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ATTACHMENT NO. 18

memorandum

date	April 30, 2018
to	Jose Mendivil, City of Culver City
cc	Michael Allen, City of Culver City
from	Mike Harden and Olivia Chan, ESA PCR
subject	9735 Washington or “Brick-Machine” Project – Noise/Vibration Revisions

An Initial Study/Mitigated Negative Declaration (IS/MND or MND) was prepared by the City of Culver City (City) in accordance with the California Environmental Quality Act (CEQA), as amended, to evaluate the potential environmental effects associated with implementation of the proposed office, retail, and restaurant development project known as Brick and Machine (the "Project"). The MND was circulated for public review from August 2, 2017 to August 23, 2017. The City received one (1) comment letter during the public review period from Allen Matkins Attorneys at Law (on behalf of the Southern California Hospital or “SCH-CC”), dated August 21, 2017. Responses to comments raised in the letter were provided by ESA PCR to the City on September 28, 2017. Supplemental noise and vibration analyses were performed and summarized by ESA PCR in a Memorandum titled “9735 Washington or “Brick-Machine” Project – Noise/Vibration Corrections and Revisions” on February 14, 2018.

Since preparation of the February 2018 supplemental analyses, further evaluation of noise and vibration impacts has been undertaken by Wilson Ihrig, as presented in Attachment A to this Memorandum.

This Memorandum includes revisions to Section XII, Noise, of the IS/MND. These revisions supersede and replace prior revisions to the IS/MND presented in the September 28, 2017 and February 14, 2018 memoranda.

Construction Noise

Utilizing a refined list of construction equipment provided by construction management, a detailed noise and vibration study was performed by Wilson Ihrig, a highly specialized acoustics, noise & vibration consultant, to assess potential impacts to the nearest SCH-CC hospital rooms and determine whether the findings in the IS/MND that construction noise and vibration impacts would be less than significant after implementation of mitigation measures remain valid.

Utilizing worst-case reference noise levels, Wilson Ihrig concluded that construction noise at the nearest hospital room, located on the second level of the hospital, would reach 81 dBA Leq. Wilson Ihrig has also concluded that with this predicted noise level and implementation and monitoring of IS/MND Mitigation Measures NOISE-1 through NOISE-4, as revised, construction noise impacts would be less than significant, consistent with the IS/MND findings.[1] The refinements to Mitigation Measures NOISE-1, NOISE-3, and NOISE-4 are shown with new text in underline and text that has been removed in ~~stricken through~~.

NOISE-1 The Project shall implement noise reduction strategies to reduce noise levels from construction to achieve a performance standard of less than 63 dBA Leq (1-hour) measured at the building facade of the nearest adjacent patient room at the hospital and at the building façade of the nearest residential uses. Noise reduction strategies shall include one or a combination of the following to achieve the performance standard.

- Use construction equipment, fixed or mobile, that individually generates less noise than presumed in the FHWA RCNM (refer to Table B-14 of the MND). Examples of such equipment are compact, small, or mini model versions of backhoes, cranes, excavators, loaders, tractors, of other applicable equipment that are equipped with engines typically less than 125 horsepower. Construction equipment noise levels shall be documented based on manufacturer's specifications. The construction contractor shall keep construction equipment noise level documentation onsite for the duration of construction.

- Noise-generating equipment operated at the project site shall be equipped with the most effective noise control devices, i.e., mufflers, lagging, and/or motor enclosures. All equipment shall be properly maintained to assure that no additional noise, due to worn or improperly maintained parts, would be generated. The reduction in noise from noise shielding and muffling devices shall be documented based on manufacturer's specifications. The construction contractor shall keep noise shielding and muffling device documentation onsite and documentation demonstrating that the equipment has been maintained in accordance with the manufacturers' specifications onsite for the duration of construction.

- Stage noise-generating construction equipment as far away from adjacent sensitive receptors as practicable.

- With the hospital's consent, provide and/or install portable sound blanket screens for placement on the interior or exterior of patient room windows with a line of sight to the construction area.

- Mitigation Measure NOISE-4 requires a noise barrier that shields portions of the adjacent hospital from the construction area. If warranted, an approximate 10-foot long angled extension shall be added to the required minimum 20-foot tall noise barrier to provide further noise level reductions for patient rooms on the upper floors.

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1 The threshold of significance in the IS/MND is based on a 5 dBA Leq increase over the ambient condition. Based on a measured daytime ambient level of 58 dBA Leq (see Table B-13 of the IS/MND), a performance standard of less than 63 dBA Leq (1-hour) has been incorporated into the revised noise mitigation measures presented in this Memorandum.

The effectiveness of the noise reduction strategies to achieve the performance standard shall be documented by on-site noise monitoring conducted by a qualified acoustical analyst using a Type 1 instrument in accordance with the American National Standards Institute (ANSI) S1.4. Noise monitoring shall be conducted throughout project construction. The results of the noise monitoring shall be used to inform the extent to which the noise reduction strategies shall be implemented throughout the duration of construction and what additional measures, if needed, shall be implemented. All noise monitoring shall be conducted to the satisfaction of the City of Culver City.

NOISE-2 The project applicant shall designate a construction relations officer to serve as a liaison with surrounding residents and property owners who is responsible for responding to any concerns regarding construction noise and vibration. The liaison's telephone number(s) shall be prominently displayed at the project site. Signs shall also be posted at the project site that includes permitted construction days and hours.

NOISE-3 Construction and demolition activities shall be scheduled so as to avoid operating more than one piece ~~several pieces~~ of motorized equipment simultaneously within 15 feet of the adjacent sensitive receptor's property line. The Chief Building Official, or designated representative, shall conduct periodic site visits to ensure compliance with the requirements set forth in this measure.

NOISE-4 Temporary noise barriers ~~that provide a minimum of 20 dB noise reduction shall be~~ at a minimum height of 20 feet shall be installed along the northwestern and northeastern project boundary ~~used to block the line-of-site between construction equipment and noise-sensitive receptors (residences and hospital uses, R1)~~ during project construction. ~~Noise barriers shall be a minimum of 20-feet tall along the north boundary adjacent to residential and hospital uses.~~

The use of all or a combination of the required noise reduction measures would provide sufficient noise level reduction at floors 2 through 6 of the hospital and at the adjacent residential use such that impacts with mitigation would be less than significant, consistent with the findings in the IS/MND circulated for public review in August 2017.

In addition to the above, and in regards to temporary construction noise effects on a small outdoor break area or patio on the south side of the hospital building, this area is enclosed by a fence and appears to be located on or adjacent to a loading/service area of the hospital between two mechanical equipment sheds with fan units. Although this area is currently subject to noise from loading/delivery activities and from the equipment sheds/fan units in close proximity, the mitigation measures outlined above are expected to reduce noise levels at this area during peak construction noise activities by approximately 29 dBA or to a noise level of approximately 53 dBA Leq.

Interior Noise

According to the City of Culver City General Plan Noise Element, the acceptable interior noise level for hospital patient rooms is 45 dBA Leq. As discussed in Attachment A, assuming a conservative interior-to-exterior attenuation rate of 21 dBA, mitigated exterior noise levels of 63 dBA Leq would attenuate to 42 dBA Leq. Therefore, construction noise would not exceed the interior standard for hospital uses and impacts would be less than significant.

Construction Vibration

Utilizing a refined list of construction equipment provided by construction management, a detailed noise and vibration study was performed by Wilson Ihrig, an acoustics, noise & vibration consultant, to assess potential impacts to SCH-CC (see Attachment A of this Memo). Wilson Ihrig concluded that vibration associated with construction vibration would not exceed applicable thresholds for structural damage or acceptable vibration levels for hospital operating rooms with implementation of Mitigation Measure NOISE-5 as modified below. No new impacts have been identified and no additional mitigation would be required.

NOISE-5 Contractors shall ~~would~~ phase in construction activity, use low-impact construction technologies, and avoid the use of heavy vibrating equipment ~~where possible~~ to reduce or avoid construction vibration impacts. The use of a hoe ram shall be at least 30 feet and use of a concrete mixer truck and dump truck shall be at least 10 feet from the property line of the adjacent hospital. ~~Especially, contractors shall use smaller and lower impact construction technologies to avoid human annoyance to the adjacent buildings.~~ ~~Contractors shall avoid the use of driving piles and drill piles instead where necessary to avoid structural damage.~~

In order to ensure that construction vibration levels do not exceed applicable thresholds (0.2 PPV in/sec for structural damage, 0.035 PPV in/sec for human annoyance, or 72 VdB for hospital operating rooms), the contractor shall install and maintain at least two continuously operational automated vibrational monitors with one adjacent to the nearest sensitive space within the basement of the hospital; and one on the adjacent residential building at the locations closest to the active auger bit until it can be confirmed that applicable vibration thresholds will not be exceeded. The monitoring system must produce real-time specific alarms (via text message and/or email to on-site personnel) when vibration velocities are approaching, but prior to, the applicable vibration threshold. In the event of an alarm, feasible steps by the contractor must be taken to reduce vibratory levels, including but not limited to halting/staggering concurrent activities, utilizing lower-vibratory techniques, and slowing the speed of the auger. In the event of an alarm after steps have been taken to reduce vibratory levels, work in the vicinity shall be halted and potential adjustments to the construction program assessed to ensure that vibration thresholds would not be exceeded upon continuation of construction activity. In the event that the structural damage threshold is exceeded, the adjacent hospital and residential buildings shall be inspected for damage, as applicable.

In the event damage occurs due to construction vibration, repairs shall be arranged by the contractor and/or the applicant's representative in consultation with SCH-CC, the residential building owner and/or the City Building Official, as necessary.

The construction contractor shall be responsible for implementing this measure during the construction phase. The Chief Building Official, or designated representative, shall conduct periodic site visits to ensure compliance with the requirements set forth in this measure. Vibration monitoring data shall be collected by the contractor and reported to the City Chief Building Office on a weekly basis

Operational Vibration

Wilson Ihrig estimated potential vibration impacts due to automobiles entering and exiting the project’s subterranean parking and use of a stacked parking system. As discussed in Attachment A, estimated vibration velocities would not exceed applicable thresholds for hospital operating rooms or structural damage. No new impacts have been identified and no mitigation is required.

Attachments:

A. Detailed Noise and Vibration Study for the Proposed Mixed-Use Development at 9735 Washington Boulevard or “Brick-Machine”, Culver City, California, prepared by Wilson Ihrig, April 30, 2018.

WI #17-093

April 30, 2018

John M. Bowman
Elkins Kalt Weintraub Reuben Gartside LLP
2049 Century Park East, Suite 2700
Los Angeles, California 90067

Subject: Detailed noise and vibration study for the proposed mixed-use development at 9735 Washington Boulevard or "Brick and Machine", Culver City, California, Revision A

Dear Mr. Bowman,

Per your request, Wilson Ihrig has conducted a detailed noise and vibration study for the Brick and Machine (Project) at 9735 Washington Boulevard in Culver City, California. The purpose of this study is to estimate noise and vibration levels at the SCH-CC property during project construction and operations. This study addresses concerns expressed by the SCH-CC in the letter subject "'Brick and Machine' (9735 Washington Boulevard), Action Item List RE Noise and Vibration Analysis, VA Project No. 6933-001" dated March 8, 2018 from Veneklasen Associates. The intent is to provide information which can be used by the Project, together with representatives for SCH-CC, to design noise and vibration mitigation measures that both parties find satisfactory.

1 Construction

Project construction includes demolition of the vacant structure on site and removal of parking lot asphalt, curbs, etcetera. This will be followed by the installation of a temporary shoring system adjacent to the property line to temporarily support below grade soil pressures as the soil is excavated and until the Project below grade foundation walls and structure are constructed to permanently support the loads.

A list of equipment that will be used during construction has been provided by the project construction management and is provided in Table 1, along with the estimated durations of each project phase.

Table 1: Construction equipment roster by phase and estimated durations

<u>Demolition/Site Preparation, approximately 4 weeks, month 1</u> Excavator (with grapple and mounted pneumatic impact hammer, i.e. "hoe ram") Concrete Saw 2 Dump Trucks (to be loaded with excavator)
<u>Shoring, approximately 2 weeks, month 2 to 2.5</u> Drill Rig Hydraulic Crane Concrete Pump Skip Loader Tie-back Rig Air Compressor Small Tools – Chain Saws, etc. Welding Equipment with Generator 110-yard Ready Mix Truck (one truck on site at a time)
<u>Excavation, approximately 12 weeks, month 2.5 to 5.5</u> Excavator Loader Backhoe Street Sweeper Up to 3 Bottom Dump Trucks on site at a time
<u>Foundation/Superstructure, approximately 54 weeks, month 5.5 to 19</u> Concrete Pump Truck Air Compressor Forklift Crane Manlift Generator Pump Up to 2 Pneumatic Tools at a time Up to 2 Ventilation Fans at a time Welder

1.1 Construction Noise

Noise calculations for construction equipment have been made using the following formulas, which are consistent with the Federal Highway Administration's (FHWA) Roadway Construction Noise Model methodology for prediction of construction noise.

$$L_{max} = E.L. - 20\log(D/50) - A_{shielding}$$

$L_{eq} = L_{max} + 10 \log (U.F.)$

Total $L_{eq} = 10 * \log(\sum(10^{(\text{individual equipment Leq values})/10})$

where:

L_{max} = maximum calculated construction noise level at a given location, dBA

E.L. = reference equipment noise emission level (based on L_{max} at 50 feet)

D = distance between source and receptor (ft)

$A_{shielding}$ = attenuation provided by local site conditions, intervening buildings, barriers, etc.

L_{eq} = time-averaged noise level at a given location, dBA

U.F. = equipment usage factor (percentage of time that equipment is operating at full power over the specified time period)

A summary of the equipment noise calculation inputs is provided below in Table 2**.** The table includes the reference noise levels and usage factors for each piece of equipment. The reference noise levels in Table 2 are taken from two sources: (1) Specification 721.560 from the Central Artery/Tunnel (CA/T) project in Boston, Massachusetts and (2) actual measured levels listed in the Federal Highway Administration (FHWA) Roadway Construction Noise Model User's Guide Final Report, January 2006. The measured noise levels in the FHWA report are based upon extensive measurements that had been conducted for the Central Artery/Tunnel (CA/T) project. The louder of the two reference noise levels were selected for this study.

Table 2: Equipment Noise Calculation Input

Phase / Activity	**Noise Generating Tools/ Equipment**	**Qty.**	**Spec 721.560 Lmax[(a)] at 50ft, dBA, slow**	**Actual Measured Lmax[(b)] at 50ft, dBA, slow**	**Acoustical Usage Factor[(c)]**
Demolition / Site Preparation	Grapple (on Backhoe)	1	85	**87**	40%
	Mounted Impact Hammer (Hoe Ram)	1	90	90	20%
	Excavator	1	**85**	81	40%
	Concrete Saw	1	**90**	**90**	20%
	Dump Truck	2	**84**	76	40%
Shoring	Drill Rig[d]	1	**85**	81	20%
	Crane	1	**85**	81	16%
	Concrete Pump	1	**82**	81	20%
	Skip Loader[e]	1	**80**	79	40%
	Tie-back Rig[f]	1	**85**	81	20%
	Air Compressor	1	**80**	78	40%
	Chain Saw	1	**85**	84	20%
	Welder	1	73	**74**	40%
	Generator	1	**82**	81	50%
	Concrete Mixer Truck	1	**85**	79	40%
Excavation	Excavator	1	**85**	81	40%
	Loader	1	**80**	79	40%
	Backhoe	1	**80**	78	40%
	Street Sweeper	1	80	**82**	10%
	Dump Trucks	3	**84**	76	40%
Foundation Work	Concrete Pump Truck	1	**82**	81	20%
Superstructure	Air Compressor	1	**80**	78	40%
	Forklift[g]	1	**80**	79	40%
	Crane	1	**85**	81	16%
	Manlift	1	**85**	75	20%
	Generator	1	70	**73**	50%

Phase / Activity	Noise Generating Tools/ Equipment	Qty.	Spec 721.560 Lmax[(a)] at 50ft, dBA, slow	Actual Measured Lmax[(b)] at 50ft, dBA, slow	Acoustical Usage Factor[(c)]
	Pump	1	77	**81**	50%
	Pneumatic Tools	2	**85**	**85**	50%
	Ventilation Fans	2	**85**	79	100%
	Welder	1	73	**74**	40%

Notes:

a) "Spec" refers to noise levels stated in noise specification 721.560 for the CA/T project (FHWA, 2006)
b) "Actual" refers to Lmax values measured at 50 ft from the equipment for the CA/T project (FHWA, 2006)
c) Usage factors taken from the RCNM equipment noise database (FHWA, 2006)
d) For Drill Rig, the RCNM's Rock Drill emission data were used.
e) For Skip Loader, the RCNM's Front End Loader emission data were used.
f) For Tie-back Rig, the RCNM's Rock Drill emission data were used.
g) For Forklift, the RCNM's Front End Loader emission data were used.
h) Bold font indicates reference noise levels that were used in the noise analysis

Projected long-term construction noise levels are provided in Table 3**.** The calculations use the louder of the two reference noise levels with the acoustical usage factors shown in Table 2. The Total Leq for each activity was calculated for 90-foot distance, which is the distance between the center of the construction work site and the property line of SCH-CC.

Table 3: Projected Long-term Construction Noise, at Property Line

Phase / Activity	Total Leq at 90 feet, dBA
Demolition / Site Preparation	85
Shoring	82
Excavation	82
Foundation Work	70
Superstructure	86

Long-term noise levels were projected to interior spaces within the SCH-CC that have direct exposure to the construction noise, Table 4, including a family waiting area in the basement immediately adjacent to the south perimeter wall and the closest patient rooms on Level 2 through 6 of the SCH-CC. Projected noise levels at the exterior of the closest patient rooms are also provided in Table 4. The sensitive spaces in the basement, located 54 feet from the perimeter wall, are shielded by the pavilion building above and do not have direct exposure to exterior noise. Therefore, construction noise is not expected to be audible within the sensitive spaces within the basement.

Estimates of the Outdoor-Indoor Transmission Class (OITC) rating of the SCH-CC building shell were applied to the projected exterior noise levels to estimate interior noise. OITC was developed to address the reduction of noise from transportation sources of noise, such as automobiles, trucks, aircraft and trains. Noise from transportation sources have low frequency content, similar to construction equipment. Therefore, the OITC should provide a reasonable estimate of the reduction to be expected, in the absence of source level data beyond the overall levels available.

The weakest path for construction noise entering the family waiting area is the 6" thick concrete roof slab above it. According to a commercially available sound insulation prediction program (Insul Version 9.0), a 6" thick concrete slab is rated at OITC 49. The above rating is based on laboratory results with a carefully constructed sample in a purpose-built laboratory. In the field, the actual rating is typically lower due to noise leaks and noise transmitted by other paths besides through the panel itself, i.e. flanking paths. It is common practice to assume a five point reduction in the rating to account for field conditions. In this case, the rating was assumed to be OITC 44.

For the patient rooms, the long-term construction noise was projected to the exterior of the closest patient room on the second level, as a worst case for the rooms on higher levels. The horizontal distance was estimated to be 48 feet from the property line, for a total distance of 48 feet plus 90 feet (138 feet) to the center of the construction zone. The vertical distance was assumed to be 21 feet, the angular distance totaling 140 feet. The weakest path for construction noise entering the patient room is the window. Due to the relatively low levels of exterior ambient background noise, less than 58 dBA Daytime Leq and less than 55 dBA Nighttime Leq, it is unlikely that the patient room windows have a high OITC rating. Therefore, a minimum OITC 21 was assumed, based upon available ratings of typical window assemblies.

The projections for the patient rooms are conservative. They do not account for the actual surface exposure of the room to the noise, the composite transmission loss of the window plus building facade, acoustical absorption and spatial averaging of the noise within the room, and a conservative OITC rating was used.

Table 4: Projected Long-term Construction Noise, Inside SCH-CC

Phase / Activity	Total Leq in Family Waiting Area, dBA	Total Leq Outside Patient Rooms*, dBA	Total Leq Inside Patient Rooms*, dBA
Demolition / Site Preparation	41	81	60
Shoring	38	78	57
Excavation	38	78	57
Foundation Work	26	66	45
Superstructure	42	81	60

*Predicted for the closest patient room on the 2nd Level as a worst case for patient rooms on Levels 2 through 6

Projected maximum short-term noise levels at 3-foot distance are provided in Table 5**.** The distance of 3 feet represents the extents of the work area closest to the property line of the SCH-CC. The calculations use the louder of the two reference noise levels. The Lmax from the loudest two pieces of equipment by phase are shown. If multiple devices have the same maximum levels, then all devices of the same level are listed.

Table 5: Projected Short-term Construction Noise, at Property Line

Phase / Activity	Lmax at 3 feet, dBA	Equipment
Demolition / Site Preparation	114	Mounted Impact Hammer (Hoe Ram) Concrete Saw
	111	Grapple (on Backhoe)
Shoring	109	Drill Rig Crane Tie-back Rig Chain Saw Concrete Mixer Truck
	106	Concrete Pump Generator
Excavation	109	Excavator
	108	Dump Truck
Foundation Work	106	Concrete Pump Truck
Superstructure	109	Crane Manlift Pneumatic Tools Ventilation Fans
	105	Pump

As for the long-term noise projections, projections of the short-term noise within the SCH-CC are provided in Table 6. All of the same assumptions discussed above were used, except the angular distance between the sources and the patient room on Level 2 was assumed to be 55 feet, instead of 140 feet. The projections inside the patient rooms are conservative, as discussed above for the long-term noise projections.

Table 6: Projected Short-term Construction Noise, Inside SCH-CC

Phase / Activity	Lmax in Family Waiting Area, dBA	Lmax Outside Patient Rooms*, dBA	Lmax Inside Patient Room*, dBA	Equipment
Demolition / Site Preparation	70	89	68	Mounted Impact Hammer (Hoe Ram) Concrete Saw
	67	86	65	Grapple (on Backhoe)
Shoring	65	84	63	Drill Rig Crane Tie-back Rig Chain Saw Concrete Mixer Truck
	62	81	60	Concrete Pump Generator
Excavation	65	84	63	Excavator
	64	83	62	Dump Truck
Foundation Work	62	81	60	Concrete Pump Truck
Superstructure	65	84	63	Crane Manlift Pneumatic Tools Ventilation Fans
	61	80	59	Pump

*Predicted for the closest patient room on the 2nd Level as a worst case for patient rooms on Levels 2 through 6

1.2 Construction Vibration

Standard practice for predicting construction vibration utilizes an approach similar to the above described for noise predictions. In other words, a reference level is assumed, and a simple mathematical formula is used to account for the attenuation of vibration with increasing distance from the source. However, the above approach can be overly conservative because it does not account for the reduction of vibration due to the stiffness and mass of the receiving structure. On the other hand, the standard approach can alternately under-estimate vibration due to resonances within the structure, resonances between the structure foundation and soil, or additional coupling through a stiffer soil layer and piles driven into the stiffer soil. Therefore, a detailed vibration analysis was conducted using a Finite Element Analysis (FEA) approach to model the dynamics of the soil and structure.

In FEA, a structure is divided into many grid points and the connections between those points are defined by material properties (i.e. density, stiffness, damping, etc.) and geometric properties of the structure. A computer is then used to solve a complex system of differential equations to estimate the dynamic response at each grid point due to a dynamic force input at a specified location. For this study, commercial software Autodesk Nastran 2018 Version 12.0.0.121 was used for the analysis and Siemens Finite Element Modeling and Postprocessing (FEMAP) Version 11.4.2 was used to set up the analysis model and to postprocess the analysis results.

Figure 1 is a graphical representation of the FEA model used in this study. The model included elements representing the SCH-CC basement structure and pile foundation, mass of the 7-story building above the basement, pile foundations, and the surrounding soil. Geometric and material properties for the SCH-CC structure were based upon structural drawings of the SCH-CC. Material properties for the soil were based upon information contained in the Project geotechnical report. The geotechnical report indicated sandy soil from below the existing asphalt to a stiffer silty soil layer at a depth of approximately 15 feet. Therefore, different material properties were assumed for the two layers of soil within the FEA model.

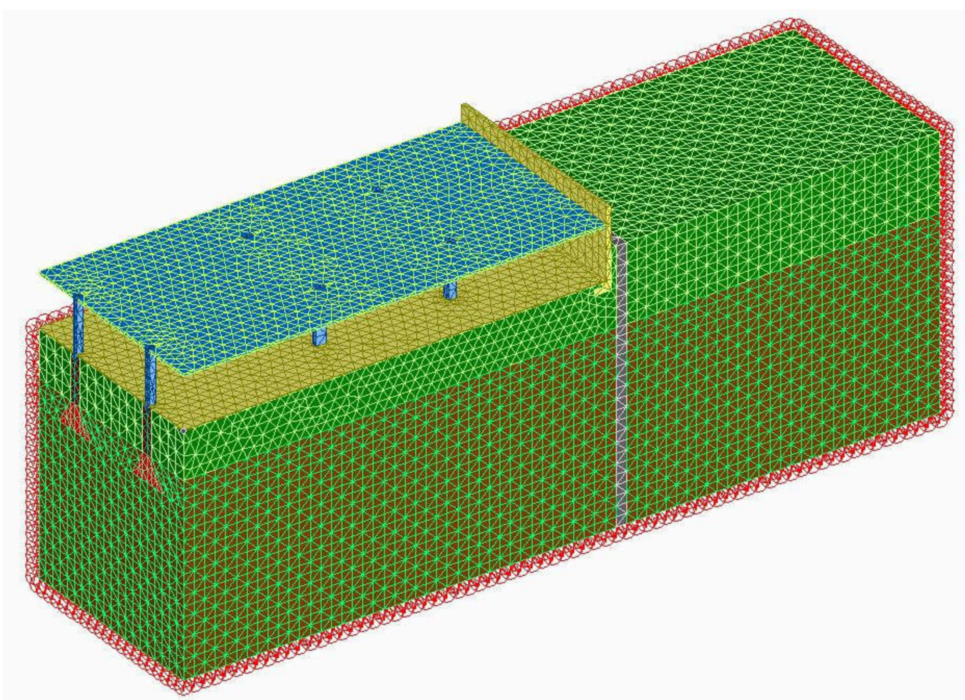

Figure 1: Graphical representation of Finite Element Model used for Brick and Machine vibration analysis

Symmetrical boundary conditions were utilized along the two edges of the model dividing the structure (north and west) and propagating boundary conditions were set at the other three edges (south, east, and the bottom) to simulate the continuation of soil away from the structure.

To calculate vibration in the structure, a unit dynamic force was applied individually at specific locations and the FEA model was used to calculate the vibration velocity response at the force location and at select locations in the structure, over a frequency range from 3 to 87 Hz (covering 1/3 octave bands from 3.15 to 80 Hz). Transmission losses, from the source to locations within the structure were estimated from the ratio of the vibration velocity calculated in the structure to the vibration velocity at the force input.

Responses were calculated within the structure at three locations: in the basement wall at the existing grade level (approximately mid-way between the basement slab and Level 1 slab), in the basement wall at the basement slab, in the basement slab 54 feet from the basement wall (i.e. 55 feet horizontal distance from the source). The response calculations were made at locations between column grid lines and along a column grid line, for a total of six response locations. Responses were calculated in the vertical direction and the horizontal direction towards the source.

For demolition activity, the input location was assumed to be at grade level, 1 foot from the SCH-CC basement wall, with the excitation in the vertical direction. The same was assumed for shoring activity for all equipment except the drill rig. Six input locations were calculated for the drill rig, with input in the horizontal direction towards the SCH-CC, simulating a rotating auger. The input for the drill rig was calculated at the surface, at the depth of the basement slab, and at the depth of the stiffer soil layer; this was done between grid lines and at the grid line, all locations at 1-foot horizontal distance from the SCH-CC wall.

Excavation is to take place after the shoring has been completed. Therefore, the force input was assumed to be 1 foot from the completed shoring and applied in the vertical direction. Similar to the shoring activity, the force was inputted at three depths, at the existing grade, basement level, and at the top of the stiffer soil layer. For the latter two locations at depth, elements in the FEA model representing the soil were removed to simulate the actual conditions during excavation. Additionally, the shoring wall was simulated, using a spatial average of the material properties of the steel soldier piles and the concrete, assuming regular weight concrete with a compressive strength of 3000 psi.

Figure 2 shows the transmission losses calculated with the source at the soil surface, 1 foot from the SCH-CC, acting in the vertical direction. The data in the figure indicate transmission losses in the wall that are reasonably uniform over the range of frequencies, but significantly different at the location in the basement slab, 55 feet away. The latter appears to be affected either by resonances in the structure, foundation, and/or in the softer soil layer between the basement slab and the stiffer layer below. Similar data were observed at all other locations of the source and responses, and construction phases.

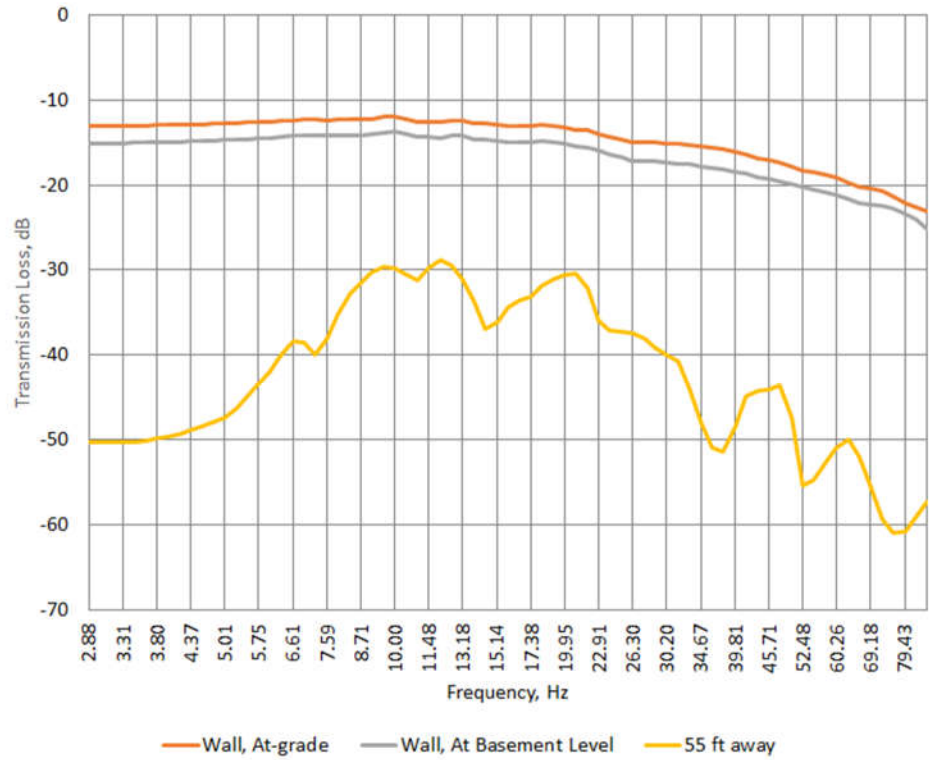

Figure 2: Estimated transmission losses from source at-grade, 1 foot from SCH-CC wall, in the vertical direction

Overall transmission losses were calculated from energy averages of the transmission losses calculated over the range of frequencies. The most conservative estimates of transmission loss for each construction phase were used to predict vibration within the SCH-CC. Table 5 provides the overall transmission loss values that were used in the study, expressed in decibels.

Reference vibration levels from the California Department of Transportation (Caltrans) "Transportation and Construction Vibration Guidance Manual" (September 2013) were used in the study, except where noted. The reference vibration levels are at a reference distance of 25 feet from the source. For the study, the reference levels were calculated to a distance of 1 foot from the source using the following formula:

$$PPV(1ft) = PPV_{Ref}(25/1)^{1.1} \text{ (in/sec)}$$

The transmission losses in Table 7 were applied to the reference vibration levels calculated at 1 foot to estimate vibration within the SCH-CC. Table 8 provides the reference vibration levels at 25 ft and 1 ft, and the predicted levels within the SCH-CC expressed in PPV and VdB re 1 micro-in/s for each piece of vibration generating equipment during the demolition, shoring, and excavation phases of construction. Decibels were used for RMS because of the wide range of levels predicted, making comparisons between locations and equipment easier. Bold font in Table 8 indicates levels that exceed PPV 0.2 in/s, 78 VdB in all areas except sensitive spaces 54 feet from the wall, and 72 VdB in sensitive areas 54 feet from the wall.

Table 7: Estimated overall transmission loss from construction vibration source

Phase / Activity	To Wall At-Grade, dB	To Wall at Basement, dB	Basement Slab, 54 ft from Wall, dB
Demolition / Site Preparation	-12	-14	-31
Shoring (except Drill Rig)	-12	-14	-31
Shoring (Drill Rig)	-8	-6	-25
Excavation	-23	-23	-32

Table 8: Estimated vibration levels in the SCH-CC during Brick and Machine construction

Phase / Activity	Vibration Generating Tools/ Equipment	PPV Ref. Level at 25 ft (in/s)	PPV Ref. Level at 1 ft (in/s)	Max PPV in SCH-CC (in/s)	RMS in Wall at-grade (VdB)	RMS in Wall at basement (VdB)	RMS 54 ft from wall (VdB)
Demolition / Site Preparation	Grapple (on Backhoe)	0.003	0.103	0.03	76	74	57
	Mounted Impact Hammer (Hoe Ram)	0.24	8.278	**2.08**	**114**	**112**	**95**
	Excavator	0.089	3.070	**0.77**	**106**	**104**	**87**
	Concrete Saw[a]	0.001	0.034	0.01	67	65	48
	Dump Truck	0.076	2.621	**0.66**	**104**	**102**	**85**
Shoring	Drill Rig[b]	0.008	0.276	0.14	**89**	**91**	72
	Crane	n.a.[c]	n.a.	--	--	--	--
	Concrete Pump	n.a.	n.a.	--	--	--	--
	Skip Loader[d]	0.003	0.103	0.03	76	74	57
	Tie-back Rig[e]	0.008	0.276	0.14	**89**	**91**	72
	Air Compressor	n.a.	n.a.	--	--	--	--
	Chain Saw	n.a.	n.a.	--	--	--	--
	Welder	n.a.	n.a.	--	--	--	--
	Generator	n.a.	n.a.	--	--	--	--

Phase / Activity	Vibration Generating Tools/ Equipment	PPV Ref. Level at 25 ft (in/s)	PPV Ref. Level at 1 ft (in/s)	Max PPV in SCH-CC (in/s)	RMS in Wall at-grade (VdB)	RMS in Wall at basement (VdB)	RMS 54 ft from wall (VdB)
	Concrete Mixer Truck	0.076	2.621	**0.66**	**104**	**102**	**85**
Excavation	Excavator	0.089	3.070	**0.22**	**93**	**95**	**86**
	Loader[f]	0.003	0.103	0.01	65	65	56
	Backhoe[g]	0.003	0.103	0.01	65	65	56
	Street Sweeper	n.a.	n.a.	--	--	--	--
	Dump Trucks	0.076	2.621	0.19	**93**	**93**	**84**

Notes:

a) Ref. level for concrete saw was based on measurements conducted by Wilson Ihrig for a previous project.
b) For Drill Rig, the reference level for a hydro-mill in soil in the Federal Transit Administration (FTA) "Transit Noise and Vibration Impact Assessment" guidance manual was used
c) Reference levels designated "n.a." indicate equipment that does not represent a significant source of vibration and no reference vibration levels are available.
d) For Skip Loader, the Caltrans reference level for a small bulldozer was used.
e) For Tie-back Rig, the reference level for a hydro-mill in soil in the FTA guidance manual was used
f) For Loader, the Caltrans reference level for a small bulldozer was used.
g) For Backhoe, the Caltrans reference level for a small bulldozer was used.
h) Bold font indicates predicted levels that exceed PPV 0.2 in/s, 78 VdB (0.008 in/s RMS) in areas adjacent to the planned construction, or 72 VdB (0.004 in/s RMS) in vibration sensitive areas 54 ft from the basement wall.

The predicted vibration indicated in Table 6 exceed acceptable levels from a hoe ram, excavator, concrete mixer truck, and dump trucks. Distances from the property line required to reduce vibration to PPV 0.2 in/s within the soil are 10 feet for trucks, 12 feet for the excavator, and 30 feet for the hoe ram. Reducing vibration within the soil to PPV 0.2 in/s will assure that vibration within the SCH-CC structure does not exceed PPV 0.2 in/s. As there is at least 31 decibels reduction of vibration from the soil outside the SCH-CC to the vibration sensitive areas as indicated in Table 7 for the above activities, the vibration within the sensitive areas would be approximately 0.0014 in/s r.m.s, or 63 VdB, or less.

The hoe ram will only be used during demolition of the existing building which is located approximately 58 feet away from the property line, i.e. more than 30 feet away as recommended above. Concrete from the mixer truck will be pumped in, with the mixer truck at least 10 feet away from the property line. Dump trucks will not be allowed to use Delmas Terrace within 10 feet of the property line. Therefore, vibration from the above equipment will be unlikely to impact the SCH-CC.

2 Operational Noise

Operational noise is discussed in detail in the Proposed Mitigated Negative Declaration (MND) provided by the Project to the City of Culver City. However, this report addresses potential noise from use of the proposed outdoor dining area on the 4th Level of the project.

Based on the acoustical study conducted by others and described in the MND, the average background noise at the center of the dining area is estimated to be 55 dBA. The sound pressure level experienced by a listener who is three feet away from the speaker typically ranges from 60 to 65 dBA. Therefore, diners will likely be speaking to each other at a normal level of effort. Assuming "unconcentrated assembly without fixed seats" per California Building Code, there would be 1 occupant per 15 square foot, or 133 total occupants in the 2,000 square foot outdoor area. Assuming half of those occupants are speaking simultaneously (and the other half listening), and accounting for acoustical shielding that will be provided by the 5-story high portion of the Project between the outdoor dining area and the SCH-CC, the maximum noise level expected from daily operation of the outdoor dining area, from people talking, is 47 dBA at the SCH-CC property line, located approximately 130 feet from the center of the dining area. All levels at the SCH-CC will benefit from shielding provided by the 5-story portion of the Project. The projected noise level at the SCH-CC facade from people talking in the Project outdoor dining area is 44 dBA.

Noise from other activities in the 4th Level outdoor dining area will be controlled to meet the requirements of the City of Culver City Municipal Code.

3 Operational Vibration

Potential sources of operational vibration are automobiles entering and exiting the Project sub-level parking via the ramp at the northwest corner, adjacent to the SCH-CC and the two-level, stacked parking system on the ground floor. An approach similar to that used to estimate vibration from construction above was used to estimate operational vibration. The reference level for automobiles on the garage ramp was based upon vibration measurements conducted in a similar concrete structure. The reference level for the stacked parking system was based upon vibration measurements conducted next to a freight elevator in an all-concrete structure. The insertion losses calculated above for the excavation phase of construction were utilized. Table 9 indicates the predicted vibration levels within the SCH-CC from Brick and Machine operations.

Table 9: Estimated vibration levels in the SCH-CC during Brick and Machine operations

Activity	PPV Ref. Level at 1 ft (in/s)	Max PPV (in/s)	RMS in Wall at-grade (VdB)	RMS in Wall at basement (VdB)	RMS 54 ft from wall (VdB)
Automobiles on Garage Ramp	0.12	0.003	67	67	58
Parking Stacking System	0.007	0.0005	42	42	33

Please feel free to contact me with any questions on this information.

Very truly yours,

WILSON IHRIG

James E. Phillips, MS, FASA

Principal

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