

MEMORANDUM

To: Mr. Philip Olbrechts, City of MLT Hearing Examiner
From: Sound Transit; City of Mountlake Terrace
Date: June 26, 2019
Regarding: Joint Recommendation Regarding Conditions of Approval for Sound Transit CUP (Reference Permit Nos. PCU-18-0001, PSD-18-0001, & PSE-18-0005)

Sound Transit and the City of Mountlake Terrace are pleased to report that they have reached agreement on amendments to certain conditions of approval recommended in the City's Staff Report (filed on June 13, 2019). The parties jointly recommend that the Examiner adopt the following conditions of approval with the line edits shown below. (Deletions are shown in strikethrough, and additions are shown in underlined text.) The parties have now reached agreement on all of the recommended Conditions of Approval with the exception of the conditions relating to the Veteran's Park Trail Connection required under Conditions 23.b and 24.c, which will be the subject of evidence and testimony to be presented at the hearing.

1. Amend Condition 1.d.iii to read as follows:
 - iii. ~~Does not physically preclude achieving the project's primary intended legal use.~~ Does not effectively preclude the essential public facility by rendering it impracticable.

2. Amend Condition 3 to read as follows:
 3. Approved CUP Conditions Kept on Site: At least one copy each of the Hearing Examiner's decision and these Conditions of Approval must be accessible on each site where significant construction work is occurring. The decision and Conditions of Approval must be kept on site for reference at all hours when work is occurring.

3. Amend Condition 6.a to read as follows:
 - a. Final design and location of the Lynnwood Link Extension and related improvements must comply with the drawings as provided as part of the record ~~in~~ including Exhibits ST-A02, ST-B02, ST-C02, ST-D02, ST-E02, ST-F02, ST-G02, ST-H02, ST-I02, ST-J01, ST-K02, ST-L02, ST-M02, and ST-N02, except as modified by these, or other, Conditions of Approval.

4. Amend Condition 7 to read as follows:
 7. Schedule: Sound Transit must prepare and submit a construction schedule identifying the overall estimated construction timeline, phases, planned instances and duration of night work, ~~and planned instances and duration of noisy work.~~ Sound Transit must provide an updated construction schedule to the City monthly for the duration of work. The City's construction coordinator will attend the weekly construction meeting and the Construction Project Management Plan update including schedule

must be made available to the construction coordinator at each weekly meeting.

5. Delete Condition 8.h in its entirety (including subsections 8.h.i through 8.h.vi, inclusive) and replace with the following text:

- h. Sound Transit and its contractors shall adhere to the best management practices set forth in Subsections 3.05 and 3.06 of Section 01 57 15 – Temporary Noise and Vibration Control, contained Sound Transit's Contract L200/L300 – Lynnwood Link Extension: Northgate Station to Lynnwood Transfer Center, Revision 1, 2018-7-26 (included as Attachment 1).

6. Amend Condition 9 to read as follows:

9. Site Work:

- a. Sound Transit must prepare and submit all plans required by City Code or these conditions for City review and approval, including (at a minimum) the following plans described in the application documents: Tree Protection Plan; ~~Hazardous and Contaminated Waste Management Plan; Spill Prevention, Control, and Countermeasures Plan;~~ and Stormwater Pollution Prevention Plan. These plans must be prepared by qualified professionals. These plans must be complied with throughout the duration of the project.

- b. The required Tree Protection Plan must include consultation with a certified arborist or similar qualified professional. Sound Transit must receive City approval of the required Tree Protection Plan prior to commencement of work affecting trees within the project limits but outside the WSDOT right-of-way. This plan must be complied with throughout the duration of the project.

7. Amend Condition 11.b to read as follows:

- b. Sound Transit must maintain construction haul routes free of mud, dirt, and debris caused by work associated with the project. Sound Transit must perform street sweeping along haul routes on a weekly basis or as otherwise directed by the City to avoid unusually heavy accumulations of mud, dirt, or debris. The time and day of street sweeping must be coordinated with the City's Public Works department and must avoid peak traffic periods.

8. Amend Condition 11.d to read as follows:

- d. Any City street or public property damaged by vehicles or equipment related to this project must be repaired and/or restored to pre-construction condition or better prior to substantial completion. The City must inspect the area of repair/restoration and formally accept it by the same administrative process as any improvements to be transferred to the City.

9. Amend condition 14.a to read as follows:

- a. Construction-related vehicles and trucks utilizing City streets must follow the haul routes set forth in the Guideway and Site-Specific Drawings (Exhibits ST-A02, ST-B02, ST-C02, ST-D02, ST-E02, ST-F02, ST-G02, ST-H02, ST-I02, ST-J02, ST-K02, ST-L02, ST-M02, and ST-N02) except where modified by these, or other, Conditions of Approval, or as otherwise approved by the City.
10. Amend condition 15.a to read as follows:
 - a. All improvements to be transferred to the City must be inspected by City staff or designee prior to administrative acceptance of said improvements.
 11. Amend condition 23.a to read as follows:
 - a. Sound Transit must prepare a trail closure plan identifying proposed closure measures to be implemented during construction, such as signage and ~~security patrols~~ project site fencing. The plan must be submitted to the City for review and approval prior to trail closure. Sound Transit must maintain ~~security of the closed trail~~ the closure measures for the duration of construction.
 12. Amend condition 24.e to read as follows:
 - e. Vegetative screening must be installed and maintained to obscure the 12-foot high wall at the traction power substation (TPSS) as shown in Exhibit ~~MLT-14 ST-25a~~ Sound Transit must prepare and submit a planting plan to the City and for review and approval by the Community and Economic Development Director.
 13. Amend condition 29 to read as follows:
 29. Utility Easement. Sound Transit ~~must procure~~ shall request that WSDOT grant the City a 20-foot permanent easement for the City for all relocated City-owned stormwater, water, and sewer underground utilities. If WSDOT agrees to grant the City an easement, Sound Transit shall procure the same. If WSDOT is unwilling to grant the City an easement, Sound Transit shall procure a utility permit or franchise agreement to allow the City to operate and maintain such facilities within WSDOT right-of-way on reasonable terms acceptable to the City. The easement, utility permit, or franchise agreement must be obtained prior to final administrative approval under Condition 6(d).
 14. Amend Condition 37.c to read as follows:
 - c. Boundary Line Adjustment: All proposed structures are required to meet building setback requirements. A Boundary Line Adjustment may be required by the City prior to building permit submittal to ensure that setbacks will be met. If required, Sound Transit shall prepare, submit, and record upon approval by the City a Boundary Line Adjustment to

~~consolidate~~ reconfigure the Site F properties and create a separate lot for the signal bungalow consistent with Chapter 17.02 MTMC.

2. Delete Condition 40.b:

- b. ~~Sound originating from mechanical equipment, including generator and HVAC units, related to the signal bungalow must be mitigated such that ambient noise levels are not increased at the nearest property line of receiving properties. Acceptable forms of mitigation include dense vegetation, acoustic panels, and similar treatments. If constructed or installed sound mitigation is necessary, Sound Transit must submit a final design detail to the City for review and approval by the Community and Economic Development Director.~~

15. Amend Condition 40.c to read as follows:

- c. The signal bungalow must be enclosed by a masonry wall with a decorative wrought-iron gate, of sufficient height to fully obscure all elements of the signal bungalow from view by the public right-of-way and neighboring properties. The wall must be screened by Type III landscaping. Sound Transit must submit a final planting detail to the City for review and approval by the Community and Economic Development Director. The decorative wrought iron fence gate must be a minimum of six feet in height. Sound Transit must submit a final fencing design detail to the City for review and approval by the Community and Economic Development Director.

16. Amend Condition 41 to read as follows:

41. Access Routes. Use of All vehicle haul routes and access routes to Site F by heavy vehicles shall be limited to no more than 24 times per year. Sound Transit shall keep records of such use by heavy vehicles for a period of five years, commencing upon revenue service. Sound Transit shall provide a semi-annual report to the City concerning the number of heavy vehicles making such use. If use of any vehicle haul route or access route to Site F by heavy vehicles exceeds 24 times in any given year within the monitoring period, the vehicle haul route or access route must be upgraded by Sound Transit to accommodate the largest vehicles that used during construction and permanent access to the proposed hi-rail access point during the monitoring period.

17. Amend Condition 47.d to read as follows:

- d. Sound Transit must install a noise barrier sufficient to mitigate site-specific project noise for affected residential properties consistent with Condition of Approval no. 8. The noise barrier must be based on a site-specific noise analysis that considers all work-related activities that will occur on the site. The noise barrier may be combined with the visual barrier required in Condition of Approval no. ~~49~~47(c) above. The gates for the access points on 222nd Street SW must be of equivalent sound attenuation capability.

18. Amend Condition 47.e to read as follows:

- e. All ~~sound and~~ visual barriers must be installed prior to use of the site, except for the installation of the temporary erosion and sediment controls. Upon commencement of site use, Sound Transit shall monitor noise for a period not to exceed seven days from such commencement in order to determine the most effective design for the noise barrier required by Condition 47.d above. Sound Transit shall promptly submit the design to the City for review and approval and shall thereafter promptly install the noise barrier.
19. Amend Condition 50.b to read as follows:
- b. Heavy vehicles are allowed on 222nd Street SW for demolition of the single-family homes and associated structures. Heavy vehicles are otherwise prohibited on 222nd Street, unless development of alternative access is not physically possible.
20. Amend Condition 62 to read as follows:
- 62. Boundary Line Adjustment: All proposed structures are required to meet building setback requirements. A Boundary Line Adjustment may be required by the City prior to building permit submittal to ensure that setbacks will be met. If required, Sound Transit shall prepare, submit, and record upon approval by the City a boundary line adjustment to ~~consolidate~~ reconfigure the Site M properties consistent with Chapter 17.02 MTMC.

Attachment 1: Condition 8.h Best Practices

SECTION 01 57 15

TEMPORARY CONSTRUCTION NOISE AND VIBRATION CONTROL

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section specifies requirements for complying with applicable noise regulations, and noise and vibration limits

1.02 REFERENCES

- A. Reference Standards: This Section incorporates by reference the latest revisions of the following documents.

- 1. American National Standards Institute (ANSI) / Acoustical Society of America (ASA)
 - a. ANSI/ASA S1.4 American National Standard Specification for Sound Level Meters
 - b. ANSI/ASA S2.4 American National Standard Method for Specifying the Characteristics of Auxiliary Analog Equipment for Shock and Vibration Measurements
 - c. ANSI/ASA S1.11-2004 American National Standard Specification for Octave-Band and Fractional-Octave-Band Analog and Digital Filters

- B. Definitions

- 1. Construction Site: For purpose of noise and vibration control requirements, the Construction Work Area limits. This includes Right-of-Way, property, and construction easements, used expressly for construction.
- 2. Noise Level Measurements: A-weighted and "slow" response readings from instruments complying with TYPE 1 or TYPE 2 requirements of the ANSI/ASA S1.4.
- 3. A-Weighted Noise Levels: Decibels (referenced to 20 micro-Pascal) as measured with A-weighting network of standard sound level meter, abbreviated dBA.
- 4. Vibration Measurements: The use of a vibration transducer, amplifier, peak detector, and frequency band filters complying with ANSI/ASA S2.4. For the purpose of assessing vibration annoyance, only vibration in the vertical direction need be measured. For the purpose of assessing the potential for architectural damage, vibration shall be measured in all three orthogonal directions. Unless otherwise noted, vibration measurements should be made on the ground surface or building foundation.
- 5. Vibration: For vibration annoyance, velocity. levels expressed in decibels referenced to one micro-inch per second, abbreviated VdB. For vibration-induced cosmetic architectural damage peak particle velocity (PPV) expressed in inches per second.

6. Noise Sensitive Locations: Residential areas, hospitals, parks, and other locations so named herein.
7. Maximum Sound Level Lmax: The maximum recorded root mean square (RMS) A-weighted sound level for a given time interval or event measured with the "slow" meter response.
8. Equivalent Sound Level (Leq): The level in decibels of a constant sound having the same energy content as the actual time-varying level during a specified interval. The Leq is used to characterize time-varying, fluctuating sound levels with a single number. Typical intervals for Leq are hourly and daily. The time duration of the Leq shall be indicated when reporting the Leq.
9. Vibration Monitoring: Monitoring used to determine if the construction equipment and methods used to complete the work cause vibrations that equal or exceed threshold values. The data gathered provide onsite feedback of the potential effects of specific operations and procedures.
10. LAmax: The maximum A-weighted sound level measured with the "slow" meter response
11. LAmin: The minimum A-weighted sound level measured with the "slow" meter response
12. LAeq: The A-weighted Equivalent Sound Level
13. LCmax: The maximum C-weighted sound level measured with the "fast"
14. Ln: The time varying noise level exceeded n% of the time when measured with the SLOW meter response. The time duration of the Ln shall be indicated when reporting the Ln.
15. One third octave band: Filter conforming to specifications for Class 2 or better one-third octave band filters as defined in ANSI S1.11-2004
16. NIST: National Institute of Standards and Technology

1.03 SUBMITTALS AND TRANSMITTALS

A. Submittals

1. Noise and Vibration Control Plan (including Monitoring Plan)
2. Noise and Vibration Control Plan (including Monitoring Plan) Updates, as necessary
3. Qualifications of the Acoustic Specialist

B. Transmittals

1. Certificates of calibration for monitoring instruments, prior to initial use and upon annual recalibrations.
2. Updated certificates to monitoring instruments after repairs.
3. Vibration Measurement Reports: When Required, submit weekly the measurements taken during the previous week. Use approved Contractor-generated vibration-monitoring form. Note the type of measurement (for

example, baseline, on-going construction) on the form. Reports shall indicate if vibration limits were exceeded and describe mitigation measures.

4. Noise Measurement Reports: Submit weekly the measurements taken during the previous week. Use Noise Measurements Report Form provided in Exhibit C. Note the type of measurement (for example, baseline, on-going construction) on the form. Reports shall indicate if noise limits were exceeded and describe mitigation measures.

1.04 QUALITY ASSURANCE

A. Qualifications of the Acoustic Specialist:

1. Membership in at least one of the following recognized acoustical organizations:
 - a. Institute of Noise Control Engineering (INCE): INCE Member. INCE Associate membership is insufficient.
 - b. Acoustical Society of America (ASA): Member. Student and Associate Memberships are insufficient.
 - c. National Council of Acoustical Consultants (NCAC): Employee of an NCAC Member Firm.
2. Minimum 10 years of experience performing similar work involving noise and vibration control engineering, community noise measurements, and reporting.

PART 2 - PRODUCTS

2.01 NOISE CONTROL MATERIALS

- A. Noise control materials may be new or used. Used materials must be sound and free of damage and defects and of a quality and condition to perform their designed function for the duration of construction of this Contract.

2.02 NOISE MEASUREMENT EQUIPMENT

- A. Installed sound monitoring stations approved by the local jurisdiction, which are equipped with the following measurement and documentation devices:
 1. Sound level analyzer with the following capabilities:
 - a. Capable of measuring on both the A-Weighted and C-Weighted scales required by regulatory criteria and Noise Level Limits.
 - b. Complies with the criteria for a TYPE 1 (Precision) or TYPE 2 (General Purpose) Sound Level Meter as defined in the ANSI/ASA S1.4.
 - c. Continuous broadband logging of 1-second LAeq, LAmax and LAmin.
 - d. Continuous 1/3 octave band spectral logging of 1-second LAeq, LAmax and LAmin.
 - e. Sound recording and external equipment trigger capabilities in the event of a variance exceedance.
 - f. Sufficient internal memory for one (1) week of logged data and sound recordings.
 - g. Sound recordings shall have minimum 16-bit resolution.

2. Free-field microphone housed in an environmental shroud providing protection from rain and wind conditions. The environmental shroud to be capable of outdoor measurements for at least one (1) year without service or replacement.
- B. Portable sound monitoring equipment with the following measurement and documentation capability:
- a. Capable of measuring on both the A-Weighted and C-Weighted scales required by regulatory criteria and Noise Level Limits.
 - b. Complies with the criteria for a TYPE 1 (Precision) or TYPE 2 (General Purpose) Sound Level Meter as defined in the ANSI/ASA S1.4.
 - c. Continuous 1/3 octave band spectral logging of 1-second LAeq, LAmax and LAmin.
- C. Calibrate sound level analyzer, microphones, and calibrators for certified laboratory conformance prior to commencement of work at the Site, and thereafter, at least once per year until Acceptance.

2.03 VIBRATION MONITORING EQUIPMENT

- A. Provide portable seismographs for monitoring the velocities of ground vibrations resulting from construction activities. The seismograph has the following minimum features:
1. Seismic Velocity range: plus or minus 0.005 to plus or minus 10 inches per second with an accuracy of within 3 percent of the measured peak particle velocity or better at frequencies between 1 Hertz and 250 Hertz, and with a resolution of 0.005 inch per second or less.
 2. Frequency response (within 3 dB): 1 to 250 Hertz.
 3. Multi-channel (triaxial) for vibration monitoring.
 4. Two power sources: internal rechargeable battery and charger and 115 volts AC. Battery must be capable of supplying power to monitor vibration continuously for up to 30 days.
 5. Capable of internal dynamic verification of sensor functionality.
 6. Direct writing to printer and capability to transfer data from memory to a laptop computer, portable USB storage device, or compact disc (CD). Instruments must be capable of producing strip chart recordings of readings on site within one (1) hour of obtaining the readings. Provide computer software to perform analysis, produce reports of continuous monitoring and to perform zero-crossing frequency analyses of waveform data. Ensure that all reports and analyses are capable of output to a laptop computer, portable USB storage device, or CD.
 7. Self-triggering wave form capture mode that provides the following information: plot of wave forms, peak particle velocities and frequencies of peaks.
 8. Continuous monitoring mode must be capable of recording single-component peak particle velocities, and frequency of peaks with an interval of 1 minute or less.
- B. Provide all recommended ancillary equipment as recommended by the manufacturer for a complete and functional vibration monitoring system.

PART 3 - EXECUTION

3.01 PLAN REQUIREMENTS

A. Noise and Vibration Control Plan

1. Prepared and signed by the Acoustic Specialist.
2. Include the following for construction activities that may occur at the construction site:
 - a. Site Drawing - Prepare a scaled drawing of the construction site indicating the following:
 - 1) Contract name and number
 - 2) Contractor's name
 - 3) Date and hours of work operation
 - 4) Scale
 - 5) Direction of North
 - 6) Identify noise and vibration sensitive locations near the construction site.
 - 7) Construction equipment locations used, designated by the code letter used in Column (a) in Part A of the Noise and Vibration Control Plan Form, Exhibit A.
 - 8) Locations of the noise and vibration levels calculated to the nearest residential, commercial and industrial areas as specified herein.
 - 9) Locations and types of noise and vibration abatement measures that may be required to meet codes and regulations as indicated by the calculations.
 - b. Equipment Inventory - Prepare an inventory of equipment used by providing the following information in the indicated columns of the Noise and Vibration Control Plan Form, Exhibit A.
 - 1) Column (a) - Code letter in sketch to indicate position of equipment on site
 - 2) Column (b) – Category or type of equipment
 - 3) Column (c) - Equipment manufacturer and model, if known at the time of the Plan's preparation
 - 4) Column (d) - Unique identifier (ID), such as registration number, if known at the time of the Plans preparation.
 - 5) Column (e) - Equipment horsepower
 - 6) Column (f) - Estimated noise level at 50 feet, as obtained from either the manufacturer or from approved field noise measurements of same equipment

- 7) Column (g) - Estimated date of first use on site
- 8) Column (h) Estimated date of last use on site
- 9) Noise Calculations: Prepare calculations of Lmax noise levels expected at the nearest residential and commercial property lines and identified noise-sensitive locations near the construction site, based on the equipment noise levels given in Part A of the Noise and Vibration Control Plan Form. Determine the nearest property lines from noise-sensitive locations. Make the calculations for locations where noise emitted by applicable equipment causes the greatest noise level for each type of land use, if necessary. Provide results on Part B of the Noise and Vibration Control Plan Form, Exhibit B, with calculations included below the results, and with the locations for the calculations indicated on the site sketch.

c. Summary of Required Abatement Measures, as necessary.

- 1) Noise Abatement Measures - If the results of the noise calculations indicate that noise levels are exceeded, identify proposed noise abatement measures, their anticipated effects (decibel reductions), and a schedule for their implementation. Re-calculate the noise levels at the nearest sensitive receptor location property lines that include the anticipated noise reduction effects and submit the results on Part B of the Noise and Vibration Control Plan Form. Include, as backup documentation to Part B of the Noise and Vibration Control Plan, drawings, sketches, and suitable calculations that demonstrate anticipated noise reduction benefits and that proposed structures or facilities comply with applicable building code requirements.
- 2) Noise Reduction Methods - To the extent required to meet the noise limits specified, indicate noise reduction measures to minimize construction noise emission levels.
- 3) Vibration Control – Provide measures that can be used to reduce vibrations in the event that peak particle velocity (PPV) limits are exceeded. The measures may include changes in construction techniques.

d. Shop and Working Drawings, computations, material data and other criteria for all noise abatement measures identified in the Noise and Vibration Control Plan.

3. Update and re-submit upon all major changes in work schedule, construction methods or equipment operations not included in the most recent Plan.

B. Monitoring Plan:

1. Prepared and signed by the Acoustic Specialist.
2. Include the following:

a. Monitoring Locations

- 1) A scaled plan indicating noise and vibration measurement monitoring locations on a scaled plan. If the noise and vibration monitoring locations are not shown in the Contract Documents,

propose monitoring locations that represent the closest points to noise and vibration sensitive land uses to the construction equipment being operated. If the monitoring locations are shown in the Contract Documents, they may change during the construction period. If changes are necessary, the Resident Engineer will provide the revised locations to the Contractor.

- 2) Noise measurements are to be taken at construction site boundaries, at nearby residential and commercial property lines, and at the nearest sensitive noise receptor that can be reasonably and safely accessed. Show these locations on the plan.
- b. Frequency of noise and vibration monitoring, including special circumstances that require monitoring at irregular intervals.
 - c. Description of the methodology and procedure to use for the equipment being utilized to perform the monitoring, when making noise and vibration measurements.
 - d. Proposed Contractor-generated vibration-monitoring report form, including at least the following:
 - 1) Date, start time and duration of monitoring
 - 2) Name of individual responsible for the monitoring
 - 3) Type of equipment used
 - 4) Type of measurement (for example, baseline, on- going construction).
 - 5) Clearly identified monitoring locations including a sketch on the back of or attached to the vibration report form.
 - 6) Identification of construction equipment operating during the monitoring period and the locations sketched on the back of the vibration report form.

3.02 RESPONSIBILITIES OF CONTRACTOR

- A. Perform Work within the permissible noise and vibration limits, work schedule limitations and procedures provided for in the Contract, project-specific local permits, the approved Noise Variance, if any, listed in Contract Documents, and applicable federal, state, county and local codes, regulations, and standards.
- B. Use equipment with effective noise-suppression devices and employ other noise control measures such as barriers and curtains necessary to comply with permissible noise limits.
- C. Schedule and conduct operations in a manner that minimizes to the greatest extent practicable, the disturbance to the public in areas adjacent to the construction activities and to occupants of buildings in the vicinity of the construction activities.
- D. Compliance with the requirements of the Contract may require the use of equipment with special exhaust silencers or enclosures, and construction of temporary enclosures or noise barriers around activities. Use approved haul routes and staging areas to minimize noise at residential and other sensitive receptor sites. Noise produced by elevated equipment, including crane pulleys and hoses, shall be minimized.

3.03 NOISE LEVEL LIMITS

- A. Do not operate noise generating construction equipment at the construction site outside of Authority Having Jurisdiction (AHJ) compliance requirements or approval of the Noise and Vibration Control Plan, and the Monitoring Plan. Do not operate noise generating construction equipment, which is subject to a noise variance, at the construction site prior to formal activation of the noise variance by the authority having jurisdiction.
- B. Do not exceed the maximum permissible sound levels as authorized by the local jurisdiction's noise code or authorized noise variance for nighttime construction hours.
- C. Sound created by impact types of construction equipment, including but not limited to pavement breakers, jackhammers, sandblasting tools or other types of equipment, or devices that create impact noise or are used as impact equipment, may exceed the maximum permissible sound levels, as measured at the nearest property line or monitoring point, if approved by the local jurisdiction and Sound Transit.
- D. For operation of construction equipment that could exceed allowable noise limits during nighttime hours established by the local jurisdiction, the Contractor must obtain the appropriate noise variance from the local authority having jurisdiction. During these hours, meet the performance criteria as approved by Sound Transit and the local jurisdiction.
- E. The noise limits established in the Contract are for equipment on construction sites, including but not limited to crawlers, tractors, dozers, rotary drills, loaders, power shovels, cranes, derricks, graders, off-highway trucks, ditchers, trenchers, compactors, compressors, and pneumatic-powered equipment.

3.04 VIBRATION LEVEL LIMITS

- A. For all areas, conduct construction activities so that vibration levels at the nearest affected building monitoring points do not exceed peak particle velocity (PPV) limits in the vertical direction for the durations shown in Table 1. The equivalent root-mean-square (rms) unweighted vibration levels expressed as VdB are included and assume a crest factor (peak to root-mean-square ratio) of 4. These limits apply to the frequency range of one to 100 Hertz. For assessing the potential for cosmetic structural damage, Table 2 contains the maximum threshold vibration limits for construction vibration monitoring by building type. Where appropriate, the lesser value from either Table 1 or Table 2 shall not be exceeded.

TABLE 1 - CONSTRUCTION VIBRATION LIMITS FOR ANNOYANCE

Vibration Type (Permissible Duration)	Peak Particle Velocity (in/sec)	VdB (re 1 μ -inch/sec rms)
Sustained (≥ 1 hr/day)	0.04	80
Transient (<1 hr/day)	0.12	90
Transient (<10 min/day)	0.40	100

TABLE 2: COSMETIC ARCHITECTURAL DAMAGE THRESHOLD VIBRATION LIMITS FOR CONSTRUCTION VIBRATION MONITORING

Building Category	Peak Particle Velocity (in/sec)
Reinforced-concrete, steel, or timber (no plaster)	0.50
Engineered concrete and masonry (no plaster)	0.30
Non-engineered timber and masonry buildings	0.20

Building Category	Peak Particle Velocity (in/sec)
Buildings extremely susceptible to vibration damage	0.12

3.05 CONSTRUCTION METHODS – EQUIPMENT

- A. Where practicable, use concrete crushers or pavement saws rather than hoe rams for tasks such as concrete deck removal and retaining wall demolition.
- B. Ensure that pneumatic impact tools and equipment used at the construction site have intake and exhaust mufflers recommended by the manufacturers thereof, to meet relevant noise ordinance limitations.
- C. Construction equipment, both stationary and mobile, should be of recent manufacture and incorporate effective noise-suppression design, including features such as shrouds, baffles, and mufflers or as recommended by the manufacturers. Locate noise generating stationary equipment away from sensitive receptors and shield with a noise-attenuating sound barrier or shroud.
- D. Line or cover storage bins and chutes with sound-deadening material. Ensure all vehicles engaged in loading on-site have lined truck beds.
- E. Provide mufflers or shield paneling for other equipment, including internal combustion engines, recommended by manufacturers thereof.
- F. Blasting, impact pile driving, vibratory hammers for pile casing installation, vibratory sheet installation and vibratory roller are prohibited from use during those hours established by the authority having jurisdiction.
- G. As required to meet the noise limits specified in the Contract, use alternative procedures of construction and selection of proper combination of techniques that generate least overall noise and vibration. Such alternative procedures may include, but not be limited to, the following:
 - 1. Use electric welders powered from utility main lines instead of internal combustion powered generators/welders.
 - 2. Mix concrete off-site instead of on-site.
 - 3. Employ prefabricated structures instead of assembling on-site.
 - 4. Drilled shaft installation methods.
- H. Use construction equipment manufactured or modified to attenuate noise and vibration emissions, unless waived by Resident Engineer, such as:
 - 1. Use electric instead of diesel-powered equipment.
 - 2. Use hydraulic tools instead of pneumatic impact tools.
 - 3. Use electric instead of air- or gasoline-driven saws.
- I. Minimize the use of generators or use “whisper-quiet” generators to power equipment where practical

3.06 CONSTRUCTION METHODS – OPERATIONS

- A. Operate equipment to minimize banging, clattering, buzzing, and other annoying types of noises, especially near residential areas.
- B. To the extent feasible, configure the construction site in a manner that keeps noisier equipment and activities as far as practicable from noise sensitive locations and nearby buildings.
- C. In no case do the above restrictions limit the responsibility for compliance with applicable federal, state and local safety ordinances and regulations, and other requirements of the Contract.
- D. As far as practicable, maximize physical separation between noise generators and noise receptors. Separation includes following measures:
 - 1. Provide enclosures for stationary items of equipment and barriers around particularly noisy areas on site.
 - 2. Locate stationary equipment to minimize noise and vibration impact on community, subject to verification by the Resident Engineer.
- E. Minimize noise-intrusive impacts during the most noise sensitive hours.
 - 1. Plan noisier operations during times of highest ambient noise levels.
 - 2. Keep noise levels relatively uniform; avoid excessive and impulse noises.
 - 3. Turn off idling equipment and vehicles.
 - 4. Phase in start-up and shut-down of site equipment.
 - 5. Avoid simultaneous activities that generate high noise levels.
 - 6. Conduct truck loading, unloading and hauling operations to keep noise and vibration to a minimum. Conduct these operations as far as practicable from sensitive receptors, and drop loads into truck beds from minimal height. If practicable, deposit and distribute a 12-inch layer of dirt/soil in the bed before loading heavier and/or hard debris such as rocks or demolished concrete.
 - 7. Whenever feasible, do not operate trucks on streets that pass by schools during school hours to the extent possible.
 - 8. Limit the time that steel decking or plates for street decking or covering excavated areas are in use.
 - 9. Grade surface irregularities on construction sites to minimize the generation of impact noise and ground vibrations by passing vehicles.
- F. Use warning broadband backup alarms on all equipment in operation at the site at all times, unless waived by the Resident Engineer. Use smart backup alarms during nighttime work or use equipment without back-up alarms and replace with spotters to direct the movement of equipment.
- G. Limit the use of annunciators or public-address systems, except for emergency notifications.
- H. Limit the use of jackhammers, hoe rams, and concrete saws to daytime hours as defined by the local AHJ.

3.07 CONSTRUCTION METHODS – NOISE ABATEMENT MEASURES

- A. Install noise abatement measures in locations specified in the Noise and Vibration Control Plan adjacent to equipment or receivers as required to meet the noise limits specified.
- B. Temporary noise barriers consisting of acoustic blankets suspended on chain link fence or frame shall have a minimum Sound Transmission Class (STC) rating of 30, and a minimum Noise Reduction Coefficient (NRC) rating of 0.7.
- C. Temporary sound barriers consisting of plywood shall have a minimum 3/4-inch thickness and be acoustically lined with 2 inch-thick 3 pcf duct liner facing the noise source.
- D. If required by the AHJ, conduct noise measurements to confirm that installed noise abatement treatments, including modification of equipment and temporary noise barriers perform as expected.

3.08 NOISE AND VIBRATION MEASUREMENT PROCEDURES

- A. Noise Measurement Procedure
 1. Field calibrate the sound level analyzer using an acoustic calibrator, according to the manufacturer's specifications, before each measurement. If multiple measurements are to be performed in one day, check calibration after measurements have been completed.
 2. Except as otherwise indicated, perform measurements using the A-weighting network and the SLOW response of the sound level meter.
 3. Measure impulsive or impact noises using the C-Weighting network and the FAST response of the sound level meter.
 4. Locate the measurement microphone at the nearest property line of the sensitive receptor at least four to six feet away from the nearest reflective surface. Use a windscreen appropriate for the measurement conditions.
 5. Take noise measurements at the nearest property line and agreed noise sensitive locations at least once each week and after a change in construction activity or construction location. Determine the duration of noise measurements based on the type of construction activity, the length of the activity and whether it is continuous or intermittent. Measurement periods: a minimum of 20 minutes.
 6. Ensure that construction noise measurements coincide with periods of maximum noise-generating construction activity. Take measurements during the construction phase or activity that has the greatest potential to create annoyance or to exceed applicable noise regulations and restrictions.
 7. If, in the estimation of the person responsible for the measurements, outside noise sources contribute significantly to the measured noise level, repeat the measurements with the same outside source contributions when construction is inactive to determine the background noise level.
 8. Clearly identify monitoring locations and sketch on the back of or included with the Noise Measurements Report Form, Exhibit C, along with the locations of and distances from any agreed sensitive noise receptor or location.
 9. Identify construction equipment operating and characterize the sound being generated during the monitoring period and the locations sketched on the back of or included with the Noise Measurements Report Form, along with the locations and distances to any specified noise sensitive location.

B. Vibration Measurement Procedures

1. Installation of Vibration Monitors:
 - a. For monitoring in the vicinity of nearby structures or utilities, locate vibration sensors on the ground surface near the structures or utilities at the setback line of such structures or utilities. Install geophones level and firmly mount onto the surface slab of concrete or asphalt surface, or firmly anchor in undisturbed soil. Orient one of the triaxial geophones horizontal axes (longitudinal) towards construction activity.
 - b. For monitoring on structures, install wall mount kit to attach geophones to structure face or columns. Mount geophones level and towards the construction activity.
2. All vibration monitoring equipment shall have been calibrated by the factory or with a NIST-traceable vibration signal within one year of use.
3. Take vibration measurements at sensitive locations as indicated in the Monitoring Plan at least once each week and after a change in construction activity or construction location. Measurement periods: a minimum of 20 minutes.
4. Conduct daily measurements of vibration during peak vibration generating construction activities. Any activities that may produce vibration levels above values shown in Table 2 whenever a structure is located nearby the construction activity are subject to vibration monitoring.

3.09 EXCEEDANCE OF NOISE OR VIBRATION LIMITS

- A. If the measured noise levels exceed allowable limits as specified by the local jurisdiction, immediately notify the Resident Engineer and immediately implement additional Noise Abatement Measures. Where necessary terminate the construction activity responsible for the noise limits exceedance until the specified Abatement Measures can be implemented and compliance with the approved noise levels is achieved.
- B. If the measured vibration levels exceed allowable limits as specified by the local jurisdiction or Contract, whichever is more stringent, immediately notify the Resident Engineer and immediately implement changes in construction techniques as specified in the Noise and Vibration Control Plan.

3.10 EXHIBITS

- A. Exhibit A: Noise and Vibration Control Plan – Part A
- B. Exhibit B: Noise and Vibration Control Plan – Part B
- C. Exhibit C: Noise Measurements Report Form

END OF SECTION

SECTION 01 57 15 – EXHIBIT A

**NOISE AND VIBRATION CONTROL PLAN FORM – PART A
CONSTRUCTION ACTIVITIES AT EACH CONSTRUCTION SITE
(DUPLICATE AS NEEDED)**

Contract No.: _____ Contract Name: _____

Contractor: _____ Site: _____

Date: _____ Land Use: _____

Resubmit every three months

(ATTACH SITE DRAWING)

PART A: EQUIPMENT INVENTORY

	Equipment				Noise Level	Date	Date
Code	Category	Model	ID No.	HP	At 50 Feet	Begin	End
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)

SECTION 01 57 15 – EXHIBIT B

NOISE AND VIBRATION CONTROL PLAN FORM– PART B
(DUPLICATE AS NEEDED)

Contract No.: _____ Contract Name: _____
 Contractor: _____ Site: _____
 Date: _____ Land Use: _____

PART B: CALCULATED EXPECTED CONSTRUCTION NOISE LEVELS AT NEAREST RESIDENTIAL AND COMMERCIAL RECEIVERS FOR EACH CONSTRUCTION ACTIVITY

Nearest Noise Sensitive Receivers	Calculated Sound Pressure Level [dBA Leq (h)]*	Calculated Peak Particle Velocity Vibration Level [in/sec]*

* Equipment used for each construction activity is taken from Part A of the Noise and Vibration Control Plan. Leq (h) is assumed to be based on hourly noise levels, but the duration of noise level averaging could change based on the Noise and Vibration Control Plan.

NOISE ABATEMENT MEASURES

ANTICIPATED EFFECTS

CALCULATIONS - attach additional sheet(s) as needed.

SECTION 01 57 15 – EXHIBIT C

NOISE MEASUREMENTS REPORT FORM

(DUPLICATE AS NEEDED)

Contract No.: _____ Contract Name: _____

Contractor: _____ Site: _____

Date: _____ Land Use: _____

Measured By: _____ Of: _____ (Company)

Monitoring Address: _____ (Provide Sketch on Back)

Location No: _____ Wind Speed: _____ MPH Direction: _____

Location of Sound Level Meter: (No closer than 15 meters from equipment and 3 meters from building)

Monitoring was Conducted: _____ Meters from Equipment (_____) (Type(s): Leave Blank for Baseline)

Land Use: Residential/Institutional Business/Recreational Industrial

Sound Level Meter: Make and Model: _____ dBA (Slow)

dBC (Fast)

Duration of Measurement: (20 minutes to 1 hour)

Calibration Level	
Leq	
L25	
L08	
L02	
Lmax	
Allowable Noise Limit	

Field Notes;

Check one of the following:

Ongoing Construction Post-Construction: _____ Baseline Conditions

(Contract)

(Complete all that apply below)

Active Contract(s): _____ (List all contracts that contribute to measured noise)

Complaint Response: _____ (Describe: Include Log-In Number)

Abatement Follow-Up: _____ (Describe)

END OF EXHIBITS

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