



Appendix G - NOISE TECHNICAL REPORT ADDENDUM



Yesler Terrace Redevelopment Project

Noise Technical Report Addendum

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29-24698A

Noise Affected Environment – Preferred Alternative

Existing Noise Conditions DEIS Site

The noise conditions on the DEIS Site would be the same as those described for in the *October 2010 Yesler Terrace Redevelopment Draft Environmental Impact Statement (DEIS)*.

Existing Noise Conditions East of 12th Sector

To document existing sound levels in the added East of 12th Sector of the project site, sound level measurements were taken using the same methods described in the DEIS. [Noise Addendum Figure 1](#) shows the additional measurement location. To provide context for this new data, the summary table of measurements from the DEIS is reproduced below with the new data added. As shown, existing sound levels in the East of 12th Sector are within the HUD "acceptable" range of not exceeding 65 dBA L_{dn}.

**Table3.7-1
MEASURED EXISTING SOUND LEVELS (dBA)**

SLM Location	Duration	Hourly Leq Range		L _{dn} ^{(b), (c)}
		Day ^(a)	Night ^(a)	
SLM-1	24 hours	65-68	61-68	72
SLM-2	24 hours	60-65	56-63	67
SLM-3	24 hours	61-66	57-63	67
SLM-4	24 hours	67-71	60-69	72
SLM-5	24 hours	52-66	46-57	61
SLM-6	24 hours	58-69	53-60	65
SLM-7	48 hours	71-75	68-74	78
SLM-8	25 hours	76-82	70-78	81
SLM-9	25 hours	66-69	62-69	72
SLM-10	24 hours	59-63	54-60	65
SLM-11	24 hours	67-73	57-69	73
SLM-12	24 hours	53-66	46-59	62
Yesler Community Center	2 hours	59 (10AM – 12PM)	NA	NA
East of 12th	51 hours	59-65	51-59	63-65

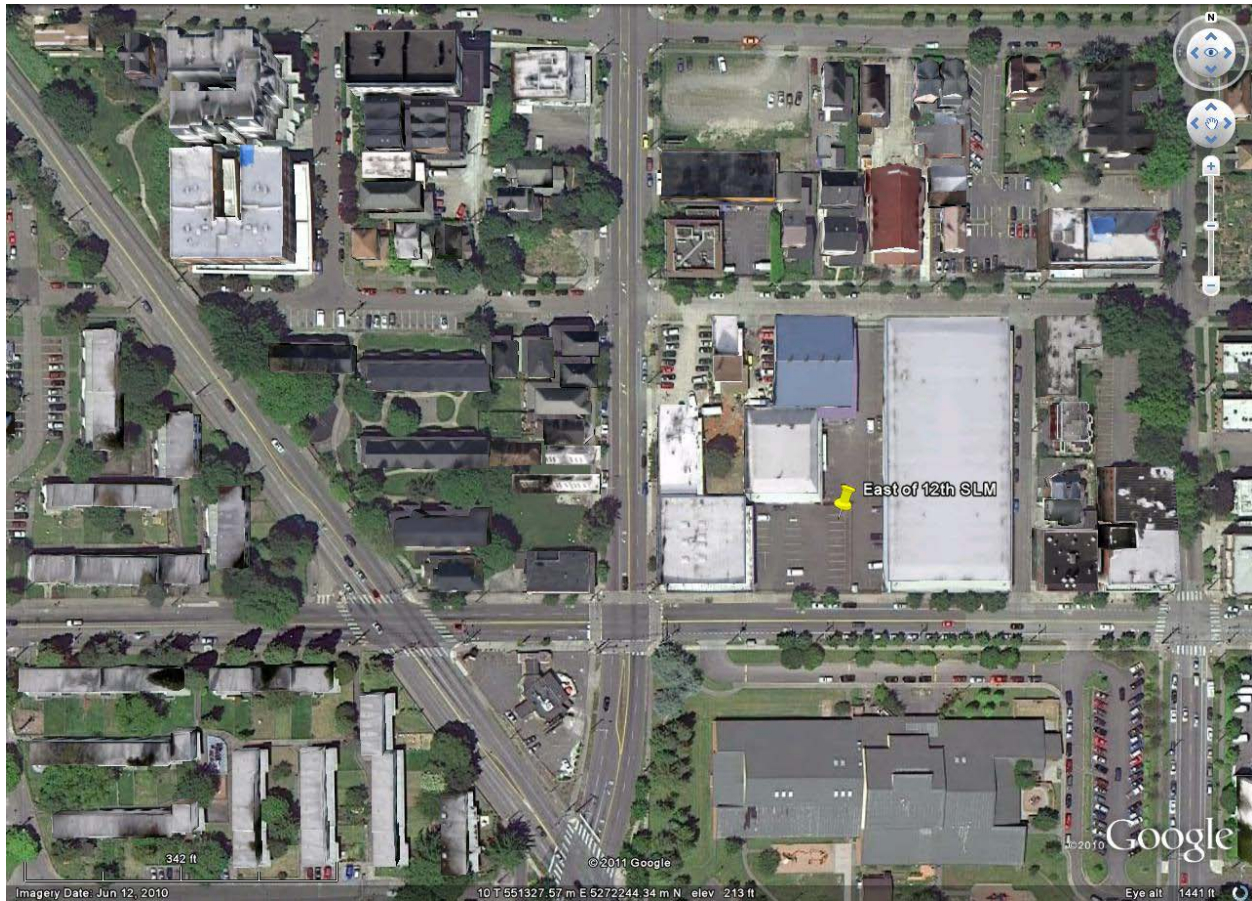
^(a) The ranges are shown for daytime hours (7 AM to 10 PM) and nighttime hours (10 PM to 7 AM).
^(b) The reported L_{dn} levels are based on measurements over the entire period. For those measurement periods longer than 24-hours, L_{dn} values were calculated for each progressive 24-hour period, but the values for the different periods were the same.
^(c) Cells with diagonal stripes indicate locations with measured sound levels greater than 65 dBA L_{dn} and less than or equal to 75 dBA and considered "Normally Unacceptable." Cells with solid shading indicate locations with measured sound levels greater than 75 dBA L_{dn}, areas classified as "Unacceptable" according to HUD noise standards.

Source: Sound level measurements by ENVIRON International Corporation, 2010, 2011.

Noise Impacts – Preferred Alternative

Construction

Construction of elements under the Preferred Alternative would generally be the same as those described for DEIS Alternatives 1-4. Care would need to be taken during construction near the north end of the site and in the East of Boren and East of 12th Sectors to ensure that construction-related noise received in the adjacent areas does not exceed the Seattle construction noise limits during day or nighttime hours.



Noise Addendum Figure 1. East of 12th Sector Sound Level Measurement Location

Operation

The site layout and building placements suggested by the Preferred Alternative configuration has the same very limited potential to result in off-site noise impacts from the project components. That is, neither project-related traffic nor project-required road alterations would be expected to result in any significant noise impacts. And the same issues discussed for HVAC equipment associated with Alternatives 1-4 would pertain to the Preferred Alternative. Noise from all such equipment would be required to comply with the applicable Seattle noise limits.

Similarly, in the East of 12th Sector, the proposed project elements would have little or no potential to result in off-site noise impacts as long as attention is paid to the locations and specifications of HVAC equipment for these buildings.

Site Suitability Assessment under HUD Criteria

The conceptual site layout and building placements in the Preferred Alternative configuration present some of the same potential for on-site noise impacts as were described for DEIS Alternatives 1-4. Noise modeling with the same tools and methods described in the DEIS were performed to assess future traffic noise levels across the project site. The site suitability analysis noise modeling considered noise "receptors" representing receivers at the various conceptual locations of on-site buildings. The findings of this analysis are summarized in Noise Addendum Figures 2 - 4, which depict the modeling results for three different elevations: ground-level, 60 feet, and 200 feet as a means of illustrating noise levels at both the lower buildings and at the towers. Note that these figures present colored coded noise "contours" that correspond to the noise levels criteria applied by HUD policy, as follows.

- Uncolored areas of the figures off site were not included in the modeling
- Uncolored areas of the figures on the project site (other than buildings) indicate sound levels in the range of 0-55 dBA L_{dn}, which HUD would consider "acceptable"
- Green areas indicate sound levels between 55 and 65 dBA L_{dn}, which HUD would consider "acceptable"
- Yellow zones indicate sound levels between 65 and 70 dBA L_{dn}, which HUD would consider "normally unacceptable"
- Orange zones indicate sound levels between 70 and 75 dBA L_{dn}, which HUD would consider "normally unacceptable"
- Red zones indicate sound levels between 75 and 80 dBA L_{dn}, which HUD would consider "unacceptable"
- Dark Blue zones indicate sound levels exceeding 79 dBA L_{dn}, which HUD would consider "unacceptable"

As shown in [Noise Addendum Figure 2](#), model-predicted day-night sound levels at ground-level (i.e., 5 feet) locations where traffic noise levels would be considered "acceptable" to HUD (i.e., requiring no special review or approvals) are limited to the white and green areas towards the center of the site, along the northern boundaries and within clusters of buildings of the primary site, and in most of the East of Boren/East of 12th Sectors. Ground-levels sound levels in the "normally unacceptable" range (>65 and <75 dBA) include the yellow and orange areas near major surface streets. Ground-levels sound levels in the "unacceptable" range (>75 dBA) include the red and blue areas near Boren (and not affecting any buildings), and the entire western side of the site. Sound levels in the >75 dBA range affect the northern most office building in the NW Sector, and sound levels exceeding 79 dBA affect three residential buildings in the SW Sector nearest I-5. Thus, sound levels at ground level locations within the red and blue zones would require the application of extensive noise control measures to provide interior sound

levels that are both consistent with HUD guidelines and appropriate for a livable interior environment. The sorts of noise control treatments that will be necessary are described below under Noise Mitigation.

Noise Addendum Figure 3 shows the modeling results for receptor locations at an elevation of 60 feet above the ground. The depicted traffic noise contours represent day-night levels on the 5th or 6th floors of buildings. As shown, model-predicted day-night sound levels at this elevation that would be considered "acceptable" to HUD are limited to the white and green areas towards the center of the site along the northern boundaries and within clusters of buildings of the primary site, and in most of the East of Boren/East of 12th Sectors. Sound levels at 60 feet in the "normally unacceptable" range (>65 and <75 dBA) include the yellow and orange areas near major surface streets, including Boren. Sound levels in the "unacceptable" range (>75 dBA) include the red and blue areas along entire western side of the site. Sound levels in the >79 dBA range affect the office building and the residential building nearest the freeway in the NW Sector. Sound levels exceeding 79 dBA also affect the four buildings in the SW Sector nearest I-5. Thus, sound levels at elevated locations within the red and blue zones would require the application of extensive noise control measures to provide interior sound levels that are both consistent with HUD guidelines and appropriate for a livable interior environment. The sorts of noise control treatments that will be necessary are described below under Noise Mitigation.

Noise Addendum Figure 4 shows the modeling results for receptor locations at an elevation of 200 feet above the ground. The depicted traffic noise contours represent day-night levels on about the 20th floor of buildings, and so pertains only to the high-rise towers. Note that **Noise Addendum Figure 4** does not include the East of 12th Sector because there are no high-rise buildings in this area of the site. As shown, model-predicted day-night sound levels at this elevation that would be considered "acceptable" to HUD are limited to the green areas towards the center of the site and along the northern boundaries and within clusters of buildings. Sound levels at 200 feet in the "normally unacceptable" range (>65 and <75 dBA) include the yellow and orange areas near major surface streets, including Boren. Sound levels in the "unacceptable" range (>75 dBA) include the red and blue areas along entire western side of the site but would actually affect only the two residential towers in the SW Sector. On the 20th floors of these buildings nearest I-5, day-night levels are in the 80 dBA range. Thus, sound levels at elevated locations within the red and blue zones would require the application of extensive noise control measures to provide interior sound levels that are both consistent with HUD guidelines and appropriate for a livable interior environment. The sorts of noise control treatments that will be necessary are described below under Noise Mitigation.

Noise Mitigation – Preferred Alternative

Noise mitigation measures related to construction of the Preferred Alternative would be generally similar to those discussed for Alternatives 1-4. Potential noise reduction treatments for residential buildings in the high noise zones described above that will be necessary to provide a livable interior acoustic environment are discussed further below.

Although specific noise control measures have not yet been determined because the project is still in the conceptual planning stage, the Seattle Housing Authority is committed to requiring noise control measures for all residential buildings exposed to exterior sound levels greater than 65 dBA_{Ldn}, particularly for those buildings nearest the western edge of the site that would not have intervening buildings obstructing sound transmission from I-5. Because few mitigation measures are feasible for reducing exterior noise levels to less than 65 dBA_{Ldn}, buildings subjected to exterior levels above 65 dBA_{Ldn} would require acoustical design and construction techniques and materials intended to reduce interior levels to 45 dBA_{Ldn} or less. The specific techniques and materials required will vary depending on the noise exposure of the building. However, for buildings in the very high noise zones (i.e., above 75 dBA_{Ldn}), extensive and unconventional methods may be required, as detailed below. In these buildings it will be necessary to employ special building materials and techniques to reduce the transmission of

noise from outside to inside spaces. Effectively controlling exterior-to-interior sound level transmission will also require careful attention to detail during installation of noise-reducing building components. With proper construction materials, techniques, and installation, it is anticipated that interior noise levels can be effectively mitigated for residential uses.

Examples of measures that are likely to be necessary include the components and the restrictions in some uses listed below.

- Along the western edge of the site along I-5, outdoor use areas, including balconies and active open space, should not be located on the western sides of the buildings or at other portions of these buildings or at ground-level locations that have an unobstructed view to the freeway. Ground level open space that has an unobstructed view to the freeway should be vegetated or otherwise modified to prevent general public use due to noise conditions.
- Use "acoustic" or "noise-reducing" exterior wall components (i.e., wall, windows, and doors) that provide an outside to inside transmission class (OITC) rating of at least 45.
 - OITC ratings for windows and doors are valid only if they are determined by laboratory (not field) tests performed by an independent laboratory for the product. Ratings estimated for glass alone are not an acceptable substitute for OITC tests of windows or doors, except for determining the rating of sidelights and transoms. Likewise, ratings estimated for door leafs alone are not an acceptable substitute for OITC ratings of doors. The installed products must have the same composition and overall configuration such as storm panels, glass type (laminated, tempered, or float glass), glass thickness, spacing between panes of insulated glass, door core, gaskets, weather stripping, door bottom seals, thresholds, etc., and the same overall configuration as the tested assembly. The overall configuration includes the operational type (casement, double hung, fixed, slider, etc.) in the case of windows, and the general size of glazing in the case of doors. Issues that do not affect the acoustical performance such as glass obscuration, internal window mullions, door and window hardware, screens, and applied door moldings can be ignored in this consideration.
 - In order to achieve the specified OITC ratings special measures will be necessary to install doors and windows. These include the use of non-hardening (acoustical) caulk at all hidden surfaces, flexible caulk at all exposed surfaces, and solid continuous blocking to fill all voids over 1/4" around windows and doors.
- Double-studded (i.e., staggered stud) exterior walls to provide to provide a physical break in the structure of the walls to eliminate the noise path through the structural components of the wall except at the top and bottom plates
- Masonry façade ranging from 4-8 inches thick
- Double layers of 5/8" sheetrock on the interior side of exterior walls
- Double sheeting or extra insulation to provide extra mass on the exterior side of exterior wall – a brick or masonry façade might suffice for this requirement
- In-window or through-wall air-conditioning, ventilating, or heating units shall not be used
- All vent ducts, including those for bathroom exhaust fans and dryers, connecting the interior space to the outdoors shall be rigid metal and contain at least two 90° bends, or one 90° bend and a total length of at least 20 feet (or the maximum length allowed by the dryer manufacturer).
- A mechanical ventilation system shall be installed that will provide the minimum air circulation, fresh air supply, heating, and cooling requirements for various uses in occupied rooms, as specified in the state building code, without the need to open windows, doors, or other openings to the exterior.

With these sorts of measures it will be difficult but not impossible to reduce interior sound levels to acceptable levels. Some examples of possible window and wall assemblies follow.

Example Double Glazed Window Assemblies

Glass Ply	PVB ^(a)	Glass Ply	Air Space	Glass Ply	PVB	Glass	OITC
.25"	.03"	.25"	4"	.125"	.03"	.125"	44
.25"	.03"	.25"	4"	.375"			44
^(a) PVB (polyvinyl butyral) interlayer							
Source: <i>Viracon Acoustical Glass Specs and Tech</i>							

Examples of Possible Noise Transmission Reducing Wall Assemblies

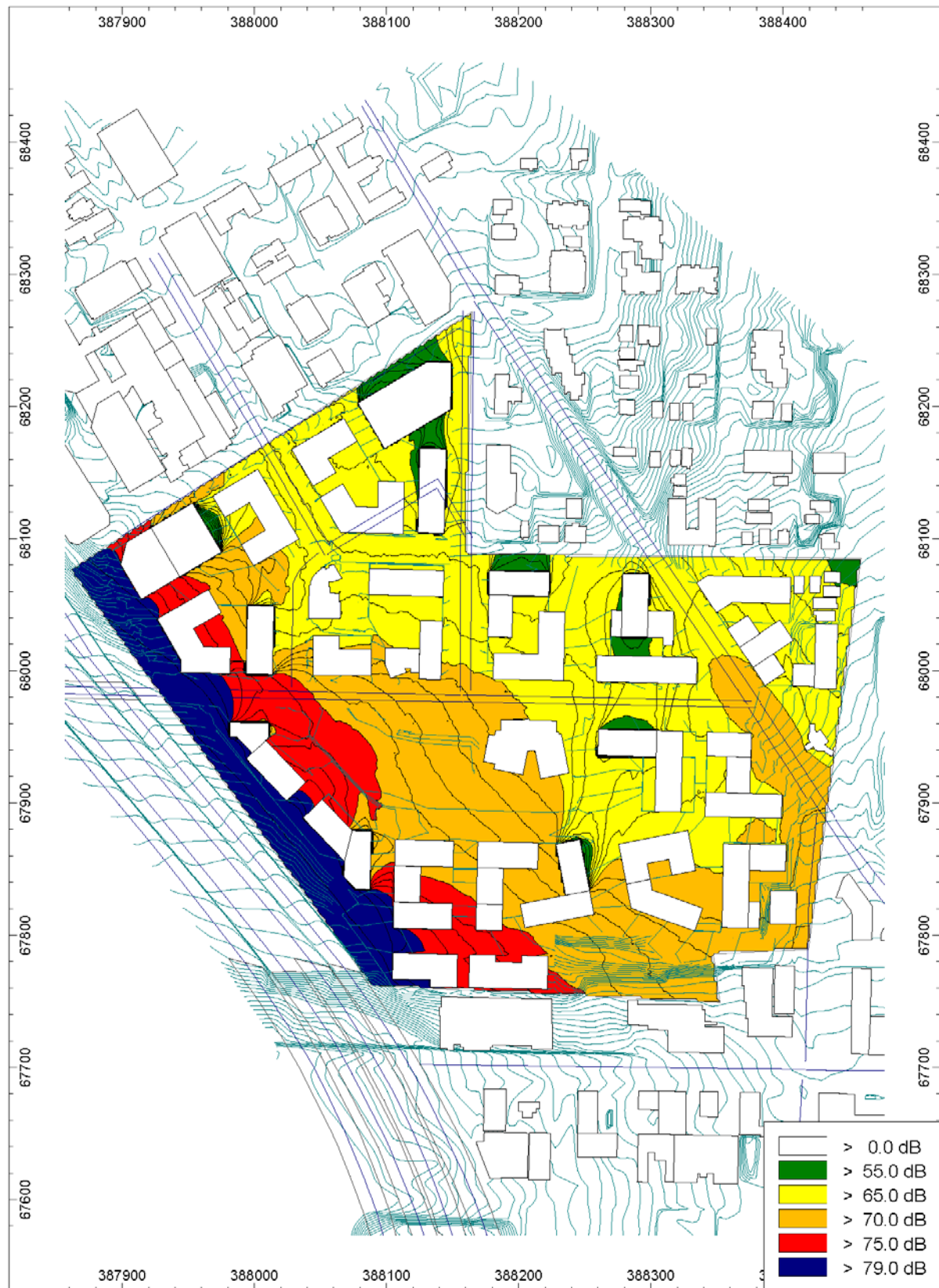
Wall Components	OITC Rating
2 layers of 5/8" sheetrock Resilient channel connectors 3.5" wood studs on 24" centers 3.5" insulation Resilient channel connectors 2 layers of 5/8" sheetrock	44
2 layers of 5/8" sheetrock Two sets of 2.5" steel studs on 24" centers – with 5/8" gap between Two layers of 2.5" insulation 2 layers of 5/8" sheetrock	47
8" masonry wall	44
Note that the first two entries are interior partition specifications used here only to illustrate the number of components that will be necessary to provide sufficient noise transmission loss	
Source: ENVIRON International Corporation based on data from National Research Council of Canada	



Noise Addendum Figure 2. Preferred Alternative - Day-Night Sound Levels (Ldn) at Ground Level Locations



Noise Addendum Figure 3. Preferred Alternative - Day-Night Sound Levels (Ldn) at 60-Foot Elevations



Noise Addendum Figure 4. Preferred Alternative - Day-Night Sound Levels (Ldn) at 200-Foot Elevations