

# Appendix H-1

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## Supplemental Construction Noise Analysis

## MEMORANDUM

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<b>To:</b>	Kara Peterson
<b>From:</b>	Nick Segovia (Dudek); Mark Storm, INCE Bd. Cert. (Dudek)
<b>Subject:</b>	SDSU Evolve Student Housing Project EIR Supplemental Construction Noise Analysis
<b>Date:</b>	April 28, 2025
<b>cc:</b>	Sarah Lozano (Dudek); Jonathan Leech (Dudek); Corinne Resha (Dudek); Emily Seklecki (Dudek); Anne Collins-Doehne (CSU); Michael Haberkorn (GDB)
<b>Attachment:</b>	1 – Construction Noise Model Worksheets

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The purpose of this technical memorandum is to provide supplementary predictive noise assessment, evaluating potential outdoor and indoor noise exposures at San Diego State University (SDSU) existing on-campus housing nearest to proposed Evolve Student Housing (Project) construction activities.

## Methodology

In a manner comparable to the prediction of Project construction noise exposure levels at off-campus residential receptors as disclosed in Section 4.11.4 of Project Draft EIR, a Microsoft Excel-based noise prediction model emulating and using reference data from the Federal Highway Administration (FHWA) Roadway Construction Noise Model (RCNM) was used to estimate aggregate Project construction noise levels from activity groupings (“phases”) for six of the seven Phases of Project development (1a, 2, 3, 4, 5, and 6 for the Peninsula) at the nearest on-campus and occupied noise-sensitive land uses. Input variables for the predictive modeling consist of the following:

- the same construction equipment types and number of each (e.g., two dozers, three excavators, a backhoe) for each of the same seven phases (demolition, site preparation, grading, trenching, building construction, paving, and architectural coating) as studied in the Draft EIR;
- the “acoustical usage factor” (AUF) for each piece of equipment (i.e., percentage of time within a specific time period, such as an hour, when active and operating equipment is expected to perform a task at full power or load capacity and thus make noise at maximum sound level [ $L_{max}$ ]);
- the on-site equipment distances from an offsite noise-sensitive receiver (NSR) position, which vary with time over the course of a typical construction work day or shift; and
- the quantity of hours that the studied construction equipment may be on site and operating (or idling) within an established work shift (up to eight hours), which itself is a fraction of the 12-hour period used to evaluate the energy-averaged equivalent level ( $L_{eq12hr}$ ) for appropriate contrast with the City of San Diego construction noise threshold.

Conservatively, no topographical shielding was assumed in the modeling. However, the studied receptor location is located within a courtyard or is otherwise occluded from direct sound paths to the active construction equipment by an intervening building structure that functions as a tall barrier.

Because the RCNM has default AUF values for a large variety of common mobile and stationary construction equipment, which were derived from an extensive study of typical construction activity patterns (FHWA 2006), those default AUF values were—as was done for the Draft EIR—used for this noise analysis to predict exterior exposures for nearest representative Huaxyacac Hall.

Additionally, an exterior-to-interior noise analysis was performed for Huaxyacac Hall in order to predict background sound levels—resulting solely from Project construction activity intrusion through the receiving building envelope (i.e., the exterior wall assembly, including closed windows)—for inhabited indoor spaces and compare them 45 dBA CNEL (as required by the California Building Code [CBC]). These interior background sound levels are calculated from the following additional steps applied to the aforementioned method for predicting the exterior noise exposures:

1. To account for the exterior-to-interior noise intrusion path through the building envelope, the predicted exterior noise exposure is reduced by 33 dB—consistent with net sound insulation performance (a.k.a., sound transmission class) of a typical exterior wall comprising a sandwich of materials with penetrations that frame a portion of the wall's surface area (e.g., a dormitory room window) with closed double-paned windows.
2. The hourly  $L_{eq}$  value resulting from the above step is then translated into a Community Noise Equivalent Level (CNEL) by the following expression: indoor CNEL = indoor hourly  $L_{eq}$  +  $10 \cdot \text{LOG}(8/24)$ ; where the 8/24 ratio is the number of daytime construction hours within a total 24-hour period when construction noise will occur.

One refinement to the exterior noise prediction model utilized to furnish the hourly  $L_{eq}$  values prior to application of the above two steps is a shortening of the evaluation time period from the work shift duration (up to eight hours) to a standardized one-hour period.

Using these methods, Attachment 1 shows worksheets comparable to those appearing in Appendix H (Noise Technical Report) of the Draft EIR which were prepared to predict aggregate exterior noise and interior noise exposures associated with up to seven construction phases, for each of six Phases of Project development, at the studied receiving structure (Huaxyacac Hall).

## Results

Applying the methodology described in the preceding Section 2 narrative, Table 1 presents the predicted exterior noise exposures (12-hour  $L_{eq}$  values) at the identified building façade locations and the corresponding indoor background noise levels at inhabited spaces resulting from exterior-to-interior sound transmission through the building structural envelope.

**Table 1. Predicted Construction Noise Exposures at Huaxyacac Hall**

Construction Phase (and Equipment Types Involved)	Exterior Noise Exposure (12-hour $L_{eq}$ ) by Project Phase (and closest activity distance to receptor*)						Interior Noise CNEL from Intrusion**
	Phase 1a (175')	Phase 2 (570')	Phase 3 (900')	Phase 4 (870')	Phase 5 (570')	Phase 6 (340')	
Demolition	57	48	44	45	N/A	N/A	41
Site Preparation	57	48	45	45	48	52	41
Grading	56	48	45	48	51	55	41
Trenching	52	44	40	41	44	47	38

**Table 1. Predicted Construction Noise Exposures at Huaxyacac Hall**

Construction Phase (and Equipment Types Involved)	Exterior Noise Exposure (12-hour $L_{eq}$ ) by Project Phase (and closest activity distance to receptor*)						Interior Noise CNEL from Intrusion**
	Phase 1a (175')	Phase 2 (570')	Phase 3 (900')	Phase 4 (870')	Phase 5 (570')	Phase 6 (340')	
Building Construction	55	46	43	43	46	51	40
Paving	50	42	39	39	43	46	34
Architectural Coating	45	36	33	33	36	40	30
<b>Threshold Exceedance?</b>	<b>No</b>	<b>No</b>	<b>No</b>	<b>No</b>	<b>No</b>	<b>No</b>	<b>No</b>

**Notes:**  $L_{eq}$  = equivalent noise level; dBA = A-weighted decibels; N/A = not applicable.

\* receptor-to-activity direct sound path is occluded by a tall barrier (i.e., intervening building).

\*\* from outdoor construction activity as close as 175 feet to the studied sample inhabited space façade.

## References Cited

Federal Highway Administration (FHWA). 2006. *FHWA Roadway Construction Noise Model: User's Guide*. Final Report. FHWA-HEP-06-015. DOT-VNTSC-FHWA-06-02. Cambridge, Massachusetts: DOT, Research and Innovative Technology Administration. August.

Federal Transit Administration (FTA). 2018. *Transit Noise and Vibration Impact Assessment Manual*. FTA Report No. 0123. John A. Volpe National Transportation Systems Center. September. Accessed January 25, 2022 at [https://www.transit.dot.gov/sites/fta.dot.gov/files/docs/research-innovation/118131/transit-noise-and-vibration-impact-assessment-manual-fta-report-no-0123\\_0.pdf](https://www.transit.dot.gov/sites/fta.dot.gov/files/docs/research-innovation/118131/transit-noise-and-vibration-impact-assessment-manual-fta-report-no-0123_0.pdf).

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# **Attachment 1**

## Construction Noise Model Worksheets

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

noise level limit (Leq) during 1-hour daytime construction to remain below 45 dBA CNEL interior =	50
allowable hours over which Leq is to be averaged =	1

<-- The interior CNEL will be this hourly dBA level + 10\*LOG(8/24); i.e., 50 + (-5) = 45 CNEL.

Construction Activity (grouping or "phase")	FHWA RCNM Equipment Type	Total Equipment Qty	AUF % (from FHWA RCNM)	Reference Lmax @ 50 ft. from FHWA RCNM	Client Equipment Description, Data Source and/or Notes	Source to NSR Distance (ft.)	Temporary Barrier Insertion Loss (dB)	Additional Noise Reduction	Distance-Adjusted Lmax	Allowable Operation Time (hours)	Allowable Operation Time (minutes)	Predicted 1-hour Leq	Source Elevation (ft)	Receiver Elevation (ft)	Barrier Height (ft)	Source to Barr. ("A") Horiz. (ft)	Rcvr. to Barr. ("B") Horiz. (ft)	Source to Rcvr. ("C") Horiz. (ft)	"A" (ft)	"B" (ft)	"C" (ft)	Path Length Diff. "P" (ft)	Abarr (dB)	Heff (with barrier)	Heff (wout barrier)	G (with barrier)	G (without barrier)	ILbarr (dB)
Demolition	excavator	3	40	81		175	0.1	33.0	34.0	8	480	44	5	10	0	165	10	175	165.1	14.1	175.1	0.00	0.1	7.5	7.5	0.6	0.6	0.1
	tractor	1	40	84		175	0.1	33.0	37.0	8	480	42	5	10	0	165	10	175	165.1	14.1	175.1	0.00	0.1	7.5	7.5	0.6	0.6	0.1
Total for Demolition Phase:													46.1															
Site Preparation	dozer	1	40	82		175	0.1	33.0	35.0	8	480	40	5	10	0	165	10	175	165.1	14.1	175.1	0.00	0.1	7.5	7.5	0.6	0.6	0.1
	tractor	2	40	84		175	0.1	33.0	37.0	8	480	45	5	10	0	165	10	175	165.1	14.1	175.1	0.00	0.1	7.5	7.5	0.6	0.6	0.1
Total for Site Preparation Phase:													46.3															
Grading	grader	1	40	85		175	0.1	33.0	38.0	7	420	42	5	10	0	165	10	175	165.1	14.1	175.1	0.00	0.1	7.5	7.5	0.6	0.6	0.1
	excavator	1	40	81		175	0.1	33.0	34.0	8	480	39	5	10	0	165	10	175	165.1	14.1	175.1	0.00	0.1	7.5	7.5	0.6	0.6	0.1
	dozer	1	40	82		175	0.1	33.0	35.0	8	480	40	5	10	0	165	10	175	165.1	14.1	175.1	0.00	0.1	7.5	7.5	0.6	0.6	0.1
Total for Grading Phase:													45.6															
Trenching	excavator	2	40	81		175	0.1	33.0	34.0	7	420	42	5	10	0	165	10	175	165.1	14.1	175.1	0.00	0.1	7.5	7.5	0.6	0.6	0.1
Total for Trenching Phase:													41.5															
Building Construction	man lift	1	20	75	"forklift"	175	0.1	33.0	28.0	8	480	30	5	10	0	165	10	175	165.1	14.1	175.1	0.00	0.1	7.5	7.5	0.6	0.6	0.1
	generator	1	50	72		175	0.1	33.0	25.0	8	480	31	5	10	0	165	10	175	165.1	14.1	175.1	0.00	0.1	7.5	7.5	0.6	0.6	0.1
	crane	1	16	81		175	0.1	33.0	34.0	4	240	32	5	10	0	165	10	175	165.1	14.1	175.1	0.00	0.1	7.5	7.5	0.6	0.6	0.1
	welder / torch	1	40	73		175	0.1	33.0	26.0	8	480	31	5	10	0	165	10	175	165.1	14.1	175.1	0.00	0.1	7.5	7.5	0.6	0.6	0.1
	tractor	1	40	84		175	0.1	33.0	37.0	7	420	41	5	10	0	165	10	175	165.1	14.1	175.1	0.00	0.1	7.5	7.5	0.6	0.6	0.1
	pumps	1	50	77		175	0.1	33.0	30.0	8	480	36	5	10	0	165	10	175	165.1	14.1	175.1	0.00	0.1	7.5	7.5	0.6	0.6	0.1
	man lift	2	20	75	"aerial lift"	175	0.1	33.0	28.0	8	480	33	5	10	0	165	10	175	165.1	14.1	175.1	0.00	0.1	7.5	7.5	0.6	0.6	0.1
	auger drill rig	1	20	84		175	0.1	33.0	37.0	2	120	33	5	10	0	165	10	175	165.1	14.1	175.1	0.00	0.1	7.5	7.5	0.6	0.6	0.1
Total for Building Construction Phase:													44.4															
Paving	paver	1	50	77		175	0.1	33.0	30.0	6	360	35	5	10	0	165	10	175	165.1	14.1	175.1	0.00	0.1	7.5	7.5	0.6	0.6	0.1
	paver	1	50	77	"paving equipment"	175	0.1	33.0	30.0	6	360	35	5	10	0	165	10	175	165.1	14.1	175.1	0.00	0.1	7.5	7.5	0.6	0.6	0.1
	roller	1	20	80		175	0.1	33.0	33.0	6	360	34	5	10	0	165	10	175	165.1	14.1	175.1	0.00	0.1	7.5	7.5	0.6	0.6	0.1
Total for Paving Phase:													39.3															
Architectural Coating	compressor (air)	1	40	78		175	0.1	33.0	31.0	6	360	35	5	10	0	165	10	175	165.1	14.1	175.1	0.00	0.1	7.5	7.5	0.6	0.6	0.1
Total for Architectural Coating Phase:													34.8															

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

noise level limit for construction phase at residential land use, per City of San Diego =												75	All elevation values below are with respect to a common horizontal plane.															
allowable hours over which Leq is to be averaged, City of San Diego =												12	The Barrier Height value below refers to top elevation of intervening building, structure, or other inserted barrier between the sound emission source and the receiver.															
Construction Activity (grouping or "phase")	FHWA RCNM Equipment Type	Total Equipment Qty	AUF % (from FHWA RCNM)	Reference Lmax @ 50 ft. from FHWA RCNM	Client Equipment Description, Data Source and/or Notes	Source to NSR Distance (ft.)	Temporary Barrier Insertion Loss (dB)	Additional Noise Reduction	Distance-Adjusted Lmax	Allowable Operation Time (hours)	Allowable Operation Time (minutes)	Predicted 12-hour Leq	Source Elevation (ft)	Receiver Elevation (ft)	Barrier Height (ft)	Source to Barr. ("A") Horiz. (ft)	Rcvr. to Barr. ("B") Horiz. (ft)	Source to Rcvr. ("C") Horiz. (ft)	"A" (ft)	"B" (ft)	"C" (ft)	Path Length Diff. "P" (ft)	Abarr (dB)	Heff (with barrier)	Heff (wout barrier)	G (with barrier)	G (without barrier)	ILbarr (dB)
Demolition	excavator	3	40	81		175	11.6		55.4	8	480	54	5	10	50	165	10	175	171.0	41.2	175.1	37.19	15.0	57.5	7.5	0.0	0.6	11.6
	tractor	1	40	84		175	11.6		58.4	8	480	53	5	10	50	165	10	175	171.0	41.2	175.1	37.19	15.0	57.5	7.5	0.0	0.6	11.6
Total for Demolition Phase:												56.7																
Site Preparation	dozer	1	40	82		175	11.6		56.4	8	480	51	5	10	50	165	10	175	171.0	41.2	175.1	37.19	15.0	57.5	7.5	0.0	0.6	11.6
	tractor	2	40	84		175	11.6		58.4	8	480	56	5	10	50	165	10	175	171.0	41.2	175.1	37.19	15.0	57.5	7.5	0.0	0.6	11.6
Total for Site Preparation Phase:												56.9																
Grading	grader	1	40	85		175	11.6		59.4	7	420	53	5	10	50	165	10	175	171.0	41.2	175.1	37.19	15.0	57.5	7.5	0.0	0.6	11.6
	excavator	1	40	81		175	11.6		55.4	8	480	50	5	10	50	165	10	175	171.0	41.2	175.1	37.19	15.0	57.5	7.5	0.0	0.6	11.6
	dozer	1	40	82		175	11.6		56.4	8	480	51	5	10	50	165	10	175	171.0	41.2	175.1	37.19	15.0	57.5	7.5	0.0	0.6	11.6
Total for Grading Phase:												56.2																
Trenching	excavator	2	40	81		175	11.6		55.4	7	420	52	5	10	50	165	10	175	171.0	41.2	175.1	37.19	15.0	57.5	7.5	0.0	0.6	11.6
Total for Trenching Phase:												52.1																
Building Construction	man lift	1	20	75	"forklift"	175	11.6		49.4	8	480	41	5	10	50	165	10	175	171.0	41.2	175.1	37.19	15.0	57.5	7.5	0.0	0.6	11.6
	generator	1	50	72		175	11.6		46.4	8	480	42	5	10	50	165	10	175	171.0	41.2	175.1	37.19	15.0	57.5	7.5	0.0	0.6	11.6
	crane	1	16	81		175	11.6		55.4	4	240	43	5	10	50	165	10	175	171.0	41.2	175.1	37.19	15.0	57.5	7.5	0.0	0.6	11.6
	welder / torch	1	40	73		175	11.6		47.4	8	480	42	5	10	50	165	10	175	171.0	41.2	175.1	37.19	15.0	57.5	7.5	0.0	0.6	11.6
	tractor	1	40	84		175	11.6		58.4	7	420	52	5	10	50	165	10	175	171.0	41.2	175.1	37.19	15.0	57.5	7.5	0.0	0.6	11.6
	pumps	1	50	77		175	11.6		51.4	8	480	47	5	10	50	165	10	175	171.0	41.2	175.1	37.19	15.0	57.5	7.5	0.0	0.6	11.6
	man lift	2	20	75	"aerial lift"	175	11.6		49.4	8	480	44	5	10	50	165	10	175	171.0	41.2	175.1	37.19	15.0	57.5	7.5	0.0	0.6	11.6
	auger drill rig	1	20	84		175	11.6		58.4	2	120	44	5	10	50	165	10	175	171.0	41.2	175.1	37.19	15.0	57.5	7.5	0.0	0.6	11.6
Total for Building Construction Phase:												55.0																
Paving	paver	1	50	77		175	11.6		51.4	6	360	45	5	10	50	165	10	175	171.0	41.2	175.1	37.19	15.0	57.5	7.5	0.0	0.6	11.6
	paver	1	50	77	"paving equipment"	175	11.6		51.4	6	360	45	5	10	50	165	10	175	171.0	41.2	175.1	37.19	15.0	57.5	7.5	0.0	0.6	11.6
	roller	1	20	80		175	11.6		54.4	6	360	44	5	10	50	165	10	175	171.0	41.2	175.1	37.19	15.0	57.5	7.5	0.0	0.6	11.6
Total for Paving Phase:												49.9																
Architectural Coating	compressor (air)	1	40	78		175	11.6		52.4	6	360	45	5	10	50	165	10	175	171.0	41.2	175.1	37.19	15.0	57.5	7.5	0.0	0.6	11.6
Total for Architectural Coating Phase:												45.4																



SDSU Evolve Student Housing Project EIR  
Supplemental Construction Noise Analysis

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

noise level limit for construction phase at residential land use, per City of San Diego =	75
allowable hours over which Leq is to be averaged, City of San Diego =	12

All elevation values below are with respect to a common horizontal plane.  
The Barrier Height value below refers to top elevation of intervening building, structure, or other inserted barrier between the sound emission source and the receiver.

Construction Activity (grouping or "phase")	FHWA RCNM Equipment Type	Total Equipment Qty	AUF % (from FHWA RCNM)	Reference Lmax @ 50 ft. from FHWA RCNM	Client Equipment Description, Data Source and/or Notes	Source to NSR Distance (ft.)	Temporary Barrier Insertion Loss (dB)	Additional Noise Reduction	Distance-Adjusted Lmax	Allowable Operation Time (hours)	Allowable Operation Time (minutes)	Predicted 12-hour Leq	Source Elevation (ft)	Receiver Elevation (ft)	Barrier Height (ft)	Source to Barr. ("A") Horiz. (ft)	Rcvr. to Barr. ("B") Horiz. (ft)	Source to Rcvr. ("C") Horiz. (ft)	"A" (ft)	"B" (ft)	"C" (ft)	Path Length Diff. "P" (ft)	Abarr (dB)	Heff (with barrier)	Heff (wout barrier)	G (with barrier)	G (without barrier)	ILbarr (dB)
Demolition	excavator	3	40	81		570	8.5		46.5	8	480	46	5	10	50	560	10	570	561.8	41.2	570.0	33.01	15.0	57.5	7.5	0.0	0.6	8.5
	tractor	1	40	84		570	8.5		49.5	8	480	44	5	10	50	560	10	570	561.8	41.2	570.0	33.01	15.0	57.5	7.5	0.0	0.6	8.5
Total for Demolition Phase:													47.7															
Site Preparation	dozer	1	40	82		570	8.5		47.5	8	480	42	5	10	50	560	10	570	561.8	41.2	570.0	33.01	15.0	57.5	7.5	0.0	0.6	8.5
	tractor	2	40	84		570	8.5		49.5	8	480	47	5	10	50	560	10	570	561.8	41.2	570.0	33.01	15.0	57.5	7.5	0.0	0.6	8.5
Total for Site Preparation Phase:													48.0															
Grading	grader	1	40	85		570	8.5		50.5	8	480	45	5	10	50	560	10	570	561.8	41.2	570.0	33.01	15.0	57.5	7.5	0.0	0.6	8.5
	excavator	2	40	81		570	8.5		46.5	8	480	44	5	10	50	560	10	570	561.8	41.2	570.0	33.01	15.0	57.5	7.5	0.0	0.6	8.5
	dozer	1	40	82		570	8.5		47.5	8	480	42	5	10	50	560	10	570	561.8	41.2	570.0	33.01	15.0	57.5	7.5	0.0	0.6	8.5
Total for Grading Phase:													48.4															
Trenching	excavator	2	40	81		570	8.5		46.5	8	480	44	5	10	50	560	10	570	561.8	41.2	570.0	33.01	15.0	57.5	7.5	0.0	0.6	8.5
Total for Trenching Phase:													43.8															
Building Construction	man lift	1	20	75	"forklift"	570	8.5		40.5	8	480	32	5	10	50	560	10	570	561.8	41.2	570.0	33.01	15.0	57.5	7.5	0.0	0.6	8.5
	generator	1	50	72		570	8.5		37.5	8	480	33	5	10	50	560	10	570	561.8	41.2	570.0	33.01	15.0	57.5	7.5	0.0	0.6	8.5
	crane	1	16	81		570	8.5		46.5	7	420	36	5	10	50	560	10	570	561.8	41.2	570.0	33.01	15.0	57.5	7.5	0.0	0.6	8.5
	welder / torch	1	40	73		570	8.5		38.5	8	480	33	5	10	50	560	10	570	561.8	41.2	570.0	33.01	15.0	57.5	7.5	0.0	0.6	8.5
	tractor	1	40	84		570	8.5		49.5	7	420	43	5	10	50	560	10	570	561.8	41.2	570.0	33.01	15.0	57.5	7.5	0.0	0.6	8.5
	pumps	1	50	77		570	8.5		42.5	8	480	38	5	10	50	560	10	570	561.8	41.2	570.0	33.01	15.0	57.5	7.5	0.0	0.6	8.5
	man lift	2	20	75	"aerial lift"	570	8.5		40.5	8	480	35	5	10	50	560	10	570	561.8	41.2	570.0	33.01	15.0	57.5	7.5	0.0	0.6	8.5
Total for Building Construction Phase:													45.9															
Paving	paver	1	50	77		570	8.5		42.5	6	360	36	5	10	50	560	10	570	561.8	41.2	570.0	33.01	15.0	57.5	7.5	0.0	0.6	8.5
	paver	1	50	77	"paving equipment"	570	8.5		42.5	6	360	36	5	10	50	560	10	570	561.8	41.2	570.0	33.01	15.0	57.5	7.5	0.0	0.6	8.5
	roller	2	20	80		570	8.5		45.5	6	360	39	5	10	50	560	10	570	561.8	41.2	570.0	33.01	15.0	57.5	7.5	0.0	0.6	8.5
Total for Paving Phase:													42.0															
Architectural Coating	compressor (air)	1	40	78		570	8.5		43.5	6	360	37	5	10	50	560	10	570	561.8	41.2	570.0	33.01	15.0	57.5	7.5	0.0	0.6	8.5
Total for Architectural Coating Phase:													36.5															

SDSU Evolve Student Housing Project EIR  
Supplemental Construction Noise Analysis

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

noise level limit for construction phase at residential land use, per City of San Diego =	75
allowable hours over which Leq is to be averaged, City of San Diego =	12

All elevation values below are with respect to a common horizontal plane.  
The Barrier Height value below refers to top elevation of intervening building, structure, or other inserted barrier between the sound emission source and the receiver.

Construction Activity (grouping or "phase")	FHWA RCNM Equipment Type	Total Equipment Qty	AUF % (from FHWA RCNM)	Reference Lmax @ 50 ft. from FHWA RCNM	Client Equipment Description, Data Source and/or Notes	Source to NSR Distance (ft.)	Temporary Barrier Insertion Loss (dB)	Additional Noise Reduction	Distance-Adjusted Lmax	Allowable Operation Time (hours)	Allowable Operation Time (minutes)	Predicted 12-hour Leq	Source Elevation (ft)	Receiver Elevation (ft)	Barrier Height (ft)	Source to Barr. ("A") Horiz. (ft)	Rcvr. to Barr. ("B") Horiz. (ft)	Source to Rcvr. ("C") Horiz. (ft)	"A" (ft)	"B" (ft)	"C" (ft)	Path Length Diff. "P" (ft)	Abarr (dB)	Heff (with barrier)	Heff (wout barrier)	G (with barrier)	G (without barrier)	ILbarr (dB)
Demolition	excavator	3	40	81		900	7.3		43.2	8	480	42	5	10	50	890	10	900	891.1	41.2	900.0	32.35	15.0	57.5	7.5	0.0	0.6	7.3
	tractor	1	40	84		900	7.3		46.2	8	480	40	5	10	50	890	10	900	891.1	41.2	900.0	32.35	15.0	57.5	7.5	0.0	0.6	7.3
Total for Demolition Phase:													44.5															
Site Preparation	dozer	1	40	82		900	7.3		44.2	8	480	38	5	10	50	890	10	900	891.1	41.2	900.0	32.35	15.0	57.5	7.5	0.0	0.6	7.3
	tractor	2	40	84		900	7.3		46.2	8	480	43	5	10	50	890	10	900	891.1	41.2	900.0	32.35	15.0	57.5	7.5	0.0	0.6	7.3
Total for Site Preparation Phase:													44.7															
Grading	grader	1	40	85		900	7.3		47.2	7	420	41	5	10	50	890	10	900	891.1	41.2	900.0	32.35	15.0	57.5	7.5	0.0	0.6	7.3
	excavator	2	40	81		900	7.3		43.2	7	420	40	5	10	50	890	10	900	891.1	41.2	900.0	32.35	15.0	57.5	7.5	0.0	0.6	7.3
	dozer	1	40	82		900	7.3		44.2	8	480	38	5	10	50	890	10	900	891.1	41.2	900.0	32.35	15.0	57.5	7.5	0.0	0.6	7.3
Total for Grading Phase:													44.7															
Trenching	excavator	2	40	81		900	7.3		43.2	8	480	40	5	10	50	890	10	900	891.1	41.2	900.0	32.35	15.0	57.5	7.5	0.0	0.6	7.3
Total for Trenching Phase:													40.5															
Building Construction	man lift	1	20	75	"forklift"	900	7.3		37.2	8	480	28	5	10	50	890	10	900	891.1	41.2	900.0	32.35	15.0	57.5	7.5	0.0	0.6	7.3
	generator	1	50	72		900	7.3		34.2	8	480	29	5	10	50	890	10	900	891.1	41.2	900.0	32.35	15.0	57.5	7.5	0.0	0.6	7.3
	crane	1	16	81		900	7.3		43.2	7	420	33	5	10	50	890	10	900	891.1	41.2	900.0	32.35	15.0	57.5	7.5	0.0	0.6	7.3
	welder / torch	1	40	73		900	7.3		35.2	8	480	29	5	10	50	890	10	900	891.1	41.2	900.0	32.35	15.0	57.5	7.5	0.0	0.6	7.3
	tractor	1	40	84		900	7.3		46.2	7	420	40	5	10	50	890	10	900	891.1	41.2	900.0	32.35	15.0	57.5	7.5	0.0	0.6	7.3
	pumps	1	50	77		900	7.3		39.2	8	480	34	5	10	50	890	10	900	891.1	41.2	900.0	32.35	15.0	57.5	7.5	0.0	0.6	7.3
	man lift	2	20	75	"aerial lift"	900	7.3		37.2	8	480	31	5	10	50	890	10	900	891.1	41.2	900.0	32.35	15.0	57.5	7.5	0.0	0.6	7.3
Total for Building Construction Phase:													42.7															
Paving	paver	1	50	77		900	7.3		39.2	6	360	33	5	10	50	890	10	900	891.1	41.2	900.0	32.35	15.0	57.5	7.5	0.0	0.6	7.3
	paver	1	50	77	"paving equipment"	900	7.3		39.2	6	360	33	5	10	50	890	10	900	891.1	41.2	900.0	32.35	15.0	57.5	7.5	0.0	0.6	7.3
	roller	2	20	80		900	7.3		42.2	6	360	35	5	10	50	890	10	900	891.1	41.2	900.0	32.35	15.0	57.5	7.5	0.0	0.6	7.3
Total for Paving Phase:													38.8															
Architectural Coating	compressor (air)	1	40	78		900	7.3		40.2	6	360	33	5	10	50	890	10	900	891.1	41.2	900.0	32.35	15.0	57.5	7.5	0.0	0.6	7.3
Total for Architectural Coating Phase:													33.2															

SDSU Evolve Student Housing Project EIR  
Supplemental Construction Noise Analysis

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

noise level limit for construction phase at residential land use, per City of San Diego =										75
allowable hours over which Leq is to be averaged, City of San Diego =										12

Construction Activity (grouping or "phase")	FHWA RCNM Equipment Type	Total Equipment Qty	AUF % (from FHWA RCNM)	Reference Lmax @ 50 ft. from FHWA RCNM	Client Equipment Description, Data Source and/or Notes	Source to NSR Distance (ft.)	Temporary Barrier Insertion Loss (dB)	Additional Noise Reduction	Distance-Adjusted Lmax	Allowable Operation Time (hours)	Allowable Operation Time (minutes)	Predicted 12-hour Leq
Demolition	excavator	3	40	81		870	7.4		43.5	8	480	43
	tractor	1	40	84		870	7.4		46.5	8	480	41
Total for Demolition Phase:												44.7
Site Preparation	dozer	1	40	82		870	7.4		44.5	8	480	39
	tractor	2	40	84		870	7.4		46.5	8	480	44
Total for Site Preparation Phase:												44.9
Grading	grader	1	40	85		870	7.4		47.5	7	420	41
	excavator	2	40	81		870	7.4		43.5	7	420	40
	tractor	2	40	84		870	7.4		46.5	8	480	44
	dozer	2	40	82		870	7.4		44.5	8	480	42
Total for Grading Phase:												47.9
Trenching	excavator	2	40	81		870	7.4		43.5	8	480	41
Total for Trenching Phase:												40.7
Building Construction	man lift	1	20	75	"forklift"	870	7.4		37.5	8	480	29
	generator	1	50	72		870	7.4		34.5	8	480	30
	crane	1	16	81		870	7.4		43.5	7	420	33
	welder / torch	1	40	73		870	7.4		35.5	8	480	30
	tractor	1	40	84		870	7.4		46.5	7	420	40
	pumps	1	50	77		870	7.4		39.5	8	480	35
	man lift	2	20	75	"aerial lift"	870	7.4		37.5	8	480	32
Total for Building Construction Phase:												42.9
Paving	paver	1	50	77		870	7.4		39.5	6	360	33
	paver	1	50	77	"paving equipment"	870	7.4		39.5	6	360	33
	roller	2	20	80		870	7.4		42.5	6	360	35
Total for Paving Phase:												39.0
Architectural Coating	compressor (air)	1	40	78		870	7.4		40.5	6	360	33
Total for Architectural Coating Phase:												33.5

All elevation values below are with respect to a common horizontal plane.

The Barrier Height value below refers to top elevation of intervening building, structure, or other inserted barrier between the sound emission source and the receiver.

Source Elevation (ft)	Receiver Elevation (ft)	Barrier Height (ft)	Source to Barr. ("A") Horiz. (ft)	Rcvr. to Barr. ("B") Horiz. (ft)	Source to Rcvr. ("C") Horiz. (ft)	"A" (ft)	"B" (ft)	"C" (ft)	Path Length Diff. "P" (ft)	Abarr (dB)	Heff (with barrier)	Heff (wout barrier)	G (with barrier)	G (without barrier)	ILbarr (dB)
5	10	50	860	10	870	861.2	41.2	870.0	32.39	15.0	57.5	7.5	0.0	0.6	7.4
5	10	50	860	10	870	861.2	41.2	870.0	32.39	15.0	57.5	7.5	0.0	0.6	7.4
5	10	50	860	10	870	861.2	41.2	870.0	32.39	15.0	57.5	7.5	0.0	0.6	7.4
5	10	50	860	10	870	861.2	41.2	870.0	32.39	15.0	57.5	7.5	0.0	0.6	7.4
5	10	50	860	10	870	861.2	41.2	870.0	32.39	15.0	57.5	7.5	0.0	0.6	7.4
5	10	50	860	10	870	861.2	41.2	870.0	32.39	15.0	57.5	7.5	0.0	0.6	7.4
5	10	50	860	10	870	861.2	41.2	870.0	32.39	15.0	57.5	7.5	0.0	0.6	7.4
5	10	50	860	10	870	861.2	41.2	870.0	32.39	15.0	57.5	7.5	0.0	0.6	7.4
5	10	50	860	10	870	861.2	41.2	870.0	32.39	15.0	57.5	7.5	0.0	0.6	7.4
5	10	50	860	10	870	861.2	41.2	870.0	32.39	15.0	57.5	7.5	0.0	0.6	7.4
5	10	50	860	10	870	861.2	41.2	870.0	32.39	15.0	57.5	7.5	0.0	0.6	7.4
5	10	50	860	10	870	861.2	41.2	870.0	32.39	15.0	57.5	7.5	0.0	0.6	7.4
5	10	50	860	10	870	861.2	41.2	870.0	32.39	15.0	57.5	7.5	0.0	0.6	7.4
5	10	50	860	10	870	861.2	41.2	870.0	32.39	15.0	57.5	7.5	0.0	0.6	7.4
5	10	50	860	10	870	861.2	41.2	870.0	32.39	15.0	57.5	7.5	0.0	0.6	7.4
5	10	50	860	10	870	861.2	41.2	870.0	32.39	15.0	57.5	7.5	0.0	0.6	7.4
5	10	50	860	10	870	861.2	41.2	870.0	32.39	15.0	57.5	7.5	0.0	0.6	7.4
5	10	50	860	10	870	861.2	41.2	870.0	32.39	15.0	57.5	7.5	0.0	0.6	7.4
5	10	50	860	10	870	861.2	41.2	870.0	32.39	15.0	57.5	7.5	0.0	0.6	7.4
5	10	50	860	10	870	861.2	41.2	870.0	32.39	15.0	57.5	7.5	0.0	0.6	7.4
5	10	50	860	10	870	861.2	41.2	870.0	32.39	15.0	57.5	7.5	0.0	0.6	7.4

HuaxyacacHall\_SDSU-Evolve\_RCNM-emulator\_031125.xlsx

Dudek Project No. 15464.12

Phase 4 (Peninsula Component)

SDSU Evolve Student Housing Project EIR  
Supplemental Construction Noise Analysis

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

noise level limit for construction phase at residential land use, per City of San Diego =												75																
allowable hours over which Leq is to be averaged, City of San Diego =												12																
												All elevation values below are with respect to a common horizontal plane. The Barrier Height value below refers to top elevation of intervening building, structure, or other inserted barrier between the sound emission source and the receiver.																
Construction Activity (grouping or "phase")	FHWA RCNM Equipment Type	Total Equipment Qty	AUF % (from FHWA RCNM)	Reference Lmax @ 50 ft. from FHWA RCNM	Client Equipment Description, Data Source and/or Notes	Source to NSR Distance (ft.)	Temporary Barrier Insertion Loss (dB)	Additional Noise Reduction	Distance-Adjusted Lmax	Allowable Operation Time (hours)	Allowable Operation Time (minutes)	Predicted 12-hour Leq	Source Elevation (ft)	Receiver Elevation (ft)	Barrier Height (ft)	Source to Barr. ("A") Horiz. (ft)	Rcvr. to Barr. ("B") Horiz. (ft)	Source to Rcvr. ("C") Horiz. (ft)	"A" (ft)	"B" (ft)	"C" (ft)	Path Length Diff. "P" (ft)	Abarr (dB)	Heff (with barrier)	Heff (wout barrier)	G (with barrier)	G (without barrier)	ILbarr (dB)
Site Preparation	dozer	1	40	82		570	8.5		47.5	8	480	42	5	10	50	560	10	570	561.8	41.2	570.0	33.01	15.0	57.5	7.5	0.0	0.6	8.5
	tractor	2	40	84		570	8.5		49.5	8	480	47	5	10	50	560	10	570	561.8	41.2	570.0	33.01	15.0	57.5	7.5	0.0	0.6	8.5
Total for Site Preparation Phase:												48.0																
Grading	grader	1	40	85		570	8.5		50.5	8	480	45	5	10	50	560	10	570	561.8	41.2	570.0	33.01	15.0	57.5	7.5	0.0	0.6	8.5
	excavator	4	40	81		570	8.5		46.5	8	480	47	5	10	50	560	10	570	561.8	41.2	570.0	33.01	15.0	57.5	7.5	0.0	0.6	8.5
	dozer	1	40	82		570	8.5		47.5	8	480	42	5	10	50	560	10	570	561.8	41.2	570.0	33.01	15.0	57.5	7.5	0.0	0.6	8.5
	tractor	2	40	84		570	8.5		49.5	8	480	47	5	10	50	560	10	570	561.8	41.2	570.0	33.01	15.0	57.5	7.5	0.0	0.6	8.5
Total for Grading Phase:												51.5																
Trenching	excavator	2	40	81		570	8.5		46.5	8	480	44	5	10	50	560	10	570	561.8	41.2	570.0	33.01	15.0	57.5	7.5	0.0	0.6	8.5
Total for Trenching Phase:												43.8																
Building Construction	man lift	1	20	75	"forklift"	570	8.5		40.5	8	480	32	5	10	50	560	10	570	561.8	41.2	570.0	33.01	15.0	57.5	7.5	0.0	0.6	8.5
	generator	1	50	72		570	8.5		37.5	8	480	33	5	10	50	560	10	570	561.8	41.2	570.0	33.01	15.0	57.5	7.5	0.0	0.6	8.5
	crane	1	16	81		570	8.5		46.5	7	420	36	5	10	50	560	10	570	561.8	41.2	570.0	33.01	15.0	57.5	7.5	0.0	0.6	8.5
	welder / torch	1	40	73		570	8.5		38.5	8	480	33	5	10	50	560	10	570	561.8	41.2	570.0	33.01	15.0	57.5	7.5	0.0	0.6	8.5
	tractor	1	40	84		570	8.5		49.5	7	420	43	5	10	50	560	10	570	561.8	41.2	570.0	33.01	15.0	57.5	7.5	0.0	0.6	8.5
	pumps	1	50	77		570	8.5		42.5	8	480	38	5	10	50	560	10	570	561.8	41.2	570.0	33.01	15.0	57.5	7.5	0.0	0.6	8.5
	man lift	2	20	75	"aerial lift"	570	8.5		40.5	8	480	35	5	10	50	560	10	570	561.8	41.2	570.0	33.01	15.0	57.5	7.5	0.0	0.6	8.5
Total for Building Construction Phase:												45.9																
Paving	paver	1	50	77		570	8.5		42.5	6	360	36	5	10	50	560	10	570	561.8	41.2	570.0	33.01	15.0	57.5	7.5	0.0	0.6	8.5
	paver	1	50	77	"paving equipment"	570	8.5		42.5	6	360	36	5	10	50	560	10	570	561.8	41.2	570.0	33.01	15.0	57.5	7.5	0.0	0.6	8.5
	roller	2	20	80		570	8.5		45.5	6	360	39	5	10	50	560	10	570	561.8	41.2	570.0	33.01	15.0	57.5	7.5	0.0	0.6	8.5
Total for Paving Phase:												42.0																
Architectural Coating	compressor (air)	1	40	78		570	8.5		43.5	6	360	37	5	10	50	560	10	570	561.8	41.2	570.0	33.01	15.0	57.5	7.5	0.0	0.6	8.5
Total for Architectural Coating Phase:												36.5																

SDSU Evolve Student Housing Project EIR  
Supplemental Construction Noise Analysis

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noise level limit for construction phase at residential land use, per City of San Diego =	75
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Construction Activity (grouping or "phase")	FHWA RCNM Equipment Type	Total Equipment Qty	AUF % (from FHWA RCNM)	Reference Lmax @ 50 ft. from FHWA RCNM	Client Equipment Description, Data Source and/or Notes	Source to NSR Distance (ft.)	Temporary Barrier Insertion Loss (dB)	Additional Noise Reduction	Distance-Adjusted Lmax	Allowable Operation Time (hours)	Allowable Operation Time (minutes)	Predicted 12-hour Leq	Source Elevation (ft)	Receiver Elevation (ft)	Barrier Height (ft)	Source to Barr. ("A") Horiz. (ft)	Rcvr. to Barr. ("B") Horiz. (ft)	Source to Rcvr. ("C") Horiz. (ft)	"A" (ft)	"B" (ft)	"C" (ft)	Path Length Diff. "P" (ft)	Abarr (dB)	Heff (with barrier)	Heff (wout barrier)	G (with barrier)	G (without barrier)	ILbarr (dB)
Site Preparation	dozer	1	40	82		340	9.9		51.2	8	480	45	5	10	50	330	10	340	333.1	41.2	340.0	34.25	15.0	57.5	7.5	0.0	0.6	9.9
	tractor	2	40	84		340	9.9		53.2		480	50	5	10	50	330	10	340	333.1	41.2	340.0	34.25	15.0	57.5	7.5	0.0	0.6	9.9
Total for Site Preparation Phase:													51.7															
Grading	grader	1	40	85		340	9.9		54.2	8	480	48	5	10	50	330	10	340	333.1	41.2	340.0	34.25	15.0	57.5	7.5	0.0	0.6	9.9
	excavator	4	40	81		340	9.9		50.2	8	480	50	5	10	50	330	10	340	333.1	41.2	340.0	34.25	15.0	57.5	7.5	0.0	0.6	9.9
	dozer	1	40	82		340	9.9		51.2	8	480	45	5	10	50	330	10	340	333.1	41.2	340.0	34.25	15.0	57.5	7.5	0.0	0.6	9.9
	tractor	2	40	84		340	9.9		53.2	8	480	50	5	10	50	330	10	340	333.1	41.2	340.0	34.25	15.0	57.5	7.5	0.0	0.6	9.9
Total for Grading Phase:													55.2															
Trenching	excavator	2	40	81		340	9.9		50.2	8	480	47	5	10	50	330	10	340	333.1	41.2	340.0	34.25	15.0	57.5	7.5	0.0	0.6	9.9
Total for Trenching Phase:													47.5															
Building Construction	man lift	1	20	75	"forklift"	340	9.9		44.2	8	480	35	5	10	50	330	10	340	333.1	41.2	340.0	34.25	15.0	57.5	7.5	0.0	0.6	9.9
	generator	1	50	72		340	9.9		41.2	8	480	36	5	10	50	330	10	340	333.1	41.2	340.0	34.25	15.0	57.5	7.5	0.0	0.6	9.9
	crane	1	16	81		340	9.9		50.2	7	420	40	5	10	50	330	10	340	333.1	41.2	340.0	34.25	15.0	57.5	7.5	0.0	0.6	9.9
	welder / torch	1	40	73		340	9.9		42.2	8	480	36	5	10	50	330	10	340	333.1	41.2	340.0	34.25	15.0	57.5	7.5	0.0	0.6	9.9
	tractor	1	40	84		340	9.9		53.2	7	420	47	5	10	50	330	10	340	333.1	41.2	340.0	34.25	15.0	57.5	7.5	0.0	0.6	9.9
	pumps	1	50	77		340	9.9		46.2	8	480	41	5	10	50	330	10	340	333.1	41.2	340.0	34.25	15.0	57.5	7.5	0.0	0.6	9.9
	man lift	2	20	75	"aerial lift"	340	9.9		44.2	8	480	38	5	10	50	330	10	340	333.1	41.2	340.0	34.25	15.0	57.5	7.5	0.0	0.6	9.9
	auger drill rig	1	20	84		340	9.9		53.2	8	480	44	5	10	50	330	10	340	333.1	41.2	340.0	34.25	15.0	57.5	7.5	0.0	0.6	9.9
Total for Building Construction Phase:													50.8															
Paving	paver	1	50	77		340	9.9		46.2	6	360	40	5	10	50	330	10	340	333.1	41.2	340.0	34.25	15.0	57.5	7.5	0.0	0.6	9.9
	paver	1	50	77	"paving equipment"	340	9.9		46.2	6	360	40	5	10	50	330	10	340	333.1	41.2	340.0	34.25	15.0	57.5	7.5	0.0	0.6	9.9
	roller	2	20	80		340	9.9		49.2	6	360	42	5	10	50	330	10	340	333.1	41.2	340.0	34.25	15.0	57.5	7.5	0.0	0.6	9.9
Total for Paving Phase:													45.8															
Architectural Coating	compressor (air)	1	40	78		340	9.9		47.2	6	360	40	5	10	50	330	10	340	333.1	41.2	340.0	34.25	15.0	57.5	7.5	0.0	0.6	9.9
Total for Architectural Coating Phase:													40.2															