October 22, 2020

Michelle Carter, City Planning Associate
City of Los Angeles Department of City Planning
200 N. Spring Street, Room 763
Los Angeles, CA 90012

RE: Memorandum Analysis for Vibration Analysis in response to Justification for Appeal letter from Miguel Siqueiros and Emmanuel Sanchez-Ramos for 1614-1626 West Temple Street Project.

Dear Ms. Carter:

This letter addresses issues raised in the Justification for Appeal letter submitted by Miguel Siqueiros and Emmanuel Sanchez-Ramos (Appellants) regarding construction-related noise impacts and construction-related vibration impacts to nearby buildings of the 1614-1626 West Temple Street Project (Project). The Categorical Exemption (CE) Analysis prepared for the Project demonstrated that the Project would not result in any construction-related or operational-related noise impacts and that the Project would be in compliance with the Los Angeles Municipal Code (LAMC) Sections 41.40 and 112.05 (pages III-22 through III-34). However, in the interest of providing comprehensive information for consideration by the City in the appeal process, a vibration analysis was conducted to determine whether adjacent buildings would be exposed to significant vibration impacts from construction of the Project. Vibration impacts can range from no perceptible effects at the lowest vibration levels, to low rumbling sounds and perceptible vibration at moderate levels, to slight damage of buildings at the highest levels.

FINDINGS

The vibration analysis determined, based on modeling methodologies and thresholds established by cognizant pubic regulatory agencies, that impacts to buildings in the Project's vicinity, including the Appellants' residence, related to construction vibration resulting from the Project would be less than significant and no mitigation is required.

The remainder of this letter provides a summary of the methodology and results of the vibration analysis. Detailed backup information is provided in the Appendices.

STUDY METHODOLOGY

Project Analysis

The Project would involve the demolition of the existing 2,800 square foot commercial building located at 1614 West Temple Street, the demolition of the existing 5,500 square foot commercial building located at 1626 West Temple Street, and the construction of an 47,000 square-foot mixed-use development containing 72 residential units, of which seven units would be affordable units, and approximately 700 square feet of ground floor commercial space. The

primary source of groundborne vibration would be during construction activities. The operation of construction equipment generates vibrations that propagate though the ground and diminishes in intensity with distance from the source.

Sources of Vibration and Groundborne Noise

Groundborne noise refers to the noise generated by groundborne vibration. Groundborne noise that accompanies the building vibration is usually perceptible only inside buildings and typically is only an issue at locations with subway or tunnel operations where there is no airborne noise path or for buildings with substantial sound insulation such as a recording studio.[1] The City currently does not have any adopted standards, guidelines, or thresholds relative to groundborne vibration. As such, available guidelines from the Federal Transit Administration (FTA) are utilized to assess impacts due to groundborne vibration.[2] In most circumstances common ground-induced vibrations related to roadway traffic and construction activities pose no threat to buildings or structures.[3,4]

Regulations

The Project would be subject to Section 91.3307 of the LAMC, which states that adjoining public and private property shall be protected from damage during construction, remodeling, and demolition work.[5] Protection must be provided for footings, foundations, party (i.e., shared) walls, chimneys, skylights, and roofs and provisions shall be made to control water runoff and erosion during construction or demolition activities. For excavations, adjacent property shall be protected as set forth in Section 832 of the Civil Code of California.[6] Prior to the issuance of any permit, which authorizes an excavation, the owner of the site shall provide the Department of Building and Safety with evidence that the adjacent property owner or owners have been given a 30-day written notice of the intent to excavate, the depth to which the excavation is intended to be made, and when the excavation will commence. This notice shall be by certified mail, return receipt requested.

Thresholds of Significance

The City of Los Angeles does not have a significance threshold to assess vibration impacts during construction. Therefore, the FTA- adopted vibration standards for buildings were used to evaluate potential impacts related to construction. The California Department of Transportation's (Caltrans) has also adopted the FTA standards for use in evaluating vibration

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1 *FTA, Transit Noise and Vibration Impact Assessment, May 2018, pp 108, 112.*

2 *FTA guidelines are industry-standard for addressing vibration impacts since the FTA routinely deals with groundborne vibrations from subway systems and their effects on nearby receptors.*

3 *FTA, "Transit Noise and Vibration Impact Assessment", May 2006, Chapter 7.*

4 *Caltrans, "Transportation Related Earthborne Vibrations," February 2002.*

5 *Additional details can be found in Appendix A.*

6 *This pertains to excavations that are of a greater depth than are the walls or foundation of any adjoining building or structure and located closer to the property line than the depth of the excavation.*

impacts of Caltrans' projects. Based on the FTA and Caltrans criteria, construction impacts relative to groundborne vibration would be significant if any of the following were to occur:[7]

- Project construction activities would cause a peak particle velocity (PPV) groundborne vibration level to exceed 0.5 inches per second at any building that is constructed with reinforced-concrete, steel, or timber;
- Project construction activities would cause a PPV groundborne vibration level to exceed 0.3 inches per second at any engineered concrete and masonry building;
- Project construction activities would cause a PPV groundborne vibration level to exceed 0.2 inches per second at any non-engineered timber and masonry building; or
- Project construction activities would cause a PPV ground-borne vibration level to exceed 0.12 inches per second at any historical building or building that is extremely susceptible to vibration damage.[8]

Noise Vibration Analysis

Construction activities for the Project have the potential to generate low levels of groundborne vibration through the operation of construction equipment that generates vibrations that propagate though the ground and diminish in intensity with distance from the source. There are no known structures adjacent to the Project Site that would be considered structurally fragile or susceptible to vibration damages. According to pages III-97 and III-98 of the CE, the Project Site is not located within a Historic Preservation Review area, nor is the Project Site within a Historical Preservation Overlay Zone. The surrounding buildings consist primarily of engineered concrete and masonry buildings, and reinforced-concrete, steel, or timber buildings. As such, the potential for construction-related vibration damage to off-site structures would be considered low.

Construction-Related Vibration Impacts

The most vibration-intense phases of construction would occur during demolition and excavation of the Project Site. Pile drivers, clam shovel drops or vibratory rollers are not expected to be used during demolition or construction of the Project. Therefore, the highest vibration-generating pieces of equipment used during demolition would be a hoe ram and a large bulldozer. During excavation, the most vibration-generating pieces of equipment would be a caisson drill and a large bulldozer. The aforementioned pieces of equipment would generate PPV of 0.089 inches per second at a distance of 25 feet.[9] The closest building to the Project Site is the façade of the multi-family apartment complex located at 1637 Cortez Street, which is approximately 15 feet from the Project's southern boundary. At that distance, if a large

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7 *Federal Transit Administration, Transit Noise and Vibration Impact Assessment, May 2006; and California Department of Transportation, Transportation- and Construction –Induced Vibration Guidance Manual, June 2004.*

8 *Additional details can be found in Appendix A.*

9 *Additional details can be found in Appendix A, Table 2.*

bulldozer were to operate right next to the Project Site boundary line, the vibration level at the building façade from use of construction equipment would be 0.191 inches per second PPV, which is below the 0.2 inches per second threshold for non-engineered timber and masonry buildings.[10,11] Therefore, as the groundborne vibration does not exceed the threshold to cause structural damage to the closest adjacent building, impacts to buildings further from the Project boundary, including the Appellants' residence, would also not exceed the vibration threshold. Impacts from construction-related vibration to structures in the Project vicinity would be less than significant and no mitigation is required.

It has been a pleasure to serve you for this vibration analysis. If you have any questions, please call me at (213) 235-4772 or (951) 212-3277 cell. You may also reach me by email at katie@ecotierraconsulting.com.
Sincerely,

EcoTierra Consulting, Inc.

Katie Wilson
Senior Air Quality Analyst

Attachments

APPENDIX A DETAILED METHODOLOGY AND BACKGROUND INFORMATION
APPENDIX B VIBRATION WORKSHEET

[10] *Refer to Appendix B for modeling results.*
[11] *To be conservative, it was assumed that the closest building to the project site was a non-engineered timber and masonry building, which is the most vibration-sensitive building, after historic structures.*

APPENDIX A
DETAILED METHODOLOGY AND BACKGROUND INFORMATION

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DETAILED METHODOLOGY AND BACKGROUND INFORMATION

Ground-borne Vibration

Groundborne vibration levels resulting from construction activities were estimated using the published data in the 2013 Caltrans Transportation and Construction Vibration Guidance Manual. Per page 37 therein, vibration from construction equipment has been estimated with the following formula:

$PPVEquipment = PPVRef (25/D)^n$ (in/sec)

Where: PPVRef = reference PPV at 25 ft.
D = distance from equipment to the receiver in ft.
n = 1.5 (the value related to the attenuation rate through ground)

Operational groundborne vibration was assessed based on the proposed land uses at the project site and the expected activities that would produce groundborne vibration at the project site, such as truck deliveries and trash collecting.

Vibration Impacts to Structures

The FTA has published a technical manual titled, "Transit Noise and Vibration Impacts Assessment," which provides groundborne vibration impact criteria with respect to building damage during construction activities.[1] The vibration damage criteria adopted by the FTA are shown in **Table 1, Construction Vibration Damage Criteria**.

Table 1
Construction Vibration Damage Criteria

Building Category	PPV (in/sec)
I. Reinforced-concrete, steel, or timber (no plaster)	0.50
II. Engineered concrete and masonry (no plaster)	0.30
III. Non-engineered timber and masonry buildings	0.20
IV. Buildings extremely susceptible to vibration damage	0.12
Source: FTA, Transit Noise and Vibration Impact Assessment, September 2018.	

Vibration Source Levels for Construction Equipment

Table 2, Vibration Source Levels for Construction Equipment, identifies various PPV and RMS velocity (in VdB) levels for the types of construction equipment that would operate at the Project Site during construction.

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[1] *FTA, "Transit Noise and Vibration Impact Assessment," May 2006.*

Table 2
Vibration Source Levels for Construction Equipment

Equipment	Peak Particle Velocity (inches/second) at 25 feet	Approximate Vibration Level (L_V[1]) at 25 feet
Pile driver (impact)[2]	1.518 (upper range) 0.644 (typical)	112 104
Pile driver (sonic)[2]	0.734 upper range 0.170 typical	105 93
Clam shovel drop (slurry wall)[2]	0.202	94
Hydromill (slurry wall)	0.008 in soil 0.017 in rock	66 75
Vibratory Roller[2]	0.210	94
Hoe Ram	0.089	87
Large bulldozer	0.089	87
Caisson drill	0.089	87
Loaded trucks	0.076	86
Jackhammer	0.035	79
Small bulldozer	0.003	58

[1] RMS velocity in decibels, VdB re 1 micro-in/sec.
[2] The maximum PPV at 25 feet will be no more than .089 because pile drivers, clam shovel drop, and vibratory roller are not expected to be utilized during demolition or construction of the project.
Source: Table 7-4, Transit Noise and Vibration Impact Assessment, Federal Transit Administration, September 2018.

Operational Vibration

The PPV or the RMS velocity is usually used to describe vibration levels. PPV is defined as the maximum instantaneous peak of the vibration level, while RMS is defined as the square root of the average of the squared amplitude of the level. PPV is typically used for evaluating potential building damage, while RMS VdB is typically more suitable for evaluating human response.

The background vibration velocity level in residential areas is usually around 50 VdB. The vibration velocity level threshold of perception for humans is approximately 65 VdB. A vibration velocity level of 75 VdB is the approximate dividing line between barely perceptible and distinctly perceptible levels for most people. Most perceptible indoor vibration is caused by sources within buildings such as operation of mechanical equipment, movement of people, or the slamming of doors. Typical outdoor sources of perceptible groundborne vibration are construction equipment, steel-wheeled trains, and traffic on rough roads. If a roadway is smooth, the groundborne vibration from traffic is rarely perceptible. The range of interest is from approximately 50 VdB, which is the typical background vibration velocity level, to 100 VdB, which is the general threshold where minor damage can occur in fragile buildings.

APPENDIX B
VIBRATION WORKSHEET

GROUNDBORNE VIBRATION ANALYSIS			
Project:	1614 Temple Street		Date: 10/1/20
Source:	Large Bulldozer or Caisson Drill		
Scenario:	Unmitigated		
Location:	Project Site		
Address:	Residential use 15 feet		
PPV = PPVref(25/D)^n (in/sec)			
INPUT			
Equipment = Type	2	Large Bulldozer	INPUT SECTION IN GREEN
PPVref =	0.089	Reference PPV (in/sec) at 25 ft.	
D =	15.00	Distance from Equipment to Receiver (ft)	
n =	1.50	Vibration attenuation rate through the ground	
Note: Based on reference equations from Vibration Guidance Manual, California Department of Transportation, 2013, pgs 35-40.			
RESULTS			
PPV =	0.191	IN/SEC	OUTPUT IN BLUE