Veneklasen Associates
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April 4, 2023

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Attention: Laura Kaufman

Subject: Latigo Hillcrest Project; Los Angeles County, California
Noise and Vibration Study; Veneklasen Project No. 8119-002

Veneklasen Associates (VA) conducted an acoustical study of the Latigo Hillcrest Project to be located at 2150 Hillcrest Drive in the City of Thousand Oaks, California. The Latigo Hillcrest Project (Project) consists of a four-story mixed-use development to contain 333 multi-family residential units. The Project location is shown in Figure 1.

This study analyzes the noise and vibration impacts related to construction and future Project operations. A list of acoustical terms and their definitions is presented in Appendix A.

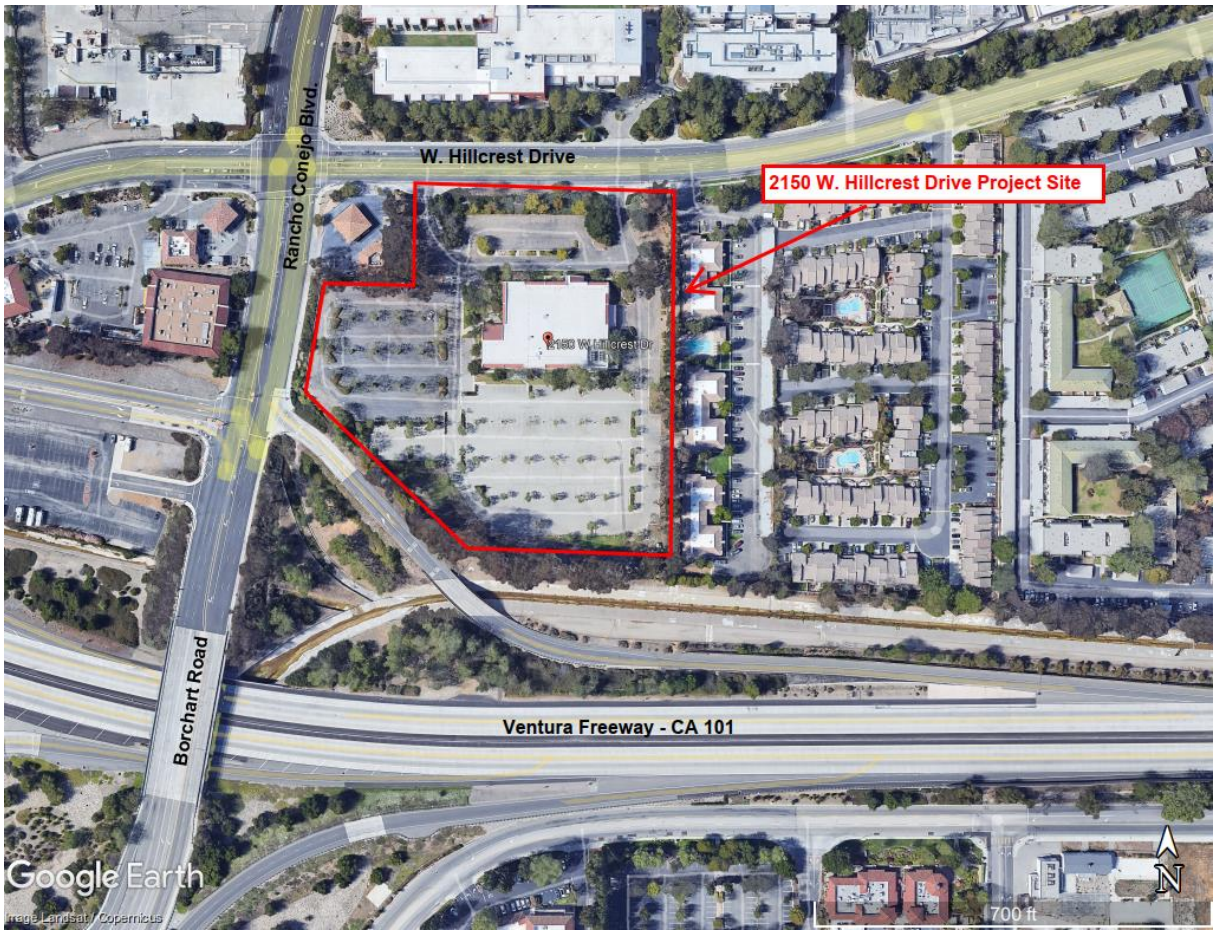

Figure 1. Project Site Location

PROJECT DESCRIPTION

The Latigo Hillcrest Project (Project), proposed by The Latigo Group, LLC, is to be located on an 8.19-net acre (8.28-gross acre) site at 2150 W. Hillcrest Drive, in the City of Thousand Oaks community of Newbury Park, California. The project consists of a four-story mixed-use development encompassing 629,937 gross square feet (sf) of building area, that would contain 333 multi-family residential units (including 30 very low-income affordable units), common areas and amenities, and 5,300 gross sf of commercial retail and restaurant space above a 564-space semi-subterranean parking structure.

Figure 2. Proposed Project Elements

NOISE AND VIBRATION CRITERIA

A. NOISE

Latigo Hillcrest Project is in Ventura County in the City of Thousand Oaks. The City of Thousand Oaks has a General Plan with a Noise Element which discusses noise issues and problems, goals and objectives of the City, and strategies for solving noise problems. The noise element states, in its Table 9: Thresholds of Significance that a three (3) decibel (dBA) or less increase in the energy-averaged noise level may be a significant change in noise level, depending on the "annual average noise level" in CNEL with the proposed project. The Noise Element also indicates that exterior noise levels of 60 CNEL and below are normally compatible with residential development, and 60 CNEL to 65 CNEL is conditionally compatible and 65 to 70 CNEL is normally incompatible, but both are compatible with a detailed acoustical analysis showing building elements required for compliance with an interior noise level of 45 CNEL. The State of California General Plan Guidelines indicates that an exterior noise environment up to 65 CNEL is "normally acceptable" for single and multi-family residential uses, while up to 75 CNEL is "conditionally acceptable" with special noise insulation requirements.

The City of Thousand Oaks Municipal Code Title 5, Chapter 21, *Noise* does not provide exterior noise level impact criteria but addresses loud, unusual, and unnecessary noise sources and limits amplified audio and power equipment to daytime hours of 7:00 am to 9:00 pm. The City Municipal Code does not specify a numerical limit on construction noise, unless it occurs from 7:00 p.m. to 7:00 a.m., or at any time on a Sunday. As nighttime or Sunday construction is not anticipated, project construction would comply with City of Thousand Oaks Municipal Code Title 8, Chapter 11, Section 11.01.

State of California Green Building Code

Section 5.507.4.2 of the California Green Building Code stipulates that for buildings exposed to a noise level of 65 dB or more when measured as a 1-hour Equivalent Sound Level (Leq), the building façade, including walls, windows, and roofs making up the building or addition envelope or altered envelope, shall provide enough sound insulation so that the interior sound level from exterior sources does not exceed 50 dBA during any hour of operation.

B. VIBRATION

The Federal Transit Authority (FTA) *Transit Noise and Vibration Impact Assessment* manual specifies vibration limits for construction activity. Neither the Ventura County or the City of Thousand Oaks codes specify vibration limits. The FTA vibration limit to prevent building damage corresponding to neighboring building construction is 94 VdB as indicated in Table 12-3 of the manual. The manual also specifies in Table 6-3 that vibration levels of 72 VdB is the limit for frequent events impacting residences and buildings where people sleep and 65 VdB is the limit for buildings where vibration would interfere with interior operations. We will utilize these criteria for this analysis.

Table 1 below summarizes the vibration criteria utilized for the construction of this Project.

Table 1. Construction Vibration Limits

Vibration Impact	Limit RMS Particle Velocity (VdB re: $1x10^{-6}$in/sec)
Building Damage	94
Buildings Where People Sleep	72
Vibration for Sensitive Operations	65

EXISTING MEASURED AMBIENT SOUND LEVEL

Acoustical measurements were conducted from November 29, 2022, to December 1, 2022, to evaluate the existing ambient sound levels near the site property lines at Locations 1, 2, 3 and 4 as indicated in Figure 3. The measured hourly average Leq ambient and Community Noise Equivalent Level (CNEL) sound levels are summarized in Table 2.

Table 2. Measured Hourly Average Ambient Noise Levels

Noise Level	Measured Ambient Noise Level (dBA L_{eq})			
	Location 1	Location 2	Location 3	Location 4
Average Hourly Day/Night Leq	60/56	62/58	60/56	65/61
CNEL	64	66	64	69

Figure 3. Measurement Locations and Sensitive Receptors Near Latigo Hillcrest Project

ACOUSTICAL ANALYSIS – NOISE

The acoustical analysis of noise for the Project includes an analysis of both the existing ambient noise level and on-site land use noise compatibility as well as future impacts to sensitive receptors due to the project.

ON-SITE NOISE FROM EXTERNAL SOURCES

Under CEQA, potential impacts of the environment on a proposed project are generally not required to be analyzed as held in the ruling in *California Building Industry Association v. Bay Area Air Quality Management District (CBIA v. BAAQMD)*. The following discussion evaluates compatibility of the proposed noise-sensitive residential project with the surrounding environment for planning and informational purposes.

The existing ambient noise level measured between 64 and 69 CNEL which by the City of Thousand Oaks General Plan is considered Conditionally Compatible to Normally Incompatible, but both are compatible with a detailed acoustical analysis showing building elements required for compliance with an interior noise level of 45 CNEL. Per the report from the Transportation Research Board, National Research Council, *Highway Noise: A Design Guide for Highway Engineers, National Cooperative Highway Research Program Report 117*, residential construction with closed windows provides an outside to inside noise attenuation of 25 dBA. This noise reduction provides an interior CNEL of 39 to 44, meeting the interior noise criteria of 45 CNEL or less. The California Green Building Code does not apply as the average hourly exterior noise level measured at Location 1 is below 65 dBA.

PROJECT IMPACTS

A. OPERATIONS

The Project operations include residential housing and commercial retail and restaurant uses. The main sources of increased noise due to these operations are traffic noise and mechanical noise such as air conditioning noise.

The traffic study produced by Stantec, *2150 HILLCREST DRIVE Traffic, Circulation and Vehicle Miles Traveled (VMT) Study*, dated March 23, 2023, indicates peak hour traffic volumes at the Project entrance and the affected intersections surrounding the Project site in Exhibits 6 and 7. An analysis of the predicted traffic volumes indicates the largest increase in traffic occurs along W. Hillcrest Drive at the entrance/exit to the Project site. Exhibit 6 indicates the Project-added AM/PM peak hour traffic volumes as 87/68 to yield an existing plus Project peak hour traffic volumes of 628 and 452. The predicted traffic noise increase for these peak hour traffic volumes is 0.6 dBA for AM traffic and 0.7 dBA for PM traffic, based on the equation for an increase in the number of equivalent noise sources ($L = 10 \bullet \log (v_2/v_1)$; where L = noise level increase, v_1= initial number of sources, and v_2 = *increased number of sources*). Based on these noise level increases, and the measured existing noise levels in Table 2, existing plus Project noise levels at the nearest sensitive receptors, the residences to the east, would range from approximately 65 dBA CNEL to 70 dBA CNEL, as shown on Table 3. This increase in traffic noise of less than one decibel is not a significant increase, as the applicable City threshold would be a 1.5 dBA increase when average noise levels with the Project range from 60-70 dBA CNEL. In addition, a noise level increase of less than one decibel would not typically be perceptible, even in controlled laboratory conditions.

Table 3. Project Operations Noise Increase

Scenario	24-Hour Noise Level at Sensitive Receptors	
	Location 3	Location 4
Existing Ambient Noise Level	64 dBA CNEL	69 dBA CNEL
Project Noise Level Increase	0.7 dBA	0.7 dBA
With Project Noise Level	65 dBA CNEL	70 dBA CNEL

Typical heating, ventilation, and air conditioning (HVAC) mechanical equipment noise produces a sound power level of 75 A-weighted decibels. This equipment is planned for rooftop installation behind roof parapets. The noise from one HVAC unit at the property line, approximately 50 feet away, is predicted to be 41 dBA without considering the sound mitigation afforded by the parapet. Assuming a nominal 5 dBA reduction due to parapet noise shielding, the predicted property line sound level is 36 dBA. With eight units along the east side of the project, the total noise level is predicted to by 45 dBA, much less than the average nighttime measured ambient noise level of 56 dBA indicated in Table 2. Should the final design of the project change the assumptions considered in this analysis, an updated acoustical analysis will be required.

B. CONSTRUCTION

The construction planned for the Latigo Hillcrest Project assumes the sample construction equipment shown in Table 4.

Table 4 – Sample Construction Schedule and Equipment

Phase	Duration	Equipment Type [a]	(# of pieces)
Demolition	20 days	Concrete Saw	1
		Dozers	1
		Excavator	1
		Bobcats	1
Grading	65 days	Excavator	1
		Front-end Loader	1
		Rubber Tired Dozers	1
		Tractor/Loader/Backhoe	1
Building Construction	655 days	Cranes	2
		Forklifts	4
		Generator Sets	2
		Welders	2
Paving	20 days [b]	Pavers	2
		Paving Equipment	2
		Rollers	2
Architectural Coating	145 days [b]	Air Compressors	1

Source: CalEEMod defaults, with adjustments for project-specific data from RCI Builders, December 2022.

[a] The Project would use off-road construction equipment that meets or exceeds EPA Tier 4 Final emissions reduction standards and certification requirements.

[b] Paving and Architectural Coating phases would overlap with Building Construction phase activities.

The analysis of the various phases of construction indicates the maximum construction noise produced occurs with all equipment operating during the grading phase. The predicted construction noise level at the residential area is 71 dBA; this calculation is indicated in Appendix B. The predicted construction noise level of 71 dBA is significantly higher than the measured daytime hourly ambient noise levels of 60 dBA Leq to 65 dBA Leq near the sensitive receptors (see Table 2) and would result in a temporary noise increase of 6 to 11 dBA as shown on Table 5. In the absence of City thresholds for substantial temporary noise increases, a threshold of a 10 dB increase above ambient noise levels, which humans perceive as a doubling of noise levels, is considered an appropriate threshold. As the temporary noise level increases from project construction are greater than 10 dB, a significant impact would occur, and a reduction measure would be required to reduce temporary noise impacts. A12-foot-high barrier at the eastern boundary of the project site is recommended to reduce the construction noise levels at the residences by 14 dBA to 62 dBA. The resulting predicted mitigated construction noise level of 62 dBA are close to the measured ambient noise levels and will temporarily increase the ambient noise level by approximately 2 to 4 dBA at the residences to the east, as shown on Table 6. As the mitigated construction noise levels would not result in a 10 dB increase above existing ambient noise levels, construction noise levels would be less than significant with mitigation.

When the selected contractor schedules the construction phases and the equipment for each phase, an updated analysis can be performed to determine if any mitigation changes are desired.

Table 5 Construction Noise Levels

Scenario	Daytime Noise Level at Sensitive Receptors	
	Location 3	Location 4
Existing Ambient Noise Level	60 dBA Leq	65 dBA Leq
Project Construction Noise Level	71 dBA	71 dBA
With Project Ambient Noise Level	71 dBA	71 dBA
Temporary Noise Increase	11 dBA	6 dBA

Table 6 Mitigated Construction Noise Levels

Scenario	Daytime Noise Level at Sensitive Receptors	
	Location 3	Location 4
Existing Ambient Noise Level	60 dBA Leq	65 dBA Leq
Project Construction Noise Level with Barrier	62 dBA	62 dBA
With Project Ambient Noise Level with Barrier	64 dBA	67 dBA
Temporary Noise Increase with Barrier	4 dBA	2 dBA

RECOMMENDED CONSTRUCTION NOISE REDUCTION MEASURES

NOI-1 A12-foot-high barrier shall be placed at the eastern boundary of the project site during construction to reduce the construction noise levels at the residences by 14 dBA to 62 dBA. The resulting predicted mitigated construction noise level of 62 dBA are close to the measured ambient noise levels and will temporarily increase the ambient noise level by approximately 2 to 4 dBA at the residences to the east, as shown on Table 6 of the EIR Noise and Vibration Study (Veneklasen 2023). When the selected contractor schedules the

construction phases and the equipment for each phase, an updated analysis can be performed to determine if any mitigation changes are desired.

ACOUSTICAL ANALYSIS - VIBRATION

A. OPERATIONS

The proposed future operations at Latigo Hillcrest Project consist of residential and commercial restaurant and retail use, resulting in vehicular traffic. On-road vehicles are unlikely to generate perceptible groundborne vibration when traveling on smooth roadways, according to the Caltrans Transportation and Construction Vibration Guidance Manual. The Federal Transit Administration Transit Noise and Vibration Impact Assessment Manual states that most complaints about vibration from buses and trucks are due to the rattling of windows or items affixed to walls, which is usually the result of airborne noise rather than groundborne vibration. The vibration from the project's operational traffic will not be perceptible at nearby receptors.

B. CONSTRUCTION

The construction projected for the Latigo Hillcrest Project includes the approximate schedule and equipment shown above in Table 4. This equipment was utilized from the Grading Phase as well as the use of a pile driver to determine possible vibration impacts to the nearby sensitive receptors. The Amgen property conducts operations that are vibrationally sensitive, and therefore the vibration limit is 65 VdB. Due to this vibration limit, an impact pile driver cannot be utilized at the Project site, as such a pile driver would require operation at not closer than 925 feet from the Amgen site to limit the vibration to 65 VdB. This Project site is located between 190 feet and 850 feet from the Amgen site, and the 925-foot distance is beyond the furthest southern edge of the Project site.

Further analysis indicates that the construction equipment operating near the northern property line of the Project is limited to two (2) units operating within the 190-foot distance from the Amgen buildings while other equipment must be operated at 500 feet to comply with the 65 VdB vibration level. The vibration limit for building damage of 94 VdB can be met with all the listed equipment operating at 50 feet but with no more than two units operating at a distance of 20 feet from a residence on the east side of the site.

These measures prevent building damage and impacts to vibration sensitive operations. With the measures in place, the vibration impacts would be below the building damage thresholds. Vibration may be perceptible for short periods when equipment is located within 20 feet of residences. Sample calculations for the vibration impacts are included in Appendix B.

RECOMMENDED CONSTRUCTION VIBRATION REDUCTION MEASURES

NOI-2 Impact pile drivers shall not be used on site and alternative equipment and methods (such as cast-in-drilled-hole (CIDH) piles) shall be used to construct the deep foundation system for the proposed project buildings.

NOI -3 No more than two units of powered construction equipment shall be used at the same time within 20 feet from any residence on the east side of the site.

CONCLUSION

This study indicates the Project site use complies with the City of Thousand Oaks General Plan and the State of California Noise Standards for retail use and for residential use with a noise study indicating any special exterior building components required for the residential units to meet an interior 65 CNEL. It also indicates that future operations at the Latigo Hillcrest Project will not create a significant noise impact or vibration impact, but an acoustical analysis will be required for the final mechanical design, to be reviewed and approved by the City, to ensure mechanical equipment noise does not impact nearby sensitive receptors.

Construction noise and vibration mitigation is required to prevent noise impacts at sensitive receptors and to prevent vibration impacts to sensitive operations at Amgen and to prevent building damage to the residences to the east of the site. The mitigation includes a 12-foot-high noise barrier at the eastern boundary of the project site during construction to mitigate noise impacts to the residences to the east and limiting equipment uses to mitigate vibration impacts the residences to the east and sensitive operations at Amgen. When construction phases and equipment use is finalized, these mitigation measures can be re-evaluated.

Sincerely,
Veneklasen Associates, Inc.

Stephen A. Martin, Ph.D., P.E.
Associate Principal
Director, Environmental Acoustics

APPENDIX A. DEFINITIONS OF ACOUSTICAL TERMS

Term	Definition
Sound	Relatively small fluctuations in the air above and below atmospheric pressure. These fluctuations travel through the air as waves and are perceived by the ear and brain as audible sound.
Noise	Characterized simply as unwanted sound.
Decibel (dB)	A unit describing the amplitude of sound in a logarithmic ratio to a reference value.
A-weighted Decibels (dB(A))	A filter applied to sound pressure levels in decibel to simulate the response of the human ear at the threshold of hearing. A-weighting de-emphasizes the low frequency components of a sound similar to the human ear at these levels. This metric has been closely tied to subjective reactions of annoyance to noise, and is used as a sound metric in this and in many other environmental acoustics reports. In this report, all dB(A) levels reported refer to the sound pressure level, referenced to 20µPa
Sound Pressure Level (SPL or L_p)	The amplitude of sound compared to the reference value of 20µPa. Sound Pressure Level is what we perceive as audible sound. Sound Pressure Level decreases as distance from the source to the receiver increases. All sound values discussed in this report refer to Sound Pressure Levels.
Sound Level Percentile (L_n)	Also referred to as a "statistical sound level", L_n refers to the sound level that is exceeded for nth percent of a given measurement period. For example, L_{50} refers to the sound level that is exceeded for 50% of a measurement period, i.e. 30 minutes out of an hour. These metrics can be used to evaluate sound levels that are apparent for a given period of time at a measurement location.
Maximum Sound Level (L_{max})	The maximum instantaneous sound level, regardless of duration. These sound levels fluctuate greatly over short periods of time, and are generally used to evaluate audibility of acoustical events.
Ambient Sound Level	The baseline sound level to which proposed or atypical sound levels are compared to. The "ambient" sound level is measured in the same location and during the same time of day for which sound exposure is to be analyzed for an assessment, without the source of the assessment operational. For the purposes of this study, the "ambient" sound level refers to the existing sound level at a location while an event at Latigo Hillcrest Project is not occuring.

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APPENDIX B. SAMPLE CONSTRUCTION NOISE AND VIBRATION ANALYSES

Construction Noise Prediction

Equipment Number	Equipment Index Number	Equipment	Reference Sound Pressure Level @ 50 ft (dBA re: 20µPa)					Reference Utilization (%)		Distance to Nearest Noise-Sensitive Receptor (ft)	Sound Pressure Level @ Receptor (dBA re: 20µPa)
			FTA	FHWA (Predicted)	FHWA (Measured)	VA	Used	FHWA	Used		
1	25	Excavator	N/A	85	81	N/A	85	40%	40%	325	65
2	27	Front End Loader	85	80	79	78	85	40%	40%	325	65
3	21	Dozer	85	85	82	N/A	85	40%	40%	325	65
4	64	Tractor	N/A	84	N/A	86	84	40%	40%	325	64
TOTAL SOUND PRESSURE LEVEL (dBA re: 20µPa)											71

Noise and Vibration Prediction: Equipment

Equipment Type [a]	(# of pieces)
Excavator	1
Front-end Loader	1
Rubber Tired Dozers	1
Tractor/Loader/Backhoe	1

Vibration within 20' of Residences

Veh. #	Index	Equipment	PPV_{ref}	L_v at 25ft (VdB)	Distance to Nearest Receptor (ft)	PPV_{equip}	L_v (VdB)	PPV Damage Criteria	L_v Damage Criteria	Annoyance Criteria	Damage Assessment	Annoyance Assessment
1	10	Excavator	0.089	87	20	0.124	89.9	0.2	94	72	No Impact	Impact
2	10	Front-end Loader	0.089	87	20	0.124	89.9	0.2	94	72	No Impact	Impact
3	10	Bulldozer	0.089	87	100	0.011	68.9	0.2	94	72	No Impact	No Impact
4	14	Tractor	0.003	58	20	0.004	60.9	0.2	94	72	No Impact	No Impact
TOTAL (All equipment simultaneously)						0.176	92.9	0.2	94	72	No Impact	Impact

Vibration with Pile Driver:

Veh. #	Index	Equipment	PPV_{ref}	L_v at 25ft (VdB)	Distance to Nearest Receptor (ft)	PPV_{equip}	L_v (VdB)	PPV Damage Criteria	L_v Damage Criteria	Annoyance Criteria	Damage Assessment	Annoyance Assessment
1	10	Excavator	0.089	87	500	0.001	48.0	0.2	65	72	No Impact	No Impact
2	10	Front-end Loader	0.089	87	500	0.001	48.0	0.2	65	72	No Impact	No Impact
3	10	Bulldozer	0.089	87	500	0.001	48.0	0.2	65	72	No Impact	No Impact
4	14	Tractor	0.003	58	500	0.000	19.0	0.2	65	72	No Impact	No Impact
12	1	Pile Driver (impact)	1.518	112	920	0.007	65.0	0.2	65	72	Impact	No Impact
TOTAL (All equipment simultaneously)						0.007	65.3	0.2	65	72	Impact	No Impact

Vibration at 190 feet from Amgen:

Veh. #	Index	Equipment	PPV_{ref}	L_v at 25ft (VdB)	Distance to Nearest Receptor (ft)	PPV_{equip}	L_v (VdB)	PPV Damage Criteria	L_v Damage Criteria	Annoyance Criteria	Damage Assessment	Annoyance Assessment
1	10	Excavator	0.089	87	190	0.004	60.6	0.2	94	72	**No Impact**	**No Impact**
2	10	Front-end Loader	0.089	87	190	0.004	60.6	0.2	94	72	**No Impact**	**No Impact**
3	10	Bulldozer	0.089	87	190	0.004	60.6	0.2	94	72	**No Impact**	**No Impact**
4	14	Tractor	0.003	58	190	0.000	31.6	0.2	94	72	**No Impact**	**No Impact**
TOTAL (All equipment simultaneously)						**0.007**	**65.3**	0.2	94	72	**No Impact**	**No Impact**