEER | Up to 81% AFUE | EnviroTuff™ Base | ENERGY STAR® |
|---|---|---|---|---|---|---|---|---|---|
| Infinity™ 15 | ✓ | ✓ | ✓ | ✓ | ✓ | 15.0 | ✓ | ✓ | ✓ |
| Performance™ Series | | | ✓ | ✓ | ✓ | 14.0 | ✓ | ✓ | ✓ |
| Comfort™ Series* | | | ✓ | ✓ | ✓ | 13.0 | ✓ | ✓ | |

## Limited Warranty

To the original owner, the Carrier® Comfort™ 13 packaged gas furnace / air conditioner system is covered by a 10-year parts limited warranty upon timely registration of your new equipment.[1] Aluminized heat exchangers carry a 10-year parts limited warranty. Optional stainless steel heat exchangers carry a lifetime parts limited warranty.[2] Copper indoor evaporator coil is covered by a five-year parts limited warranty. Optional tin-plated evaporator coil is covered by a 10-year parts limited warranty. Ask your Carrier dealer about optional extended warranties, which may include labor.

(1) Warranty period is five-year parts limited warranty if not registered within 90 days. Jurisdictions where warranty benefits cannot be conditioned on registration will automatically receive a 10-year parts limited warranty. See warranty certificate at carrier.com for complete details.
(2) Warranty period is 20-year parts limited warranty on optional stainless steel heat exchanger if not registered within 90 days. Jurisdictions where warranty benefits cannot be conditioned on registration will automatically receive a lifetime parts limited warranty.

** Freon is a registered trademark of E. I. Dupont de Nemours & Co.*

## Technology

**Puron refrigerant** – environmentally sound, replacing Freon-22* and won't deplete the ozone layer.

1 **Compressor** – as the heart of the cooling system, this compressor is designed for smooth-running, durable operation.

2 **Energy-saving blower** – optimizes airflow for your home's cooling needs with an electronically controlled, programmable motor. This motor delivers higher efficiency than standard, PSC-type motors.

3 **Innovative base** – On the inside, a high-tech composite material will not rust. Sloped drain pan improves drainage to help inhibit mold, algae and bacterial growth. Outside, metal base rails provide added stability as well as easier dealer handling and rigging.

4 **Thermostatic™ Expansion Valve** – consistently monitors refrigerant flow for peak operating conditions.

5 **Turbo-Tubular™ heat exchanger** – allows hot gases to make multiple passes across the supply air, optimizing heat transfer and system efficiency. Tough aluminum provides long-lasting corrosion resistance, helping to keep your unit working great from the inside out.

6 **All-in-one versatility** – with most models weighing less than 500 pounds, this system gives you the flexibility to install it on the roof when space is a concern.

7 **Enhanced dehumidification** – with our optional Thermidistat™ Control allows you to enjoy improved energy efficiency and comfort during the cooling season.

8 **Optional ArmorCoat™ tin-plated coil** – provides superior corrosion resistance compared to our standard copper tube/aluminum fin coil for longer life. Tin-plated coil is backed with a 10-year limited warranty.

10 YEAR LIMITED WARRANTY


## Turn to the Experts

Willis Carrier invented air conditioning in 1902. Over 100 years later, we're proud to say Carrier® systems are trusted in more homes than any other brand.

Carrier continues to be on the forefront of innovative engineering and unsurpassed standards of excellence. So when choosing a home comfort system, you'll want to turn to the experts. Your Carrier dealer will evaluate your home, such as window placement and size, ductwork, other structural specifics and lifestyle to provide a customized indoor comfort plan designed specifically for you. And when you have an expert helping you make an educated decision, you're going to feel more comfortable.

Carrier®

Turn to the Experts.℠

**www.carrier.com** **1-800-CARRIER**

**A member of the United Technologies Corporation family.**
**Stock Symbol UTX.**



01-848-204-25



Model 48ES

PRINTED ON RECYCLED PAPER

ENERGUIDE
Seasonal Energy Efficiency Ratio (SEER)
THIS MODEL
13.0
13.0 — Uses least energy → 16.05

c UL us

Always look for these symbols, the air conditioning and heating industries seals of certified performance, efficiency and capacity.

# APPENDIX D

*Roadway Noise Construction Model (RNCM) Input & Results*

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 4/18/2019
Case Description: Palm Villas - Site Prep

---- Receptor #1 ----

| | | Baselines (dBA) | | |
|---|---|---|---|---|
| Description | Land Use | Daytime | Evening | Night |
| Closest Residence | Residential | 50 | 45 | 40 |

| Description | Impact Device | Usage(%) | Equipment Spec Lmax (dBA) | Actual Lmax (dBA) | Receptor Distance (feet) | Estimated Shielding (dBA) |
|---|---|---|---|---|---|---|
| Grader | No | 40 | 85 | | 120 | 0 |
| Front End Loader | No | 40 | | 79.1 | 120 | 0 |

Results

Calculated (dBA)

| Equipment | *Lmax | Leq |
|---|---|---|
| Grader | 77.4 | 73.4 |
| Front End Loader | 71.5 | 67.5 |
| Total | 77.4 | 74.4 |

*Calculated Lmax is the Loudest value.

---- Receptor #2 ----

| | | Baselines (dBA) | | |
|---|---|---|---|---|
| Description | Land Use | Daytime | Evening | Night |
| Acoustic Center | Residential | 50 | 45 | 40 |

| Description | Impact Device | Usage(%) | Equipment Spec Lmax (dBA) | Actual Lmax (dBA) | Receptor Distance (feet) | Estimated Shielding (dBA) |
|---|---|---|---|---|---|---|
| Grader | No | 40 | 85 | | 230 | 0 |
| Front End Loader | No | 40 | | 79.1 | 230 | 0 |

Results

Calculated (dBA)

| Equipment | *Lmax | Leq |
|---|---|---|
| Grader | 71.7 | 67.8 |
| Front End Loader | 65.9 | 61.9 |
| Total | 71.7 | 68.8 |

*Calculated Lmax is the Loudest value.

---- Receptor #3 ----

Baselines (dBA)

| Description | Land Use | Daytime | Evening | Night |
|---|---|---|---|---|
| 25 Ft. Ordinance Reference | Residential | 50 | 45 | 40 |

Equipment

| Description | Impact Device | Usage(%) | Spec Lmax (dBA) | Actual Lmax (dBA) | Receptor Distance (feet) | Estimated Shielding (dBA) |
|---|---|---|---|---|---|---|
| Grader | No | 40 | 85 | | 25 | 0 |
| Front End Loader | No | 40 | | 79.1 | 25 | 0 |

Results

Calculated (dBA)

| Equipment | | *Lmax | Leq |
|---|---|---|---|
| Grader | | 91 | 87 |
| Front End Loader | | 85.1 | 81.2 |
| | Total | 91 | 88 |

*Calculated Lmax is the Loudest value.

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 4/18/2019
Case Description: Palm Villas - Grading

---- Receptor #1 ----

| | | Baselines (dBA) | | |
|---|---|---|---|---|
| Description | Land Use | Daytime | Evening | Night |
| Closest Residence | Residential | 50 | 45 | 40 |

| | | | Equipment | | | |
|---|---|---|---|---|---|---|
| | | | Spec | Actual | Receptor | Estimated |
| | Impact | | Lmax | Lmax | Distance | Shielding |
| Description | Device | Usage(%) | (dBA) | (dBA) | (feet) | (dBA) |
| Concrete Saw | No | 20 | | 89.6 | 120 | 0 |
| Dozer | No | 40 | | 81.7 | 120 | 0 |
| Front End Loader | No | 40 | | 79.1 | 120 | 0 |
| Front End Loader | No | 40 | | 79.1 | 120 | 0 |
| Backhoe | No | 40 | | 77.6 | 120 | 0 |

Results

| | | Calculated (dBA) | |
|---|---|---|---|
| Equipment | | *Lmax | Leq |
| Concrete Saw | | 82 | 75 |
| Dozer | | 74.1 | 70.1 |
| Front End Loader | | 71.5 | 67.5 |
| Front End Loader | | 71.5 | 67.5 |
| Backhoe | | 70 | 66 |
| | Total | 82 | 77.6 |

*Calculated Lmax is the Loudest value.

---- Receptor #2 ----

| | | Baselines (dBA) | | |
|---|---|---|---|---|
| Description | Land Use | Daytime | Evening | Night |
| Acoustic Center | Residential | 50 | 45 | 40 |

| | | | Equipment | | | |
|---|---|---|---|---|---|---|
| | | | Spec | Actual | Receptor | Estimated |
| | Impact | | Lmax | Lmax | Distance | Shielding |
| Description | Device | Usage(%) | (dBA) | (dBA) | (feet) | (dBA) |
| Concrete Saw | No | 20 | | 89.6 | 230 | 0 |
| Dozer | No | 40 | | 81.7 | 230 | 0 |
| Front End Loader | No | 40 | | 79.1 | 230 | 0 |
| Front End Loader | No | 40 | | 79.1 | 230 | 0 |
| Backhoe | No | 40 | | 77.6 | 230 | 0 |

Results

Calculated (dBA)

| Equipment | | *Lmax | Leq |
|---|---|---|---|
| Concrete Saw | | 76.3 | 69.3 |
| Dozer | | 68.4 | 64.4 |
| Front End Loader | | 65.9 | 61.9 |
| Front End Loader | | 65.9 | 61.9 |
| Backhoe | | 64.3 | 60.3 |
| | Total | 76.3 | 71.9 |

*Calculated Lmax is the Loudest value.

---- Receptor #3 ----

Baselines (dBA)

| Description | Land Use | Daytime | Evening | Night |
|---|---|---|---|---|
| 25 Ft. Ordinance Reference | Residential | 50 | 45 | 40 |

Equipment

| Description | Impact Device | Usage(%) | Spec Lmax (dBA) | Actual Lmax (dBA) | Receptor Distance (feet) | Estimated Shielding (dBA) |
|---|---|---|---|---|---|---|
| Concrete Saw | No | 20 | | 89.6 | 25 | 0 |
| Dozer | No | 40 | | 81.7 | 25 | 0 |
| Front End Loader | No | 40 | | 79.1 | 25 | 0 |
| Front End Loader | No | 40 | | 79.1 | 25 | 0 |
| Backhoe | No | 40 | | 77.6 | 25 | 0 |

Results

Calculated (dBA)

| Equipment | | *Lmax | Leq |
|---|---|---|---|
| Concrete Saw | | 95.6 | 88.6 |
| Dozer | | 87.7 | 83.7 |
| Front End Loader | | 85.1 | 81.2 |
| Front End Loader | | 85.1 | 81.2 |
| Backhoe | | 83.6 | 79.6 |
| | Total | 95.6 | 91.2 |

*Calculated Lmax is the Loudest value.

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 4/18/2019
Case Description: Palm Villas - Building Const.

---- Receptor #1 ----

| | | Baselines (dBA) | | |
|---|---|---|---|---|
| Description | Land Use | Daytime | Evening | Night |
| Closest Residence | Residential | 50 | 45 | 40 |

| Description | Impact Device | Usage(%) | Equipment Spec Lmax (dBA) | Actual Lmax (dBA) | Receptor Distance (feet) | Estimated Shielding (dBA) |
|---|---|---|---|---|---|---|
| Crane | No | 16 | | 80.6 | 120 | 0 |
| Gradall | No | 40 | | 83.4 | 120 | 0 |
| Gradall | No | 40 | | 83.4 | 120 | 0 |
| Backhoe | No | 40 | | 77.6 | 120 | 0 |
| Backhoe | No | 40 | | 77.6 | 120 | 0 |

Results

| | | Calculated (dBA) | |
|---|---|---|---|
| Equipment | | *Lmax | Leq |
| Crane | | 72.9 | 65 |
| Gradall | | 75.8 | 71.8 |
| Gradall | | 75.8 | 71.8 |
| Backhoe | | 70 | 66 |
| Backhoe | | 70 | 66 |
| | Total | 75.8 | 76.2 |

*Calculated Lmax is the Loudest value.

---- Receptor #2 ----

| | | Baselines (dBA) | | |
|---|---|---|---|---|
| Description | Land Use | Daytime | Evening | Night |
| Acoustic Center | Residential | 50 | 45 | 40 |

| Description | Impact Device | Usage(%) | Equipment Spec Lmax (dBA) | Actual Lmax (dBA) | Receptor Distance (feet) | Estimated Shielding (dBA) |
|---|---|---|---|---|---|---|
| Crane | No | 16 | | 80.6 | 230 | 0 |
| Gradall | No | 40 | | 83.4 | 230 | 0 |
| Gradall | No | 40 | | 83.4 | 230 | 0 |
| Backhoe | No | 40 | | 77.6 | 230 | 0 |
| Backhoe | No | 40 | | 77.6 | 230 | 0 |

Results

Calculated (dBA)

| Equipment | | *Lmax | Leq |
|---|---|---|---|
| Crane | | 67.3 | 59.3 |
| Gradall | | 70.1 | 66.2 |
| Gradall | | 70.1 | 66.2 |
| Backhoe | | 64.3 | 60.3 |
| Backhoe | | 64.3 | 60.3 |
| | Total | 70.1 | 70.5 |

*Calculated Lmax is the Loudest value.

---- Receptor #3 ----

Baselines (dBA)

| Description | Land Use | Daytime | Evening | Night |
|---|---|---|---|---|
| 25 Ft. Ordinance Reference | Residential | 50 | 45 | 40 |

Equipment

| Description | Impact Device | Usage(%) | Spec Lmax (dBA) | Actual Lmax (dBA) | Receptor Distance (feet) | Estimated Shielding (dBA) |
|---|---|---|---|---|---|---|
| Crane | No | 16 | | 80.6 | 25 | 0 |
| Gradall | No | 40 | | 83.4 | 25 | 0 |
| Gradall | No | 40 | | 83.4 | 25 | 0 |
| Backhoe | No | 40 | | 77.6 | 25 | 0 |
| Backhoe | No | 40 | | 77.6 | 25 | 0 |

Results

Calculated (dBA)

| Equipment | | *Lmax | Leq |
|---|---|---|---|
| Crane | | 86.6 | 78.6 |
| Gradall | | 89.4 | 85.4 |
| Gradall | | 89.4 | 85.4 |
| Backhoe | | 83.6 | 79.6 |
| Backhoe | | 83.6 | 79.6 |
| | Total | 89.4 | 89.8 |

*Calculated Lmax is the Loudest value.

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 4/18/2019
Case Description: Palm Villas - Paving

---- Receptor #1 ----

| | | Baselines (dBA) | | |
|---|---|---|---|---|
| Description | Land Use | Daytime | Evening | Night |
| Closest Residence | Residential | 50 | 45 | 40 |

| Description | Impact Device | Usage(%) | Equipment Spec Lmax (dBA) | Actual Lmax (dBA) | Receptor Distance (feet) | Estimated Shielding (dBA) |
|---|---|---|---|---|---|---|
| Concrete Mixer Truck | No | 40 | | 78.8 | 120 | 0 |
| Concrete Mixer Truck | No | 40 | | 78.8 | 120 | 0 |
| Concrete Mixer Truck | No | 40 | | 78.8 | 120 | 0 |
| Concrete Mixer Truck | No | 40 | | 78.8 | 120 | 0 |
| Paver | No | 50 | | 77.2 | 120 | 0 |
| Roller | No | 20 | | 80 | 120 | 0 |
| Backhoe | No | 40 | | 77.6 | 120 | 0 |

Results

| | | Calculated (dBA) | |
|---|---|---|---|
| Equipment | | *Lmax | Leq |
| Concrete Mixer Truck | | 71.2 | 67.2 |
| Concrete Mixer Truck | | 71.2 | 67.2 |
| Concrete Mixer Truck | | 71.2 | 67.2 |
| Concrete Mixer Truck | | 71.2 | 67.2 |
| Paver | | 69.6 | 66.6 |
| Roller | | 72.4 | 65.4 |
| Backhoe | | 70 | 66 |
| | Total | 72.4 | 75.2 |

*Calculated Lmax is the Loudest value.

---- Receptor #2 ----

| | | Baselines (dBA) | | |
|---|---|---|---|---|
| Description | Land Use | Daytime | Evening | Night |
| Acoustic Center | Residential | 50 | 45 | 40 |

| Description | Impact Device | Usage(%) | Equipment Spec Lmax (dBA) | Actual Lmax (dBA) | Receptor Distance (feet) | Estimated Shielding (dBA) |
|---|---|---|---|---|---|---|
| Concrete Mixer Truck | No | 40 | | 78.8 | 230 | 0 |
| Concrete Mixer Truck | No | 40 | | 78.8 | 230 | 0 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Concrete Mixer Truck | | No | 40 | 78.8 | 230 | 0 |
| Concrete Mixer Truck | | No | 40 | 78.8 | 230 | 0 |
| Paver | | No | 50 | 77.2 | 230 | 0 |
| Roller | | No | 20 | 80 | 230 | 0 |
| Backhoe | | No | 40 | 77.6 | 230 | 0 |

Results

Calculated (dBA)

| Equipment | | *Lmax | Leq |
|---|---|---|---|
| Concrete Mixer Truck | | 65.5 | 61.6 |
| Concrete Mixer Truck | | 65.5 | 61.6 |
| Concrete Mixer Truck | | 65.5 | 61.6 |
| Concrete Mixer Truck | | 65.5 | 61.6 |
| Paver | | 64 | 61 |
| Roller | | 66.7 | 59.8 |
| Backhoe | | 64.3 | 60.3 |
| | Total | 66.7 | 69.5 |

*Calculated Lmax is the Loudest value.

---- Receptor #3 ----

Baselines (dBA)

| Description | Land Use | Daytime | Evening | Night |
|---|---|---|---|---|
| 25 Ft. Ordinance Reference | Residential | 50 | 45 | 40 |

Equipment

| Description | Impact Device | Usage(%) | Spec Lmax (dBA) | Actual Lmax (dBA) | Receptor Distance (feet) | Estimated Shielding (dBA) |
|---|---|---|---|---|---|---|
| Concrete Mixer Truck | No | 40 | | 78.8 | 25 | 0 |
| Concrete Mixer Truck | No | 40 | | 78.8 | 25 | 0 |
| Concrete Mixer Truck | No | 40 | | 78.8 | 25 | 0 |
| Concrete Mixer Truck | No | 40 | | 78.8 | 25 | 0 |
| Paver | No | 50 | | 77.2 | 25 | 0 |
| Roller | No | 20 | | 80 | 25 | 0 |
| Backhoe | No | 40 | | 77.6 | 25 | 0 |

Results

Calculated (dBA)

| Equipment | *Lmax | Leq |
|---|---|---|
| Concrete Mixer Truck | 84.8 | 80.8 |
| Concrete Mixer Truck | 84.8 | 80.8 |
| Concrete Mixer Truck | 84.8 | 80.8 |
| Concrete Mixer Truck | 84.8 | 80.8 |
| Paver | 83.2 | 80.2 |
| Roller | 86 | 79 |

| | | | |
|---|---|---|---|
| Backhoe | | 83.6 | 79.6 |
| | Total | 86 | 88.8 |

*Calculated Lmax is the Loudest value.

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 4/18/2019
Case Description: Palm Villas - Arch. Coating

---- Receptor #1 ----

| Description | Land Use | Baselines (dBA) Daytime | Evening | Night |
|---|---|---|---|---|
| Closest Residence | Residential | 50 | 45 | 40 |

| Description | Impact Device | Usage(%) | Equipment Spec Lmax (dBA) | Actual Lmax (dBA) | Receptor Distance (feet) | Estimated Shielding (dBA) |
|---|---|---|---|---|---|---|
| Compressor (air) | No | 40 | | 77.7 | 120 | 0 |

Results

| Equipment | | Calculated (dBA) *Lmax | Leq |
|---|---|---|---|
| Compressor (air) | | 70.1 | 66.1 |
| | Total | 70.1 | 66.1 |

*Calculated Lmax is the Loudest value.

---- Receptor #2 ----

| Description | Land Use | Baselines (dBA) Daytime | Evening | Night |
|---|---|---|---|---|
| Acoustic Center | Residential | 50 | 45 | 40 |

| Description | Impact Device | Usage(%) | Equipment Spec Lmax (dBA) | Actual Lmax (dBA) | Receptor Distance (feet) | Estimated Shielding (dBA) |
|---|---|---|---|---|---|---|
| Compressor (air) | No | 40 | | 77.7 | 230 | 0 |

Results

| Equipment | | Calculated (dBA) *Lmax | Leq |
|---|---|---|---|
| Compressor (air) | | 64.4 | 60.4 |
| | Total | 64.4 | 60.4 |

*Calculated Lmax is the Loudest value.

---- Receptor #3 ----

| Description | Land Use | Baselines (dBA) Daytime | Evening | Night |
|---|---|---|---|---|
| 25 Ft. Ordinance Reference | Residential | 50 | 45 | 40 |

| Description | Impact Device | Usage(%) | Equipment Spec Lmax (dBA) | Actual Lmax (dBA) | Receptor Distance (feet) | Estimated Shielding (dBA) |
|---|---|---|---|---|---|---|
| Compressor (air) | No | 40 | | 77.7 | 25 | 0 |

Results

Calculated (dBA)

| Equipment | *Lmax | Leq |
|---|---|---|
| Compressor (air) | 83.7 | 79.7 |
| Total | 83.7 | 79.7 |

*Calculated Lmax is the Loudest value.