

Chapter 8:

Noise and Vibration

8.1 INTRODUCTION

Any unwanted sound constitutes noise. Noise receptors are any locations of frequent human use where noise would have the potential to interfere with typical activities; such locations would include residences, schools, hospitals, open spaces, etc. Construction of the Preferred Alternative has the potential to result in noise at receptors surrounding the construction staging and laydown areas, as well as along routes to and from these areas due to construction truck and worker vehicle trips.

Vibration refers to oscillatory motion of solid objects, including ground and/or structures. Fixed railway operations have the potential to produce high vibration levels, since railway vehicles contact a rigid steel rail with steel wheels. Train wheels rolling on the steel rails create vibration energy that is transmitted into the track support system. The amount of vibrational energy is strongly dependent on such factors as how smooth the wheels and rails are and the vehicle suspension system. The vibration of the track structure “excites” the adjacent ground, creating vibration waves that propagate through the various soil and rock strata to the foundations of nearby buildings. As the vibration propagates from the foundation through the remaining building structure, certain resonant, or natural, frequencies of various components of the building may be excited.

Operation of the infrastructure associated with the Platform component of the Preferred Alternative may have the potential to result in increased vibration at nearby receptors. Construction of the Preferred Alternative has the potential to result in vibration at receptors surrounding the Project Site where caisson installation would occur. This construction vibration could occur as a result of on-site impact equipment.

This chapter presents the analysis of the potential construction-related and operational noise and vibration impacts of the No Action Alternative and the Preferred Alternative.

8.2 REGULATORY CONTEXT

The procedures described in the FTA guidance manual, *Transit Noise and Vibration Impact Assessment* (FTA Report No. 0123, September 2018) were used for the analysis of noise and vibration associated with the No Action Alternative and the Preferred Alternative. The procedures and criteria set forth in the FTA guidance manual have been adopted by FRA for analysis of noise and vibration resulting from non-high-speed (i.e., 90 mph or below) rail projects. Since the Project Site is within New York City, guidelines included in the *CEQR Technical Manual* (see Chapter 19, Section 300) were considered to identify potential noise and vibration impacts. Additionally, operation of mechanical equipment, including fan plants and substation equipment, as well as construction of the Preferred Alternative must meet requirements of the New York City Noise Control Code. For additional details on the regulatory context for this resource category, please refer to **Appendix B**, “Methodology Report,” Chapter 5, “Noise and Vibration,” Section C, “Regulatory Context,” Section D, “Effects Assessment Methodology,” and **Appendix E**.

8.3 ANALYSIS METHODOLOGY

Please see Analysis Methodology in Chapter 5 of **Appendix B** for a complete description of the analysis methodology for this resource category.

Appendix B, Chapter 5, also provides an overview of the fundamentals of noise and vibration analyses, describes the types and sources of noise and vibration and the applicable noise and vibration standards considered in the analysis of the operation and construction of the Preferred Alternative.

The Study Area for the operational and construction airborne noise studies include receptors surrounding the Project Site and along routes that vehicular traffic associated with construction of the Preferred Alternative would use to travel. For each noise and/or vibration source included in the Preferred Alternative, a screening distance was applied based on the FTA guidance manual and noise-sensitive land uses within those distances were identified. The area within the screening distance of each noise and/or vibration source constitutes the Study Area, shown in **Figure 8-1**. The Study Area is consistent with study areas for the environmental analysis of similar projects in New York City.

8.4 AFFECTED ENVIRONMENT

8.4.1 SELECTION OF NOISE RECEPTOR LOCATIONS

The operational noise analysis considers all noise-sensitive receptors within the FTA guidance manual screening distances for each noise source associated with the operation of the project, specifically within 200 feet of the Preferred Alternative ventilation fan plants and 250 feet of the Preferred Alternative substation. Additionally, the noise from construction of the Preferred Alternative was analyzed at two additional residential receptors located outside of the operational noise screening distances but would be expected to experience noise from construction. The nine receptors represent noise-sensitive locations that would have the potential to experience noise level increases resulting from the construction or operation of the Preferred Alternative are listed in **Table 8-1** and shown in **Figure 8-1**. Other noise-sensitive locations would be outside of the FTA operational noise screening distances and therefore would not have the potential to experience adverse noise impacts.



- Project Site (Western Rail Yard)
- Substation and Fan Plant Locations
- Noise Study Area Boundary (within FTA Operational Noise Screening Distance from Project Elements)
- 1a Noise Receptor Location
- 1 Noise Monitoring Location
- Proposed Tunnel Encasement



Noise Receptor and Monitoring Locations
Figure 8-1

**Table 8-1
Noise Receptor Locations**

Receptor Site ¹	Land Use Represented	FTA Land Use Category	Noise Descriptor
1a: The High Line (NW)	Park	3	Daytime $L_{eq(1h)}$
1b: The High Line (SW)	Park	3	Daytime $L_{eq(1h)}$
2a: 15 Hudson Yards	Residential	2	L_{dn}
2b ³ : 312 Eleventh Ave	Residential	2	L_{dn}
2c: 35 Hudson Yards	Residential	2	L_{dn}
2d: 55 Hudson Yards	Commercial	N/A ²	N/A
2e: 3 Hudson Blvd	Commercial	N/A ²	N/A
3a ³ : 601 West 29th Street	Residential ⁴	2	L_{dn}
3b: 610 West 30th Street	Residential ⁴	2	L_{dn}

Notes:

- ¹ See **Figure 8-1** for locations.
- ² N/A indicates receptor associated with land use not considered sensitive to noise according to FTA operational noise criteria; however, these receptors have been included in the construction noise analysis to capture effects on commercial properties following FTA manual guidance.
- ³ Receptors 2b and 3a are outside of the operational noise screening distances, but are included for the construction noise analysis.
- ⁴ Receptors 3a and 3b represent residential buildings that are under construction and may be occupied during construction of the Preferred Alternative.

8.4.2 MEASURED NOISE LEVELS

Following the FTA guidance manual and Methodology, the existing noise exposure at each of the nine receptors identified in **Table 8-1** was determined by conducting noise measurements at three representative noise-monitoring sites shown in **Table 8-2**. The operational noise analysis utilizes the L_{dn} or $L_{eq(1hr)}$ noise metric dependent on the noise receptor's land use category, while the construction noise analysis utilizes the $L_{eq(1hr)}$ noise metric for the peak construction activity.

At sites 2 and 3, 20-minute¹ spot noise measurements were taken during weekday morning (AM), weekday midday (MD), and weekday late night periods (i.e., a peak hour, an off-peak hour, and a late-night hour) to estimate the L_{dn} existing noise level² at residential receptors. Additional 20-minute spot noise measurements were taken at sites 2 and 3 during the Saturday midday period for the construction noise analysis. The measured existing noise levels are shown in **Table 8-2**.

During the October 24 and 27, 2020 noise measurement period, the High Line was closed to the public west of Eleventh Avenue and noise monitoring could not be conducted at this location. A 1-hour measurement previously collected at the High Line on November 3, 2016 was used to estimate the existing noise exposure during the weekday AM period. Since the weekend midday time period represents the time when this open space receptor would most likely be used, the existing noise levels at Site 1 during the weekday midday and Saturday midday time periods were estimated by applying an adjustment factor to the weekday AM measurement. The adjustment factor was equal to the incremental change in noise between the respective time periods at Site 3. See **Appendix E** for calculation of adjustment factor.

¹ As described in the March 2014 Edition of the *CEQR Technical Manual* (Page 19-15), at locations in New York City where vehicular traffic is the dominant noise source, 20-minute noise measurements represent 1-hour noise levels.

² Estimation of L_{dn} follows procedure set forth in Appendix E of the FTA guidance manual.

Table 8-2
Measured Existing Noise Levels in dB(A)

Noise Monitoring Sites		Day	Time	Leq(1hr)	L _{dn}
1	The High Line, Hudson Yards, New York 10011	Weekday	AM	71.1 ¹	N/A
1	The High Line, Hudson Yards, New York 10011	Weekday	MD	71.8 ³	N/A
1	The High Line, Hudson Yards, New York 10011	Saturday	MD	67.9 ³	N/A
2 ²	Eleventh Avenue, Hudson Yards, New York 10011	Weekday	AM	70.7	71.7
2 ²	Eleventh Avenue, Hudson Yards, New York 10011	Weekday	MD	70.2	71.7
2 ²	Eleventh Avenue, Hudson Yards, New York 10011	Weekday	Late Night	66.5	71.7
2 ²	Eleventh Avenue, Hudson Yards, New York 10011	Saturday	MD	66.7	N/A
3 ²	West 30th Street, Hudson Yards, New York, 10011	Weekday	AM	69.6	69.4
3 ²	West 30th Street, Hudson Yards, New York, 10011	Weekday	MD	70.4	69.4
3 ²	West 30th Street, Hudson Yards, New York, 10011	Weekday	Late Night	62.9	69.4
3 ²	West 30th Street, Hudson Yards, New York, 10011	Saturday	MD	66.4	N/A

Notes:

- ¹ AKRF, Inc. performed field measurements on November 3, 2016.
- ² AKRF, Inc. performed field measurements on October 24 and 27, 2020.
- ³ Existing noise level estimated based on field measurements conducted November 3, 2016 at Site 1 adjusted based on the incremental changes in noise during each time period at Site 3.

Existing noise levels measured at all receptors include noise from vehicular traffic on adjacent roadways, aircraft overflights, and nearby Hudson Yards construction operations. Existing rail operations did not contribute significantly to measured noise levels at any of the noise monitoring sites, consistent with the existing rail operations being below grade and partially or fully shielded from the at-grade noise monitoring sites. Existing noise exposure at receptors 1a and 1b were estimated using data measured at Site 1. Existing noise exposure at receptors at 2a, 2b, 2c, 2d, and 2e were estimated using data measured at Site 2 and existing noise exposure at receptors 3a and 3b using data measured at Site 3.

8.5 ENVIRONMENTAL CONSEQUENCES

8.5.1 NO ACTION ALTERNATIVE

Under the No Action Alternative, the Project Sponsor would not build the Preferred Alternative and there would be no major sustained construction at the Project Site. The existing use of the rail yard and associated LIRR facilities would continue at the same level of operation, including their maintenance regimen. Therefore, the No Action Alternative would not result in adverse noise or vibration impacts.

8.5.2 OPERATIONAL IMPACTS OF THE PREFERRED ALTERNATIVE

8.5.2.1 NOISE

At each of the noise receptor sites associated with sensitive land uses, noise exposure resulting from the operation of the Preferred Alternative was determined using the methodology described in Chapter 5 of **Appendix B**. The Preferred Alternative noise exposure at each receptor was compared to FTA's noise impact criteria to identify potential impacts. **Table 8-3** shows the noise levels and incremental change in noise levels for the Preferred Alternative.

**Table 8-3
Preferred Alternative Noise Levels in dB(A)**

Receptor Site	FTA Land Use Category	Existing Noise Level (L _{dn} or L _{eq1h})	FTA Moderate Impact Threshold ¹	FTA Severe Impact Threshold ¹	Preferred Alternative Noise Exposure	Total Noise Level with the Preferred Alternative	Preferred Alternative Noise Level Increment	FTA Level of Impact ²
1a: The High Line (NW)	3	67.9	68.0	73.0	56.4	68.2	0.3	No Impact
1b: The High Line (SW)	3	67.9	68.0	73.0	67.3	70.6	2.7	No Impact
2a: 15 Hudson Yards	2	71.7	65.0	71.0	55.8	71.8	0.1	No Impact
2c: 35 Hudson Yards	2	71.7	65.0	71.0	58.0	71.9	0.2	No Impact
3b: 610 West 30th Street	2	69.4	64.0	69.0	56.8	69.6	0.2	No Impact

Notes:

- ¹ FTA bases impact criteria on the existing noise level.
- ² Noise exposure for the Preferred Alternative was compared to the FTA moderate and severe impact thresholds to determine whether a moderate or severe impact are predicted to occur; severe impacts are considered adverse impacts and moderate impacts may or may not be considered adverse impacts depending on site-specific context.
- ³ Receptors 2b and 3a are outside of the operational noise screening distances provided in the FTA guidance manual, so have been excluded from this table.

The operational noise exposure level for the Preferred Alternative was predicted based on the noise emission from the ventilation plants and substations following FTA analysis guidance. As shown in **Table 8-3**, the project noise exposure at all receptor sites would not be considered a moderate nor a severe impact according to FTA noise impact criteria. Consequently, based on the analysis results, operation of the Preferred Alternative would not result in adverse noise impacts.

8.5.2.2 VIBRATION

The Preferred Alternative would not add or relocate any vibration-producing elements or introduce any vibration sensitive receptors, so no vibration analysis is necessary for the operational condition. There would be no potential for adverse vibration impact.

8.5.3 CONSTRUCTION IMPACTS OF THE PREFERRED ALTERNATIVE

8.5.3.1 CONSTRUCTION NOISE

8.5.3.1.1 Platform and Tunnel Encasement Construction

As discussed in Chapter 3, “Alternatives,” Platform construction work would occur over approximately five years, scheduled in seven phases, labeled 1A–1D and 2E–2G, each eight to 16 months in duration (see Figure 3-1). Tunnel Encasement work would occur over approximately three years. Both are currently anticipated to begin in late 2021.

Noise from construction of the Preferred Alternative was analyzed according to the general assessment procedure of the FTA’s Guidance Manual, *Transit Noise and Vibration Impact Assessment*, as discussed in **Appendix B**, Chapter 5. Following this procedure, construction noise levels were assessed by considering the two loudest pieces of equipment for each stage of construction and assuming they are operating simultaneously. The construction stages include Tunnel Encasement as well as each of the seven distinct areas of the yard at which the platform would be constructed, as shown in the Construction Noise section of **Appendix E**.

The Project Sponsor has estimated that construction of the Platform would occur six days a week during daytime and nighttime hours (7 AM to 12 AM). Construction of the Tunnel Encasement would typically occur between 7 AM and 3:30 PM, five days a week on weekdays. The NYC Noise Control Code prohibits construction outside of weekdays 7 AM to 6 PM; however, the Project Sponsor expects NYCDOB to grant discretionary approvals (permits) to allow construction outside the normally allowed weekday hours to reduce interference with LIRR operations.

To determine whether construction noise has the potential to rise to the level of an adverse impact at each receptor, construction noise levels were compared to the FTA construction noise impact thresholds of 80 dB(A), 90 dB(A), and 100 dB(A) for residential receptors during nighttime construction (10 PM to 7 AM), residential receptors during daytime construction (7 AM to 10 PM), and non-residential receptors during all times, respectively.

As the FTA construction noise impact thresholds are screening-level thresholds, construction noise levels were also compared to the *CEQR Technical Manual* construction noise evaluation thresholds, described in **Appendix E**.

Hoe rams used during Platform and Tunnel Encasement Construction would be the loudest equipment and were considered for the worst-case construction noise analysis. During times when hoe rams would not be used, drill rigs utilized for caisson installation and support of excavation would be the loudest equipment and were used to represent construction noise levels outside of hoe ram use.

The worst-case construction noise levels were assessed during each stage of construction; details are presented in the Construction Noise section of **Appendix E**. **Table 8-4** below summarizes the worst-case noise levels during Platform construction, while **Table 8-5** summarizes the noise levels during Tunnel Encasement construction. Each table includes results for periods of hoe ram use and periods when the hoe ram would not be in use, as represented by use of drill rigs.

For this analysis, predicted construction noise levels were combined with the existing noise level at each receptor to determine total noise level and incremental increases over existing noise levels during each stage of construction. An incremental increase in noise level greater than 3 dB(A) would exceed the *CEQR Technical Manual* noise threshold detailed in **Appendix E**. A summary of the worst-case construction noise levels and associated impacts is provided in **Table 8-6**.

Table 8-4
Worst-Case Platform Construction Noise Levels in dB(A)

Receptor Site ¹	Minimum Measured Existing Daytime Noise Levels	Minimum Measured Existing Nighttime Noise Levels	Maximum Construction Noise Levels [Non-Hoe Ram Construction (i.e., Drill Rig Use)]	Maximum Incremental Change in Daytime Noise Levels [Non-Hoe Ram Construction (i.e., Drill Rig Use)]	Maximum Incremental Change in Nighttime Noise Levels [Non-Hoe Ram Construction (i.e., Drill Rig Use)]	Maximum Construction Noise Levels (Hoe Ram Use)	Maximum Incremental Change in Daytime Noise Levels (Hoe Ram Use)	Maximum Incremental Change in Nighttime Noise Levels (Hoe Ram Use)
1: The High Line (P)	67.9	N/A ²	76.4	9.1	N/A	81.4	13.7	N/A
2a: 15 Hudson Yards (R)	66.7	66.5	68.6	4.1	4.2	73.6	7.7	7.9
2b: 312 Eleventh Ave (R)	66.7	66.5	66.7	3.0	3.1	71.7	6.2	6.4
2c: 35 Hudson Yards (R)	66.7	66.5	68.5	4.0	4.1	73.5	7.6	7.8
2d: 55 Hudson Yards (C)	66.7	66.5	67.7	3.5	3.6	72.7	6.9	7.1
2e: 3 Hudson Blvd (C)	66.7	66.5	66.1	2.7	2.8	71.1	5.7	5.9
3a ³ : 601 West 29th Street (R)	66.4	62.9	71.6	6.3	9.2	76.6	10.6	13.9
3b ³ : 610 West 30th Street (R)	66.4	62.9	69.6	4.9	7.5	74.6	8.8	12.0

Notes:

¹ See **Figure 8-1** for locations.

² Receptor 1, the High Line, is currently open from 7 AM to 7 PM, therefore nighttime construction noise levels are not considered at this receptor

³ Receptors 3a and 3b represent residential buildings that are under construction and may be occupied during construction of the Preferred Alternative.

R=Residential, C=Commercial, P=Park

Table 8-5
Worst-Case Tunnel Encasement Construction Noise Levels in dB(A)

Receptor Site ¹	Minimum Measured Daytime ² Existing Noise Levels	Maximum Construction Noise Levels [Non-Hoe Ram Construction (i.e., Drill Rig Use)]	Maximum Incremental Change in Noise Levels [Non-Hoe Ram Construction (i.e., Drill Rig Use)]	Maximum Construction Noise Levels (Hoe Ram Use)	Maximum Incremental Change in Noise Levels (Hoe Ram Use)
1: The High Line (P)	71.1	88.6	17.7	93.6	22.6
2a: 15 Hudson Yards (R)	70.2	71.6	3.8	76.6	7.3
2b: 312 Eleventh Ave (R)	70.2	70.3	3.0	75.3	6.2
2c: 35 Hudson Yards (R)	70.2	66.4	1.5	71.4	3.6
2d: 55 Hudson Yards (C)	70.2	64.1	1.0	69.1	2.5
2e: 3 Hudson Blvd (C)	70.2	61.7	0.6	66.7	1.6
3a ³ : 601 West 29th Street (R)	69.6	74.8	6.3	79.8	10.6
3b ³ : 610 West 30th Street (R)	69.6	78.8	9.7	83.8	14.3

Notes:

- ¹ See **Figure 8-1** for locations.
 - ² Tunnel Encasement construction is not anticipated to occur during nighttime hours (10:00 PM–7:00 AM) or on weekends.
 - ³ Receptors 3a and 3b represent residential buildings that are under construction and may be occupied during construction of the Preferred Alternative.
- R=Residential, C=Commercial, P=Park

Table 8-6
Worst-Case Construction Noise Levels and Impact Summary

Receptor Site	Worst-Case Construction Noise Level in dB(A)	FTA Impact ¹	CEQR Impact ²
1: The High Line (P)	93.6	No	Yes
2a: 15 Hudson Yards (R)	76.6	No	Yes
2b: 312 Eleventh Ave (R)	75.3	No	Yes
2c: 35 Hudson Yards (R)	73.5	No	Yes
2d: 55 Hudson Yards (C)	72.7	No	N/A ³
2e: 3 Hudson Blvd (C)	71.1	No	N/A ³
3a ⁴ : 601 West 29th Street (R)	79.8	No	Yes
3b ⁴ : 610 West 30th Street (R)	83.8	No	Yes

Notes:

- ¹ FTA general assessment construction noise impact thresholds are 80 dB(A) for residential receptors during nighttime construction (10 PM to 7 AM), 90 dB(A) for residential receptors during daytime construction (7 AM to 10 PM), and 100 dB(A) for non-residential receptors during all times.
 - ² CEQR Impact based on duration and intensity of construction noise, as discussed below.
 - ³ The *CEQR Technical Manual* does not consider commercial buildings to be noise sensitive receptors
 - ⁴ Receptors 3a and 3b represent residential buildings that are under construction and may be occupied during construction of the Preferred Alternative.
- R=Residential, C=Commercial, P=Park

Receptor 1: The High Line

FTA Construction Noise General Assessment

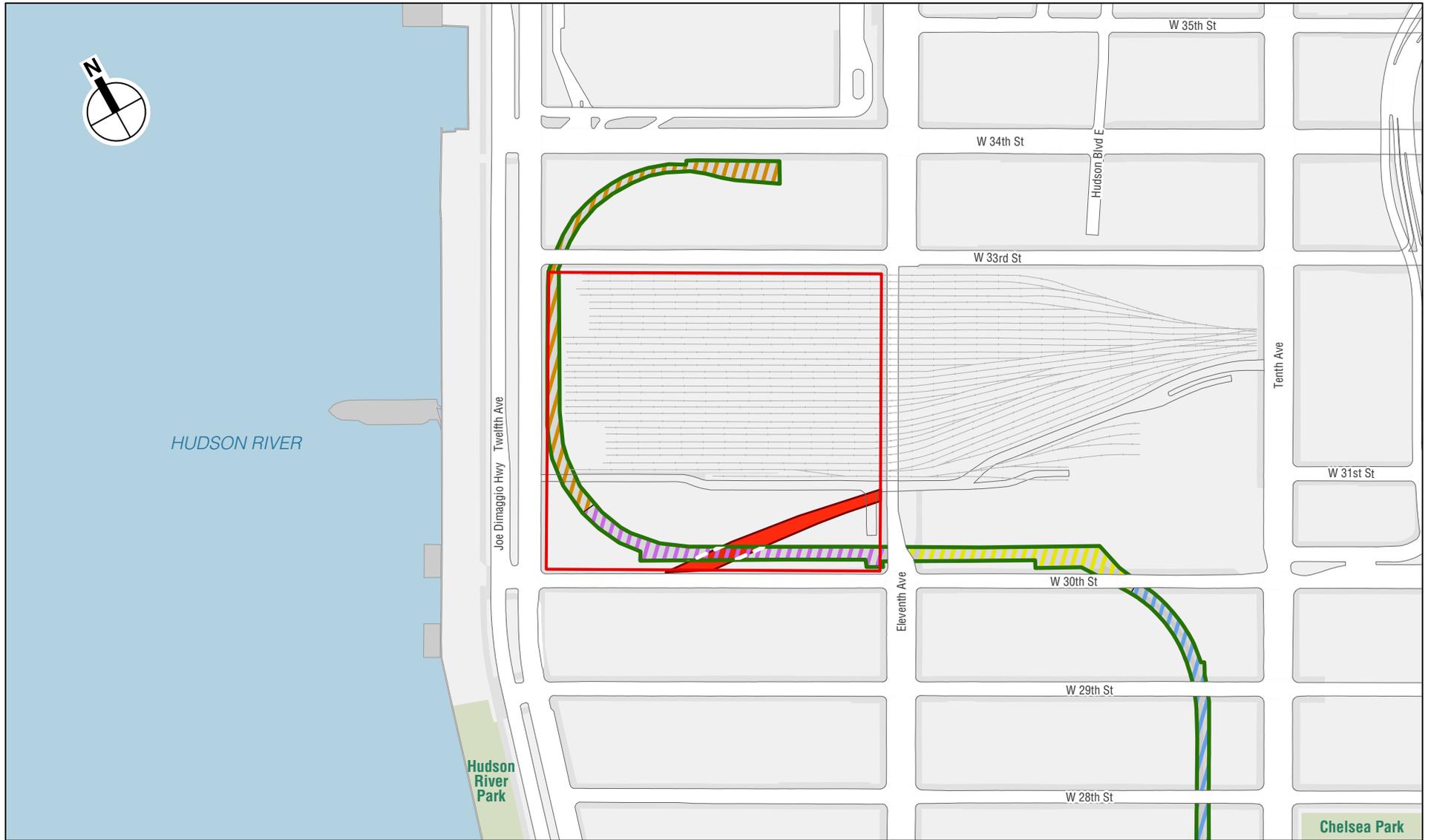
At the High Line west of Eleventh Avenue, represented by receptor 1, worst-case noise levels resulting from construction of the Preferred Alternative projected using the FTA general assessment methodology would be up to 94 dB(A) during construction for the Tunnel Encasement and up to 82 dB(A) during Platform construction. Construction noise levels would not exceed the FTA guidance manual impact threshold for commercial receptors (the FTA guidance manual does not include construction noise criteria for open spaces, so the criteria for commercial uses have been used to assess construction noise) during all stages of construction.

CEQR Technical Manual Construction Noise Evaluation

As described in **Appendix E**, evaluation of construction noise according to *CEQR Technical Manual* guidance considers both the intensity of the noise, as determined by the predicted increase in noise levels, as well as the duration of noise. The maximum predicted noise level increment at this receptor, 23 dB(A), would occur during hoe ram use periods for the first 20 months of excavation for Tunnel Encasement. During non-hoe ram use periods and the remaining 14 months of Tunnel Encasement construction, maximum predicted noise level increments at this receptor would be up to 18 dB(A) resulting from drill rig use. Tunnel Encasement construction is not anticipated to occur on weekends, leaving the High Line available for use without the effects of Tunnel Encasement construction noise during weekends. During the remaining 18 months of Platform construction (which includes evening hours and Saturdays), after the Tunnel Encasement is completed, the maximum predicted noise level increment would range between 3 and 14 dB(A), depending on the equipment used and the location of construction activity relative to the receptor (see Tables E-7 and E-8 in **Appendix E**).

The worst-case noise levels during Tunnel Encasement construction would not extend throughout the full length of the High Line, most of which would be substantially further from the construction work areas associated with the Preferred Alternative than the worst-case location represented by receptor 1. At portions of the High Line east of Eleventh Avenue (i.e., 375 feet from the center of the nearest work area), noise levels would be up to 77 dB(A) with increments up to 6 dB(A), and at portions of the High Line south of West 30th Street (i.e., 630 feet from the center of the nearest work area), noise level increments would not exceed 3 dB(A). Consequently, during worst-case conditions, the area of adverse impact according to the *CEQR Technical Manual* guidelines would be limited to the portion of the High Line north of West 30th Street, as shown in **Figure 8-2**.

Because construction of the Preferred Alternative would result in noise level increments exceeding the *CEQR Technical Manual* noise threshold of 3 dB(A) over an extended period (i.e., greater than 24 consecutive months), it would result in an adverse impact at receptor 1 according to the *CEQR Technical Manual* guidelines. Noise levels at the High Line would exceed nuisance levels, as defined by the *CEQR Technical Manual*, and may interfere with speech while construction equipment is in use. There are no feasible design control measures to substantially reduce the maximum noise levels described in **Table 8-4 and Table 8-5**.



	<i>Project Site (Western Rail Yard)</i>	Worst-Case Construction Noise Levels at the High Line			
	<i>Proposed Tunnel Encasement</i>		<i>Increments less than 3 dBA (i.e., less than CEQR construction noise screening threshold)</i>		<i>Up to 81 dBA (increments up to 14 dBA)</i>
	<i>Existing High Line Park</i>		<i>Below 77 dBA (increments less than 6 dBA)</i>		<i>Up to 94 dBA (increments up to 23 dBA)</i>

Note: Incremental changes in noise levels greater than 3 dBA exceed the CEQR Technical Manual screening threshold for construction noise.

Worst-Case Construction Noise Levels at the High Line

Receptors 2a, 2b, 2c: Residential Buildings along Eleventh Avenue between West 29th and 33rd Streets

FTA Construction Noise General Assessment

At the residential buildings along Eleventh Avenue between West 29th and West 33rd Streets represented by receptors 2a, 2b, and 2c, worst-case noise levels resulting from construction of the Preferred Alternative projected using the FTA general assessment methodology would be between 71 and 77 dB(A) during Tunnel Encasement and between 72 and 74 dB(A) during Platform construction. Construction noise levels would be below the FTA guidance manual daytime and nighttime impact criteria for residential receptors during all stages of construction.

CEQR Technical Manual Construction Noise Evaluation

As described in **Appendix E**, evaluation of construction noise according to *CEQR Technical Manual* guidance considers both the intensity of the noise, as determined by the predicted increase in noise levels, as well as the duration of noise. The maximum predicted noise level increment at these receptors, 8 dB(A), would occur during hoe ram use. Hoe ram use would occur over the course of 20 months during excavation for Tunnel Encasement, as well as over the course of an additional 9 non-consecutive months during Platform Construction. During the remaining 23 non-consecutive months of construction when hoe rams would not be used, predicted noise level increments at these receptors would range from 2 to 4 dB(A) depending on the location of construction activity relative to the receptor (see Tables E-7 and E-8 in **Appendix E**).

Because construction of the Preferred Alternative would result in noise level increments exceeding the *CEQR Technical Manual* noise threshold over an extended period (i.e., greater than 24 consecutive months), it would result in an adverse impact at receptors 2a, 2b, and 2c according to the *CEQR Technical Manual* guidelines. However, these buildings are on zoning lots upon which the NYCDP has placed (E) Designations³ for noise. NYCDP requires new construction of the lots with Noise (E) Designations to achieve a minimum of 35 dB(A) façade attenuation, which is achieved through modern façade design. With this minimum level of attenuation, interior noise levels would be less than 45 dB(A) during the worst-case construction, which is the *CEQR Technical Manual* acceptable threshold for residential spaces.

Because these buildings currently include façade attenuation that would result in acceptable interior levels, additional receptor controls would not be necessary.

³ Noise (E) Designations, as listed in Appendix C of the *New York City Zoning Resolution*, are placed on zoning lots in areas with high ambient noise levels when they are rezoned by NYCDP to allow a noise-sensitive use to be built on those sites. A Noise (E) Designation specifies a minimum level of façade noise attenuation as well as the provision of an alternate means of ventilation to allow for the maintenance of a closed-window condition. The intent of the Noise (E) Designation is to protect inhabitants of buildings constructed on the (E) Designated lot from high levels of ambient noise.

Receptors 2d and 2e: Commercial buildings between West 30th and 34th Streets

FTA Construction Noise General Assessment

At commercial buildings along Eleventh Avenue located between West 30th and West 34th Streets, represented by receptors 2d and 2e, worst-case noise levels resulting from construction of the Preferred Alternative projected using the FTA general assessment methodology would be between 67 and 69 dB(A) during Tunnel Encasement construction and between 71 and 73 dB(A) during Platform Construction. Construction noise levels would be below the FTA guidance manual impact criteria for commercial receptors during all stages of construction; therefore, construction noise would not rise to the level of an adverse impact at commercial buildings along Eleventh Avenue located between West 30th and West 34th Streets.

CEQR Technical Manual Construction Noise Evaluation

The *CEQR Technical Manual* does not consider commercial buildings to be noise-sensitive receptors.

Receptors 3a and 3b: Residential buildings along West 30th Street between Eleventh and Twelfth Avenues

FTA Construction Noise General Assessment

At residential buildings along West 30th Street between Eleventh and Twelfth Avenues, represented by receptors 3a and 3b, should construction be complete and the buildings occupied prior to or during the construction of the Preferred Alternative, worst-case noise levels resulting from construction of the Preferred Alternative projected using the FTA general assessment methodology would be between 80 and 84 dB(A) during Tunnel Encasement construction and between 75 and 77 dB(A) during Platform construction. Construction noise levels would be below the FTA guidance manual daytime and nighttime impact criteria for residential receptors during all stages of construction.

CEQR Technical Manual Construction Noise Evaluation

Manual guidance considers both the intensity of the noise, as determined by the predicted increase in noise levels, as well as the duration of noise. The maximum predicted noise level increment at these receptors, 14 dB(A), would occur during hoe ram use. Hoe ram use would occur over the course of 20 months during excavation for Tunnel Encasement, as well as over the course of an additional 9 non-consecutive months during Platform construction. During the remaining 23 non-consecutive months of construction when hoe rams would not be used, predicted noise level increments at these receptors would range from 5 to 10 dB(A) depending on the location of construction activity relative to the receptor (see Tables E-7 and E-8 in **Appendix E**).

Because construction of the Preferred Alternative would result in noise level increments exceeding the *CEQR Technical Manual* noise threshold over an extended period (i.e., greater than 24 consecutive months), it would result in an adverse impact at receptors 3a and 3b. However, these buildings are currently being constructed on zoning lots upon which the NYCDPC has placed (E) Designations⁴ for noise. NYCDPC requires new construction of the lots with Noise (E) Designations to achieve a minimum of 33 dB(A) façade attenuation through modern façade design.

Despite this attenuation requirement, interior noise levels would exceed the *CEQR Technical Manual* threshold for acceptable interior noise levels, 45 dB(A), by up to 6 dB(A) during the periods of hoe ram use and up to 1 dB(A) during the remainder of construction.

There are no feasible receptor noise control measures that would be effective in reducing interior noise levels by an additional 6 dB(A) such that interior noise levels would be below the *CEQR Technical Manual* acceptable threshold for residential use during hoe ram use. See discussion of mitigation measures in Section 8.6.

8.5.3.1.2 Construction Vehicles

In addition to the potential noise effects of on-site construction activity, the potential noise effects of construction trucks have been assessed according to *CEQR Technical Manual* guidance, specifically using the proportional modeling technique⁵ as described in **Appendix E**.⁶

Construction of the Preferred Alternative would include a construction staging area on West 33rd Street between Twelfth and Eleventh Avenues. Trucks would access the staging area via Twelfth Avenue, Eleventh Avenue, Tenth Avenue, Dyer Avenue, West 34th Street and West 33rd Street. The construction trucks, including concrete mixer trucks, materials delivery trucks, and dump trucks for excavated soils removal, would pass by residences and open space receptors (i.e., High Line and Hudson Yards Plaza) on these roadways at a rate of up to approximately 22 trucks per hour (total for both directions) on Twelfth Avenue, 17 trucks per hour on Eleventh Avenue, 22 trucks per hour on West 34th Street and West 33rd Street, and 5 trucks per hour on Tenth and Dyer Avenues.

⁴ Noise (E) Designations, as listed in Appendix C of the *New York City Zoning Resolution*, are placed on zoning lots in areas with high ambient noise levels when they are rezoned by NYCDPC to allow a noise-sensitive use to be built on those sites. A Noise (E) Designation specifies a minimum level of façade noise attenuation as well as the provision of an alternate means of ventilation to allow for the maintenance of a closed-window condition. The intent of the Noise (E) Designation is to protect inhabitants of buildings constructed on the (E) Designated lot from high levels of ambient noise.

⁵ See Section 332.1, and specifically Equation 19-1, of the *CEQR Technical Manual*.

⁶ The analysis is consistent with the general assessment techniques described in the FTA guidance manual.

At receptors along West 33rd Street between Tenth and Eleventh Avenues, including receptors 2c and 2d, this level of construction vehicle activity would constitute a 175 percent increase in the number of Passenger Car Equivalents (PCEs) on roadways, resulting in up to a 4 dB(A) incremental increase in noise levels above existing noise levels during worst-case construction throughout the 4.5 years of construction of the Preferred Alternative. However, these buildings are on zoning lots upon which NYCDOP has placed (E) Designations⁷ for noise. NYCDOP requires new construction of the lots with Noise (E) Designations to achieve a minimum of 35 dB(A) façade attenuation. With this minimum level of attenuation, interior noise levels would be less than 45 dB(A) during the worst-case construction vehicle activity, which is the *CEQR Technical Manual* acceptable threshold for residential spaces. While construction vehicle noise at residences along West 33rd Street between Eleventh and Tenth Avenues does not exceed the FTA impact criteria, with noise level increments up to 4 dB(A) over an extended duration, construction vehicle activity would constitute an adverse impact according to the *CEQR Technical Manual* guidelines. However, because these buildings currently include façade attenuation to achieve acceptable interior levels, additional receptor controls would not be necessary.

Along all other roadways that construction trucks would travel, the level of construction vehicle activity would constitute at most a 52 percent increase in the number of PCEs on roadways adjacent to noise receptors, resulting in no more than a 2 dB(A) noise level increase, which would not exceed the *CEQR Technical Manual* noise impact criteria. Consequently, based on the analysis results, construction truck activity associated with the Preferred Alternative would not have the potential to result in adverse construction noise impacts at any receptors.

8.5.3.2 CONSTRUCTION VIBRATION

8.5.3.2.1 Platform Construction and Tunnel Encasement

The FTA thresholds for impact from ground-borne vibration and noise are based on the maximum levels for a single event. Equipment such as hoe rams, large bulldozers, and drill rigs utilized for support of excavation and caisson installation would result in the greatest potential to produce high levels of vibration during construction of the Preferred Alternative. Utilizing the FTA Guidance Manual's general assessment methodology for construction vibration, 20 feet is the distance at which operation of drill rigs, hoe rams, or large bulldozers would result in vibration capable of causing damage to extremely fragile buildings. With the exception of the High Line and the NRT, there are no buildings or structures located within 20 feet of the construction work areas, and therefore, vibration from construction would not be anticipated to result in the potential for damage at any buildings.

⁷ Noise (E) Designations, as listed in Appendix C of the *New York City Zoning Resolution*, are placed on zoning lots in areas with high ambient noise levels when they are rezoned by NYCDOP to allow a noise-sensitive use to be built on those sites. A Noise (E) Designation specifies a minimum level of façade noise attenuation as well as the provision of an alternate means of ventilation to allow for the maintenance of a closed-window condition. The intent of the Noise (E) Designation is to protect inhabitants of buildings constructed on the (E) Designated lot from high levels of ambient noise.

The High Line is a steel structure, which would have a damage criterion of 0.5 in/sec according to the FTA Guidance Manual. The Project Sponsor has determined that support of excavation during the Tunnel Encasement construction would occur beneath the High Line, as close as 9 feet away from the support columns. At this distance, vibration levels from drill rigs would be up to 0.4 in/sec, which is below the FTA threshold for damage for steel structures. Following the FTA general assessment methodology for construction vibration, the distance at which there is a potential for damage to steel structures including the High Line, from operation of drill rigs, hoe rams, or large bulldozers is 8 feet. Additionally, because the High Line is an historic structure, the protection and monitoring procedures that the Project Sponsor would develop for the High Line would require monitoring of vibration levels at its structure during any subsurface construction within 90 feet.

Caisson drilling during the Preferred Alternative Platform Construction may occur adjacent to the existing NRT, as close as 11 feet away. At this distance, vibration levels from drill rigs would be less than the FTA guidance manual impact criteria for reinforced concrete construction of 0.5 in/sec.

FRA would include conditions as part of its environmental decision regarding the Preferred Alternative to ensure that the potential effects to the NRT and High Line from construction vibration are not adverse. These conditions include requiring the Project Sponsor to develop a CPP for the construction of the Platform and Tunnel Encasement in order to protect the NRT and High Line. The CPP would be incorporated into the overarching CEPP that would be developed for the Preferred Alternative (see Chapter 22, "Mitigation Measures and Project Commitments") and would be required to meet the guidelines set forth in the NYCDOB *Technical Policy and Procedure Notice #10/88*, the *Protection for Landmarked Buildings* guidance document of the NYCLPC, and the National Park Service's *Preservation Tech Notes, Temporary Protection #3: Protecting a Historic Structure during Adjacent Construction*. The CPP is described in Chapter 22.

The levels at which vibration is perceived by occupants of buildings as annoying or disruptive are lower than the levels necessary to cause damage to structures, particularly for buildings where people sleep or perform sensitive tasks such as reading a video screen. The FTA impact thresholds are based on the use of the affected building, with buildings where vibration would interfere with interior operations being the most sensitive, followed by residential spaces where people normally sleep, and institutional land uses being the least sensitive.

Following the FTA's general assessment method, the distances at which drill rigs, hoe rams, or large bulldozers would result in exceedances of the human annoyance criteria would be 135 feet for buildings where vibration would interfere with interior operations and 79 feet for residential buildings. While there are no buildings where vibration would interfere with interior operations within 135 feet of construction, the proposed residential building located at 610 West 30th Street is located approximately 73 feet from the closest point of support of excavation drill rig operation for the Tunnel Encasement. If completed and occupied prior to the construction of the Preferred Alternative, this residential building would have the potential to experience perceptible and potentially annoying vibration levels. However, because Tunnel Encasement construction is not anticipated to occur during nighttime hours when people would typically be sleeping, and drill rigs would only be within 79 feet of the residential building for a small segment of the support of excavation (approximately 15 feet in length near West 30th Street), vibration from construction would not rise to the level of an adverse impact at this building.

Any blasting activities associated with excavation of rock during construction of the Tunnel Encasement would be coordinated and conducted with permission from the Fire Department of the City of New York (FDNY). The Project Sponsor would provide a blasting schedule to neighboring building owners and occupants. Construction vibration monitoring would be required during blasting activities to ensure that vibration does not exceed a level that could result in damage to any nearby buildings or structures.

Consequently, because vibration from construction would not exceed the FTA criteria for damage at any building, as confirmed by vibration monitoring at the High Line when necessary, and would not exceed the FTA criteria for human annoyance over an extended duration at any receptor, construction of the Preferred Alternative would not result in adverse construction vibration impacts.

8.5.3.2.2 Construction Vehicles

Construction-related vehicles including worker vehicles and/or materials and equipment deliveries generally do not have the potential to result in vibration levels that could result in building damage and/or human annoyance and consequently do not typically result in adverse construction vibration impacts.

8.6 AVOIDANCE, MINIMIZATION, AND MITIGATION MEASURES

FRA has not identified any adverse impacts from operation of the Preferred Alternative related to noise or vibration. The Project Sponsor would incorporate sufficient noise control measures in the final design of the ventilation system plans to ensure operation of the Preferred Alternative would be in compliance with the NYCNCC noise limits at all surrounding residential receptors.

FRA has not identified any adverse impacts from construction of the Preferred Alternative related to vibration.

FRA found that construction of the Preferred Alternative would not have the potential to result in exceedances of the general construction noise assessment screening-level thresholds included in the FTA guidance manual. However, FRA found that construction of the Preferred Alternative would exceed the *CEQR Technical Manual* thresholds and have the potential to result in adverse noise impacts at the High Line within approximately 630 feet of the nearest work area, residential buildings along Eleventh Avenue between West 29th and West 33rd Streets, along West 30th Street between Eleventh and Twelfth Avenues, and along West 33rd Street between Tenth and Eleventh Avenues.

The following practices would be used to the extent feasible and practicable to reduce noise and vibration levels associated with construction of the Preferred Alternative:

- Noise from construction equipment would comply with New York City noise emission standards. These standards mandate that certain classifications of construction equipment and motor vehicles meet specified noise emission standards, and construction material be handled and transported in such a manner to not create unnecessary noise.
- Construction of the Preferred Alternative would include sufficient mitigation to meet the NYCNCC construction noise limit of an L_{max} of 85 dB(A) at the exteriors of any adjacent residential properties.

- Construction noise is regulated by the NYCNCC. Additionally, the USEPA specifies noise emission standards for medium and heavy trucks. NYCDEP enforces the NYCNCC, which indicates that, except under exceptional circumstances, construction activities must be limited to weekdays between the hours of 7:00 AM and 6:00 PM. At all other times, including anytime on the weekends, an after-hours authorization is required. After hours variance (AHV) applications must be filed with the NYCDOB at least two business days before the first intended work day. Permit authorization for weekend or after hour construction work may be granted for the following circumstances—emergency work, cases of public safety, City construction projects, construction activities with minimal impact, and for a claim of undue hardship resulting from unique site characteristics, unforeseen conditions, scheduling conflicts and/or financial considerations. The Project Sponsor would be required to obtain NYCDOB approval for construction outside of weekdays 7 AM to 6 PM, which is prohibited by the NYCNCC. The same requirements for obtaining AHV's for any construction activities to occur outside the work hours allowed under the NYCNCC were identified as necessary for the 2009 SEQRA/CEQR FEIS Western Rail Yard project and the 2014 SEA/FONSI for Amtrak's Concrete Casing project.
- To the extent practicable given space constraints at the work sites, construction would use acoustical noise tent and/or enclosures surrounding hoe rams, jackhammers, or pavement breakers that can provide up to 15 dB(A) of noise reduction during any demolition activities. For additional noise reduction, jackhammer noise mufflers that can provide up to an additional 10 dB(A) of noise reduction can also be used.
- To minimize the noise from the backup warning alarms on trucks, vehicles would be routed through the construction sites to minimize the use of alarms. In addition, vehicles would also be equipped with OSHA-approved quieter backup alarms.
- Any blasting activities associated with excavation of rock during construction of the Tunnel Encasement would be coordinated and conducted with permission from the FDNY. The Project Sponsor would provide a blasting schedule to neighboring building owners and occupants. Construction vibration monitoring would be required during blasting activities to ensure that vibration does not exceed a level that could result in damage to any nearby buildings or structures.
- Consistent with the protection and monitoring procedures developed for the High Line, construction vibration monitoring would be required whenever construction would occur within 90 feet of the High Line structure to ensure that construction activities do not result in vibration levels that would be capable of causing damage.

FRA would include conditions as part of its environmental decision regarding the Preferred Alternative, i.e., in the ROD for this EIS in accordance with NEPA, to ensure that the potential effects to the NRT from construction vibration are not adverse. These conditions include requiring the Project Sponsor to develop a CPP for the construction of the Platform and Tunnel Encasement in order to protect the NRT and High Line. The CPP would be incorporated into the overarching CEPP that would be developed for the Preferred Alternative (see Chapter 22) and would be required to meet the guidelines set forth in the NYCDOB *Technical Policy and Procedure Notice #10/88*, the *Protection for Landmarked Buildings* guidance document of the LPC, and the National Park Service's *Preservation Tech Notes, Temporary Protection #3: Protecting a Historic Structure during Adjacent Construction*. *