Chapter 12A: Noise

12A.1 INTRODUCTION

Chapter 12 of this Environmental Impact Statement (EIS) presents the evaluation conducted by the Federal Railroad Administration (FRA) and New Jersey Transit Corporation (NJ TRANSIT) of the potential noise and vibration impacts associated with the construction and operation of the Hudson Tunnel Project. It is divided into two subchapters, Chapter 12A, "Noise," and Chapter 12B, "Vibration." In Chapter 12A, the FRA and NJ TRANSIT have assessed the potential noise impacts associated with the Preferred Alternative by comparing existing noise levels with the projected future noise levels at sensitive receptors near the Project site. This chapter presents the evaluation of the potential for adverse noise impacts from both construction and operation of the Preferred Alternative and potential measures to avoid, minimize, and mitigate noise impacts. The Port Authority of New York and New Jersey (PANYNJ), in its role as Project Sponsor, has accepted and relied on the evaluations and conclusions of this chapter.

Chapter 12B presents the assessment of potential vibration impacts associated with the Preferred Alternative undertaken by FRA and NJ TRANSIT and accepted and relied upon by the PANYNJ.

This chapter reflects the following changes made since the Draft EIS (DEIS) for the Hudson Tunnel Project:

- The DEIS provided the noise and vibration analyses in one chapter, Chapter 12, "Noise and Vibration." The chapter is now divided into two parts for the Final EIS (FEIS) to simplify the presentation of the analysis.
- FRA and NJ TRANSIT revised the noise analyses using the Federal Transit Administration's updated methodology, *Transit Noise and Vibration Impact Assessment Manual*, FTA Report No. 0123, September 2018.
- FRA and NJ TRANSIT updated the noise analysis to include new residences and a park on Paterson Plank Road in North Bergen, New Jersey and a future development on Manhattan Avenue in Union City, New Jersey that were not present when the DEIS was prepared.
- The analysis incorporates revisions and refinements to the construction staging approach in New Jersey, including the addition of a new potential haul route for truck access to the Hoboken staging site. It also incorporates revisions and refinements to the construction methods in New York. For both New Jersey and New York, it includes more refined information on construction equipment that may be used at the construction sites. More detailed tables are provided to better explain the results related to construction impacts.
- The analysis of effects in North Bergen now incorporates the effect of train horn noise from trains on the Northeast Corridor (NEC) tracks.
- The analysis of effects in Weehawken and Hoboken now incorporates the potential influence of reflected noise off the Palisades cliff.

This chapter contains the following sections:

12A.2 ANALYSIS METHODOLOGY

During development of this EIS, FRA and NJ TRANSIT developed methodologies for evaluating the potential effects of the Hudson Tunnel Project in coordination with the Project's Cooperating and Participating Agencies (i.e., agencies with a permitting or review role for the Project). The methodologies used for analysis of noise are summarized in this chapter.

Following completion of the DEIS, the PANYNJ became the Project Sponsor for the Hudson Tunnel Project (see Chapter 1, "Purpose and Need," Section 1.1.2, for more information). Consistent with the roles and responsibilities defined in Section 1.1.1 of that chapter, as the current Project Sponsor, the PANYNJ will comply with mitigation measures and commitments identified in the Project's Record of Decision (ROD).

FRA and NJ TRANSIT conducted the noise analysis following procedures described in the FTA guidance manual, *Transit Noise and Vibration Impact Assessment Manual*, FTA Report No. 0123, September 2018. FRA uses the FTA guidance manual for analysis of noise and vibration resulting from non-high-speed (i.e., 125 miles per hour or below) rail projects.

Following the procedures set forth in the FTA guidance manual, airborne noise impacts can be analyzed using three potential steps: (1) a Screening procedure; (2) a General Noise Assessment; and/or (3) a Detailed Noise Analysis. The Screening procedure is performed first to determine whether any noise-sensitive receptors are within distances where impacts are likely to occur. When there are noise-sensitive receptors in locations where impacts are likely to occur, then a

General Noise Assessment is performed to determine locations where noise impacts could occur. If this General Noise Assessment indicates that a potential for noise impact does exist, then a Detailed Noise Analysis may be necessary. The FTA's Detailed Noise Analysis methodology is used to predict impacts and evaluate the effectiveness of mitigation with greater precision than can be achieved with the General Noise Assessment. For the Hudson Tunnel Project, FRA and NJ TRANSIT conducted a Detailed Noise Analysis in accordance with FTA methodology.

12A.2.1 NOISE FUNDAMENTALS AND DEFINITIONS

Quantitative information on the effects of airborne noise on people is well documented. If sufficiently loud, noise may adversely affect people in several ways. For example, noise may interfere with human activities, such as sleep, speech communication, and tasks requiring concentration or coordination. It may also cause annoyance, hearing damage, and other physiological problems. Several noise scales and rating methods are used to quantify the effects of noise on people. These scales and methods consider such factors as loudness, duration, time of occurrence, and changes in noise level with time. However, all the stated effects of noise on people are subjective.

Sound pressure levels are measured in units called "decibels" (dB). The particular character of the noise that we hear is determined by the rate, or "frequency," at which the air pressure fluctuates, or "oscillates." Frequency defines the oscillation of sound pressure in terms of cycles per second. One cycle per second is known as 1 Hertz (Hz). People can hear over a relatively limited range of sound frequencies, generally between 20 Hz and 20,000 Hz, and the human ear does not perceive all frequencies equally well. High frequencies are more easily discerned and therefore more intrusive than many of the lower frequencies.

12A.2.1.1 "A"-WEIGHTED SOUND LEVEL (dBA)

To bring a uniform noise measurement that simulates people's perception of loudness and annoyance, the decibel measurement is weighted to account for those frequencies most audible to the human ear. This is known as the A-weighted sound level, or dBA, and because of the weighting based on human perception, it is the most often used descriptor of noise levels where community noise is the issue. As shown in **Table 12A-1**, the threshold of human hearing is defined as 0 dBA; very quiet conditions (e.g., a library) are approximately 40 dBA; levels between 50 dBA and 70 dBA define the range of normal daily activity; levels above 70 dBA are considered noisy, and then loud, intrusive, and deafening as the scale approaches 130 dBA. For most people to perceive an increase in noise, it must be at least 3 dBA. At 5 dBA, the change will be readily noticeable.[1] An increase of 10 dBA is generally perceived as a doubling of loudness.

[1] Bolt, Beranek and Newman, *Fundamentals and Abatement of Highway Traffic Noise*, U.S. Department of Transportation, Federal Highway Administration, National Highway Institute, 1973.

Table 12A-1
Common Noise Levels

Sound Source	(dBA)
Military jet, air raid siren	130
Amplified rock music	110
Jet takeoff at 500 meters	100
Freight train at 30 meters	95
Train horn at 30 meters	90
Heavy truck at 15 meters	
Busy city street, loud shout	80
Busy traffic intersection	
Highway traffic at 15 meters, train	70
Predominantly industrial area	60
Light car traffic at 15 meters, city or commercial areas or residential areas close to industry	
Background noise in an office	50
Suburban areas with medium density transportation	
Public library	40
Soft whisper at 5 meters	30
Threshold of hearing	0

Note: A 10 dBA increase in level appears to double the loudness, and a 10 dBA decrease halves the apparent loudness.

Sources: Cowan, James P. *Handbook of Environmental Acoustics*. Van Nostrand Reinhold, New York, 1994. Egan, M. David, Architectural Acoustics. McGraw-Hill Book Company, 1988.

Combinations of different sources are not additive in an arithmetic manner, due to the decibel scale's logarithmic nature. For example, two noise sources—a vacuum cleaner operating at approximately 72 dBA and a telephone ringing at approximately 58 dBA—do not combine to create a noise level of 130 dBA, the equivalent of a jet airplane or air raid siren (see **Table 12A-1**). In fact, the noise produced by the telephone ringing may be masked by the noise of the vacuum cleaner and not be heard. The logarithmic combination of these two noise sources would yield a noise level of 72.2 dBA.

12A.2.1.2 EFFECTS OF DISTANCE ON NOISE

Noise varies with distance. For example, highway traffic 50 feet away from a receptor (such as a person listening to the noise) typically produces sound levels of approximately 70 dBA. The same highway noise measures 66 dBA at a distance of 100 feet, assuming soft ground conditions (such as grass). This decrease is known as "drop-off." The outdoor drop-off rate for a line source, such as a railway, is a decrease of approximately 4.5 dBA (for soft ground) for every doubling of distance between the noise source and receptor. For hard ground (such as concrete), the outdoor drop-off rate is 3 dBA for line sources. Assuming soft ground, for a point source, such as a stationary piece of construction equipment (e.g., a drill rig), the outdoor drop-off rate is a decrease of approximately 7.5 dBA for every doubling of distance between the noise source and receptor (for hard ground the outdoor drop-off rate is 6 dBA for point sources).

12A.2.1.3 NOISE DESCRIPTORS USED IN IMPACT ASSESSMENT

The sound-pressure level unit of dBA describes a noise level at just one moment, but since very few noises are constant, other ways of describing noise over more extended periods have been developed. One way of describing fluctuating sound is to describe the fluctuating noise heard over a specific period as if it were a steady, unchanging sound (i.e., as if it were averaged over that time period). For this condition, a descriptor called the "equivalent sound level" (L_{eq}) can be computed. L_{eq} is the constant sound level that, in a given situation and period (e.g., 1 hour, denoted by $L_{eq(1)}$, or 24 hours, denoted as $L_{eq(24)}$), conveys the same sound energy as the actual time-varying sound.

A descriptor for cumulative 24-hour exposure is the day-night average sound level, abbreviated as L_{dn}. This is a 24-hour measurement that accounts for the moment-to-moment fluctuations in A-weighted noise levels due to all sound sources, combined. Mathematically, the L_{dn} noise level is the energy average of all $L_{eq(1)}$ noise levels over a 24-hour period, where nighttime noise levels (10 PM to 7 AM) are increased by 10 dBA before averaging because of increased noise sensitivity during nighttime when people are typically sleeping.

Following guidance in the FTA guidance manual, *Transit Noise and Vibration Impact Assessment*, either the maximum $L_{eq(1)}$ sound level or the L_{dn} sound level is used for operational noise impact assessment, depending on land use category as described below in Section 12A.2.2.1. Also as specified in the FTA guidance manual, the 8-hour equivalent level, i.e., the $L_{eq(8)}$, and the 30-day average L_{dn} are used for construction noise impact assessment as described below in Section 12A.2.2.2.

12A.2.2 STANDARDS AND CRITERIA

12A.2.2.1 OPERATIONAL NOISE IMPACT CRITERIA

The FTA guidance manual defines noise criteria based on the specific type of land use that would be affected, with explicit operational noise impact criteria for three land use categories. These impact criteria are based on either peak 1-hour L_{eq} or 24-hour L_{dn} values. **Table 12A-2** describes the land use categories defined in the FTA report, and provides noise metrics used for determining operational noise impacts. As described in **Table 12A-2**, categories 1 and 3—which include land uses that are noise-sensitive, but where people do not sleep—require examination using the 1-hour L_{eq} descriptor for the noisiest peak hour. Category 2, which includes residences, hospitals, and other locations where nighttime sensitivity to noise is very important, requires examination using the 24-hour L_{dn} descriptor.

Table 12A-2
FTA's Land Use Category and Metrics for Transit Noise Impact Criteria

Land Use Category	Noise Metric (dBA)	Description of Land Use Category
1	Outdoor $L_{eq(h)}$*	Land where quiet is an essential element of its intended purpose. Example land uses include preserved land for serenity and quiet, outdoor amphitheaters and concert pavilions, and national historic landmarks with considerable outdoor use. Recording studios and concert halls are also included in this category.
2	Outdoor L_{dn}	This category is applicable to all residential land use and buildings where people normally sleep, such as hotels and hospitals.
3	Outdoor $L_{eq(h)}$*	This category is applicable to institutional land uses with primarily daytime and evening use. Example land uses include schools, libraries, theaters, and churches where it is important to avoid interference with such activities as speech, meditation, and concentration on reading material. Places for meditation or study associated with cemeteries, monuments, museums, campgrounds and recreational facilities are also included in this category.

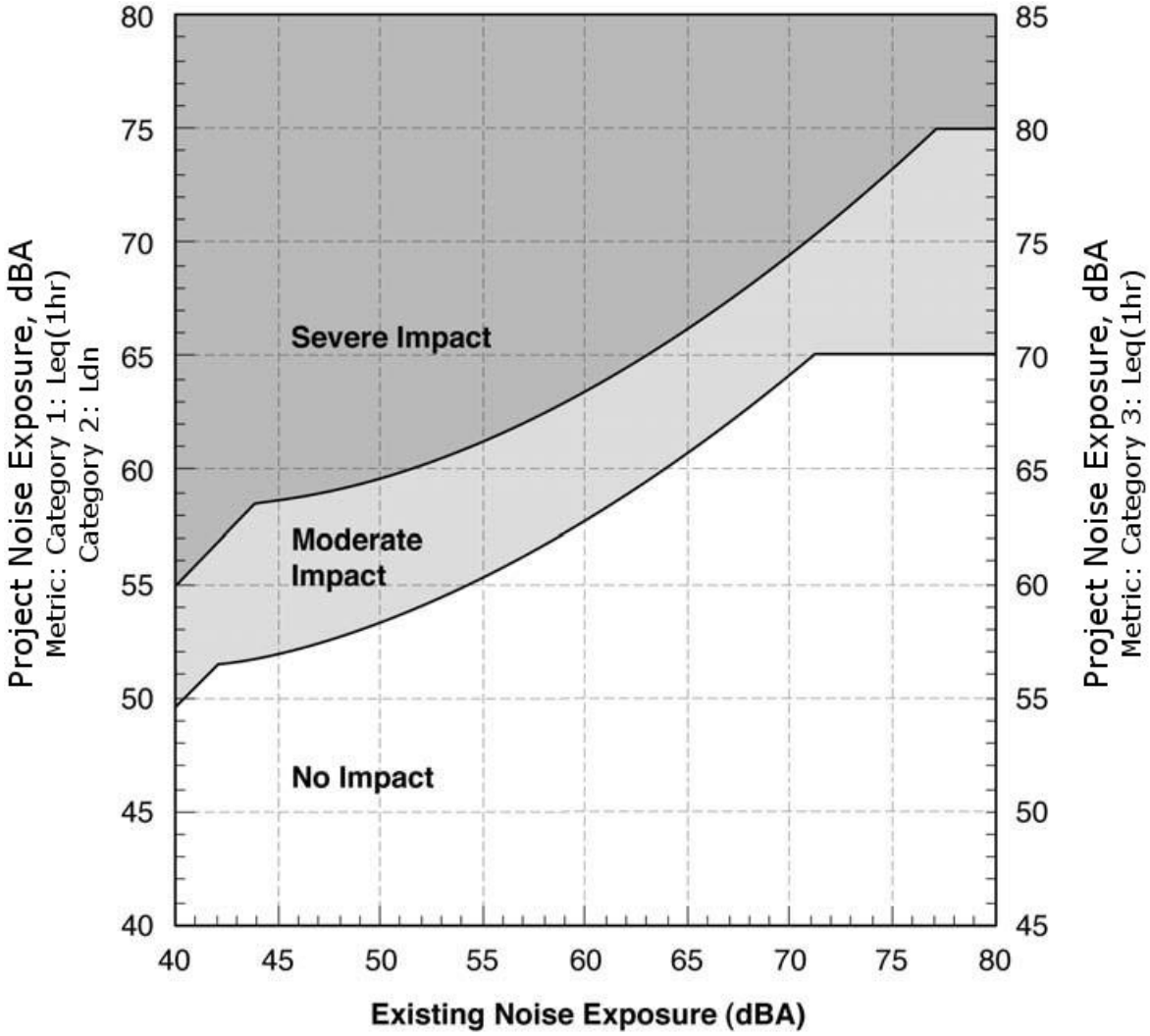
Note: * $L_{eq(1hr)}$ for the loudest hour of project-related activity during hours of noise sensitivity.
Source: FTA. *Transit Noise and Vibration Impact Assessment Manual,* FTA Report No. 0123, September, 2018.

FTA's noise impact criteria for transit projects, as presented in Figure 4-2 in the FTA guidance manual, are shown in **Figure 12A-1**. The FTA impact criteria are keyed to the noise level generated by the project (called "project noise exposure") in locations of varying existing noise levels. Two types of impacts—moderate and severe—are defined for each land use category, depending on existing noise levels. Thus, where existing noise levels are 40 dBA, for land use categories 1 and 2, the respective L_{eq} and L_{dn} noise exposure from the project would create moderate impacts if they were above approximately 50 dBA, and would create severe impacts if they were above approximately 55 dBA. For category 3, a project noise exposure level above approximately 55 dBA would be considered a moderate impact, and above approximately 60 dBA would be considered a severe impact. The difference between "severe impact" and "moderate impact" is that a severe impact indicates a significant percentage of people would find the change in noise level to be annoying, while a moderate impact occurs when a change in noise level would be noticeable to most people but not necessarily sufficient to result in strong adverse reactions from the community.

12A.2.2.2 CONSTRUCTION NOISE IMPACT CRITERIA

12A.2.2.2.1 FTA Noise Impact Criteria

The FTA guidance manual specifies separate noise impact thresholds for the detailed construction noise assessment in the daytime (defined as 7AM to 10 PM) and nighttime (defined as 10 PM to 7 AM) and for the 30-day average construction noise level. Separate impact thresholds are specified for various types of land use—e.g., residential, commercial, and industrial—depending on each use's sensitivity to noise, although the land use categories for the construction noise impact thresholds are not the same as the FTA land use categories described for the operational noise impact criteria as described in Section 12A.2.2.1. The impact thresholds for construction are shown in **Table 12A-3**.



Source: Transit and Noise Vibration Impact Assessment, FTA Report No. 0123, September 2018

FTA Noise Impact Criteria for Transit Projects
Figure 12A-1

Table 12A-3
FTA Detailed Noise Analysis Construction Noise Impact Criteria (in dBA)

Land Use	$L_{eq(8)}$ - Day (7AM to 10PM)	$L_{eq(8)}$ - Night (10PM to 7AM)	L_{dn} 30-Day Average
Residential	80	70	75[1]
Commercial	85	85	80[2]
Industrial	90	90	85[2]

Notes: [1] In urban areas with very high ambient noise levels (L_{dn} greater than 65 dBA), L_{dn} from construction operations should not exceed existing ambient + 10 dBA.

[2] 24 hour L_{eq}, not L_{dn}.

Source: FTA. *Transit Noise and Vibration Impact Assessment Manual,* FTA Report No. 0123, September, 2018.

12A.2.2.2.2 New York City CEQR Noise Impact Criteria

For receptors in New York City, the construction noise impact criteria from the New York City *CEQR Technical Manual* were also considered in the identification of adverse noise impacts. The *CEQR Technical Manual* was developed by New York City for evaluation of the environmental impacts of projects proposed in New York, based on local conditions and issues; these criteria for adverse impacts are well suited for evaluation of effects in New York City. Consideration of noise impacts using CEQR impact criteria will allow New York City agencies that will issue a permit or approval to use this analysis to meet their environmental review obligations under CEQR.

Chapter 22, Section 100 of the *CEQR Technical Manual* breaks construction duration into "short-term" and "long-term" and states that construction noise is not likely to require analysis unless it "affects a sensitive receptor over a long period of time." Consequently, the construction noise analysis considers both the potential for construction of a project to create high noise levels (the "intensity"), and whether construction noise would occur for an extended period of time (the "duration") in evaluating potential construction noise effects.

Chapter 19, Section 421 of the *CEQR Technical Manual* states that the impact criteria for vehicular sources, using conditions without the proposed project, or the "No Action" noise level as the baseline, should be used for assessing construction effects. As recommended in Chapter 19, Section 410 of the *CEQR Technical Manual*, this study uses the following CEQR criteria to define a significant adverse noise impact from mobile and on-site construction activities:

- If the No Action noise level is less than 60 dBA Leq(1), a 5 dBA Leq(1) or greater increase would be considered significant per CEQR criteria.
- If the No Action noise level is between 60 dBA Leq(1) and 62 dBA Leq(1), a resultant Leq(1) of 65 dBA or greater would be considered a significant increase per CEQR criteria.
- If the No Action noise level is equal to or greater than 62 dBA Leq(1), or if the analysis period is a nighttime period (defined in the *CEQR* criteria as being between 10 PM and 7 AM), the incremental significant impact threshold would be 3 dBA $L_{eq(1)}$ per CEQR criteria.

Because future noise levels for the Project site and surrounding area in New York City without the Preferred Alternative will be comparable to existing noise levels in New York, with only moderate noise increases due to growth of vehicular traffic in the area as a result of the numerous new development projects anticipated, existing noise levels were used as a conservative representation of future noise levels in the No Action condition for the construction noise analysis.

12A.2.3 METHODOLOGY FOR EVALUATING NOISE IMPACTS

12A.2.3.1 CONSTRUCTION IMPACTS

FRA and NJ TRANSIT analyzed airborne noise associated with construction of the Preferred Alternative using the procedures for Detailed Noise Analysis described in the FTA guidance manual to the extent possible based on the conceptual construction information available. **Appendix 12** includes an illustration of the conceptual staging site layouts that were analyzed in this chapter, with the potential locations of different kinds of construction equipment on each staging site. Noise due to the operation of construction equipment on-site at a specific receptor location near a construction site was calculated by computing the sum of the noise produced by all major pieces of equipment operating at the construction site. For each piece of equipment the noise levels at a receptor site is a function of:

- The noise emission level of the equipment;
- A usage factor, which accounts for the percentage of time the equipment is operating;
- The distance between the piece of equipment and the receptor;
- Topography and ground effects; and
- Shielding.

Similarly, noise levels due to construction traffic are a function of:

- The noise emission levels of the type of vehicle (e.g., auto, light-duty truck, heavy-duty truck, bus);
- Vehicular speed;
- The distance between the roadway and the receptor;
- Topography and ground effects; and
- Shielding.

For the analysis, FRA and NJ TRANSIT assumed a confluence of worst-case conditions—peak Project-generated construction traffic, peak construction, and lowest ambient noise levels for existing conditions, all operating simultaneously during the construction periods. This methodology resulted in a conservative estimate of impacts. FRA and NJ TRANSIT compared the projected construction noise levels at each receptor to the FTA construction noise impact criteria to determine the potential for construction noise impacts. The identification of impacts at receptors near the Project construction work areas considered the magnitude of construction noise at the receptors as well as the duration of construction at the adjacent work area.

FRA and NJ TRANSIT estimated the noise levels associated with construction-generated mobile noise sources (i.e., construction vehicles operating on roadways) in New York City using the method described in subsection 332.1 of the *CEQR Technical Manual*, which employs the concept of "Noise Passenger Car Equivalents" (Noise PCEs). This concept involves converting predicted truck volumes into the number of cars that would result in the same amount of noise (where a medium-duty truck is equivalent to 13 passenger cars and a heavy truck is equivalent to 47 passenger cars). FRA and NJ TRANSIT compared the estimated construction-generated Noise PCEs existing Noise PCEs along roadways adjacent to receptors to conservatively estimate the change in noise levels due to mobile construction noise sources.

12A.2.3.2 OPERATIONAL IMPACTS

For the analysis of operational airborne noise, FRA and NJ TRANSIT used the following procedures:

- Identification of noise-sensitive land uses (e.g., residential, church, certain parks) within the screening distance from the alignment and selection of representative noise receptor sites.
- Determination of existing noise levels at the selected receptor sites by performing field measurements and using acoustical fundamentals. For sites at which direct access to conduct noise level measurements was not available, measurements performed at a nearby location with a comparable level of non-rail noise were used to represent existing noise levels.
- At selected noise receptor sites that experience existing rail noise, calculation of existing rail noise levels at each receptor site for each analysis time period using FRA's Chicago Rail Efficiency and Transportation Efficiency (CREATE) model and data associated with the existing conditions on the railway. These calculated rail noise levels were then subtracted from measured existing noise levels to determine the non-rail component of the noise level (e.g., noise from vehicular traffic, aircraft, parking lots, etc.) at each site.
- Calculation of future rail noise levels resulting from the Preferred Alternative according to the CREATE model.
- Calculation of future noise levels resulting from operation of the proposed fan plants included in the Preferred Alternative based on manufacturer's specifications for the proposed ventilation equipment.
- Determination of future noise levels with the Preferred Alternative at each receptor site as the sum of calculated rail noise level, ventilation shaft fan plant noise level, and the calculated non-rail noise level.
- Determination of the Project noise exposure at each receptor site, using the future noise levels for the Preferred Alternative.
- Comparison of the Project noise exposure for the Preferred Alternative to the FTA criteria to identify potential impacts.

12A.2.3.3 SELECTION OF RECEPTOR LOCATIONS

The study area for the operational airborne noise study includes receptors within the FTA guidance manual screening distances of the proposed new surface tracks in the Meadowlands in New Jersey and the new fan plants in New Jersey and New York. The study area for the construction airborne noise study includes receptors within the FTA guidance manual screening distances of the new surface tracks in New Jersey and the fan plant buildings and construction staging areas in New York and New Jersey.

12A.2.3.4 METHODOLOGY AND EQUIPMENT USED FOR NOISE SURVEY

Noise measurements were taken using Brüel & Kjær Noise Level Meters Type 2260 and 2250, Brüel & Kjær Sound Level Calibrators Type 4231, and Brüel & Kjær ½-inch microphones Type 4189. Instruments were mounted at a height of approximately 5 feet above the ground. The meters were calibrated before and after readings using Brüel & Kjær Type 4231 sound level calibrators using the appropriate adaptors. The sound meters digitally recorded the data and displayed the data at the end of the measurement period in units of dBA. Measured quantities included L_{eq}, L_1, L_{10}, L_{50}, and L_{90}. Windscreens were used during all sound measurements except for calibration. All measurement procedures conformed to the requirements of ANSI Standard S1.13-2005.

12A.3 AFFECTED ENVIRONMENT: EXISTING CONDITIONS

12A.3.1 NEW JERSEY

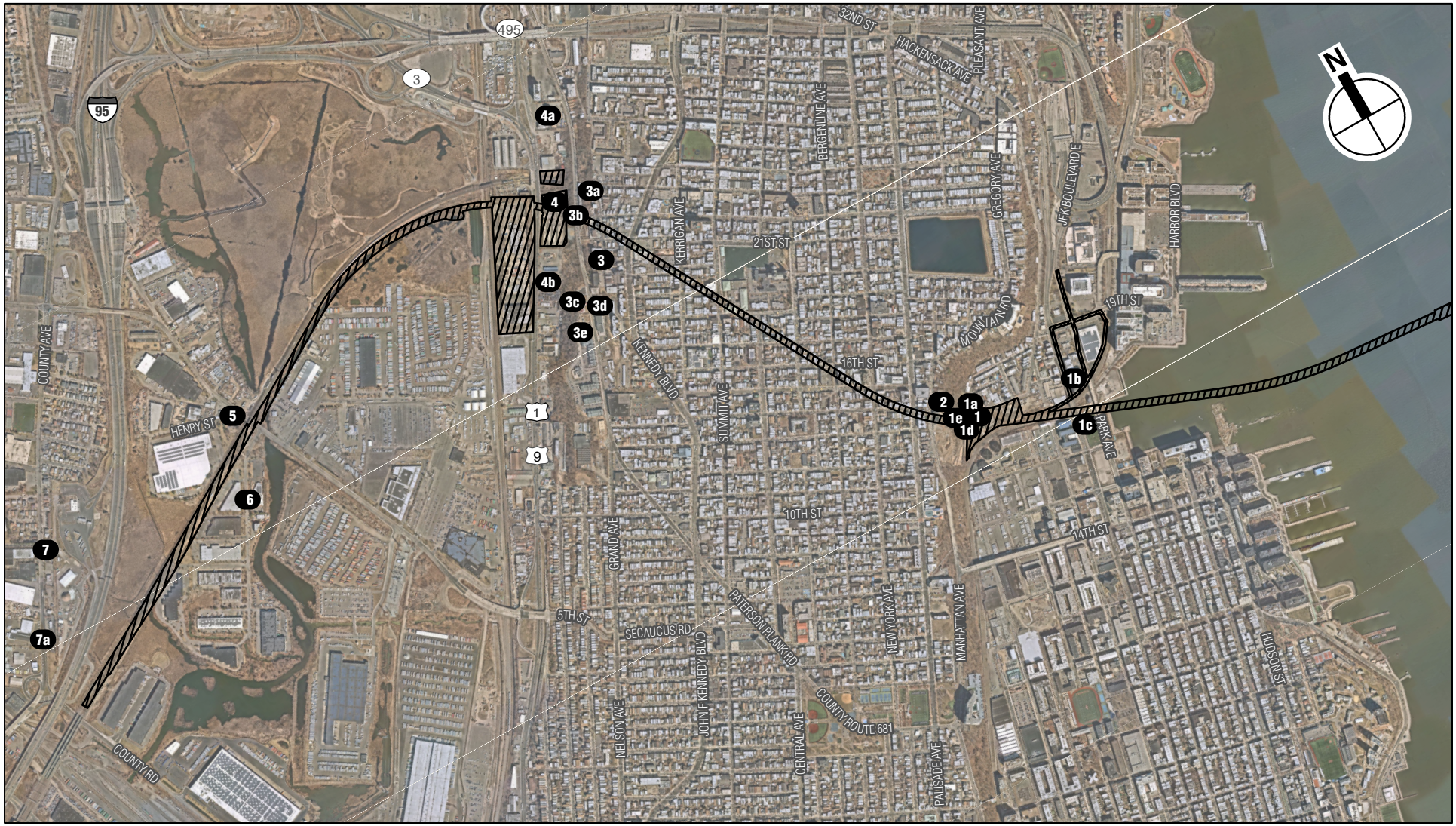
12A.3.1.1 NOISE RECEPTOR LOCATIONS

Twenty receptor sites in New Jersey were selected to represent noise-sensitive locations that would have the greatest potential to experience noise level increases resulting from the Preferred Alternative. The receptors are representative of existing land uses in the Project area and were chosen to provide geographic coverage of the areas where noise impacts may occur. The 20 receptor locations were selected at the closest developed land uses to the new surface tracks in the Meadowlands, the new Hudson River Tunnel portal at Tonnelle Avenue, the Hoboken fan plant, and each of the construction staging areas in New Jersey. For this reason, each receptor studied would be more likely to experience noise impacts from Project activities than other sites in their general locations. For example, receptors near the Hoboken staging area were chosen to include representative locations for: the residences immediately adjacent to staging area/fan plant in the Shades neighborhood of Weehawken (receptor 1a); the new residential development currently under construction on Manhattan Avenue adjacent to the Hoboken staging site in Union City (receptors 1d and 1e); the residences at the top of the Palisades above the Hoboken staging site in Union City (receptor 2); and the residences and park near the underpinning work at Willow Avenue east of the Hoboken staging site in Hoboken (receptors 1b and 1c). The locations of the 20 receptor sites are listed in **Table 12A-4** and shown in **Figure 12A-2**.

A recording studio on Park Avenue in Weehawken is also located within the area that may experience elevated noise levels resulting from construction of the Preferred Alternative. The recording studio does not have windows and the masonry façade of the building would shield the interior uses from airborne noise. FRA and NJ TRANSIT analyzed the potential impacts at this location due to vibration and ground-borne noise associated with the Preferred Alternative in this FEIS in Chapter 12B, “Vibration,” Section 12B.7.2.

Following the DEIS, FRA and NJ TRANSIT updated the noise analysis for this FEIS to include new residences and a park on Paterson Plank Road, represented by receptors 3c, 3d, and 3e, and a future residential development currently under construction on Manhattan Avenue in Union City, represented by receptors 1d and 1e. In addition, FRA and NJ TRANSIT adjusted the analysis to account for the noise of train horns for trains approaching the North River Tunnel along the surface alignment in the Meadowlands. In this area, train operators on the NEC are required to sound train horns on the approach to the North River Tunnel near Tonnelle Avenue in the Meadowlands, to protect the safety of workers who may be working in the vicinity.

4/27/2021



HUDSON TUNNEL PROJECT

New Jersey Noise Receptor Locations

Figure 12A-2

Table 12A-4
Noise Receptor Locations in New Jersey

Receptor Site[1]		Land Use Represented	FTA Land Use Category	Noise Descriptor
1[2]	77 West 18th St, Weehawken	Noise survey location representing Site 1a, 1b, and 1c	2	L_{dn}
1a	78 West 18th St, Weehawken	Residential	2	L_{dn}
1b[3]	1700 Park Ave, Weehawken	Residential	2	L_{dn}
1c[3]	1600 Park, Hoboken	Recreational	3	Daytime $L_{eq(1h)}$
1d	1300 Manhattan Avenue (Block 187), Union City	Future Residential	2	L_{dn}
1e	1300 Manhattan Avenue (Block 185), Union City	Future Residential	2	L_{dn}
2	1404 Manhattan Ave, Union City	Residential	2	L_{dn}
3	2001 Grand Ave, North Bergen	Residential	2	L_{dn}
3a	2215 Grand Ave, North Bergen	Residential	2	L_{dn}
3b	2200 Paterson Plank Rd, North Bergen	Residential	2	L_{dn}
3c	Paterson Plank Park, 1811 Paterson Plank Rd, North Bergen	Recreational	3	Daytime $L_{eq(1h)}$
3d	1607 Paterson Plank Rd, North Bergen	Residential	2	L_{dn}
3e	1706 Paterson Plank Rd, North Bergen	Residential	2	L_{dn}
4[2]	2432 Tonnelle Ave, North Bergen	Noise survey location representing Site 4a and 4b	2	L_{dn}
4a	2600 Tonnelle Ave, North Bergen	Hotel	2	L_{dn}
4b	2000 Tonnelle Ave, North Bergen	Religious	3	Daytime $L_{eq(1h)}$
5	Henry St (near Secaucus Rd on north side of NEC), Secaucus	Residential	2	L_{dn}
6	200 Penhorn Ave, Secaucus	Religious	3	Daytime $L_{eq(1h)}$
7	148 County Ave, Secaucus	Residential	2	L_{dn}
7a	58 County Ave, Secaucus	Residential	2	L_{dn}

Notes: [1] See **Figure 12A-2** for locations.
[2] While receptors 1, 4, and 7 are not noise-sensitive locations, FRA and NJ TRANSIT used measured noise levels from these locations to represent other noise-sensitive areas.
[3] These receptors were outside the screening distance for the operational noise analysis, but were in proximity to construction work areas; therefore were included in the construction noise analysis only.

12A.3.1.2 MEASURED NOISE LEVELS

Noise measurements were conducted at survey locations to represent each of the receptors in **Table 12A-8**. Data from the surveys were utilized to determine existing noise levels according to the FTA guidelines, using the noise level descriptor for each receptor's land use category per **Table 12A-4**. At receptor sites 1, 4, and 7, 24-hour continuous noise level measurements were conducted, as indicated in **Table 12A-5**. For the remaining residential receptors, 24-hour measurements could not be conducted due to site access and security. Instead, one-hour spot noise measurements were conducted during the AM peak, midday, and late-night time periods. Noise levels from these three measurements were combined to estimate the existing L_{dn} following the

guidelines in Appendix E of the FTA manual. At receptor site 6, one-hour spot noise level measurements were conducted during the peak AM time period, which represents the peak (i.e., worst-case) period of noise production for the Project, since this is when peak vehicle activities would occur. Noise level measurements were conducted on October 26 and November 1, 2, 3, 4, 14, 15, and 18, 2016.

Existing noise at receptors 3a through 7a includes noise generated by existing rail operations along the Northeast Corridor (NEC), including the noise from train horns of trains on the surface tracks in the Meadowlands approaching the existing tunnel portal in North Bergen. Additionally, existing noise levels at all receptors include noise generated by other sources including vehicular traffic, aircraft overflights, and nearby mechanical equipment. The CREATE rail model, along with existing conditions rail traffic data, was used to determine the level of rail noise at each receptor location. To determine the level of non-rail noise at each receptor, noise levels were measured at or near the receptor site, and the calculated rail noise (obtained using the CREATE rail model) was subtracted from the measured level. At receptor sites 1a, 1b, 1c, 1d, 1e, 3a, 3b, 3c, 3d, 3e, 4a, 4b, and 7a, measurements conducted at nearby locations with comparable levels of non-rail noise were used to estimate existing noise levels. In some cases, the measurement location was up to a few hundred feet away from the receptor location. The total existing noise level at each noise receptor site consists of the existing condition rail noise level and the calculated non-rail noise level.

Table 12A-5 shows the calculated rail noise, calculated non-rail noise, and existing noise levels (which are the sum of the rail and non-rail noise components) at each New Jersey receptor site. These values were calculated following the procedures described above.

12A.3.2 HUDSON RIVER

There are no noise receptors within the Hudson River that would have the potential to experience adverse impacts as a result of the Preferred Alternative. The nearest upland area or structure to the work area within the river would be the bulkhead along the west side of Manhattan, approximately 700 feet to the east. At this distance, noise produced by construction of the Preferred Alternative would not have the potential to appreciably increase noise levels. For discussion of construction noise effects on the in-water environment, please see Chapter 11, “Natural Resources,” Section 11.6.3.1.3.

Table 12A-5
Existing Noise Levels in New Jersey (in dBA)

Receptor Site		FTA Land Use Category	Noise Descriptor	Measurements Performed	Calculated Rail Noise Level Component	Calculated Non-Rail Noise Level Component	Existing Noise Level
1a	78 West 18th St, Weehawken	2	L_{dn}	Based on 24-hour at Site 1	0	60	60
1b	1700 Park Ave, Weehawken	2	L_{dn}	Based on 24-hour at Site 1	0	60	60
1c	1600 Park, Hoboken	3	Daytime $L_{eq(1h)}$	Based on 24-hour at Site 1	0	57	57
1d	1300 Manhattan Avenue (Block 187), Union City	2	L_{dn}	Based on 24-hour at Site 1	0	60	60
1e	1300 Manhattan Avenue (Block 185), Union City	2	L_{dn}	Based on 24-hour at Site 1	0	60	60
2	1404 Manhattan Ave, Union City	2	L_{dn}	AM peak, midday, late night	0	63	63
3	2001 Grand Ave, North Bergen	2	L_{dn}	AM peak, midday, late night	56	0	56
3a	2215 Grand Ave, North Bergen	2	L_{dn}	Based on Site 3	56	0	56
3b	2200 Paterson Plank Rd, North Bergen	2	L_{dn}	Based on Site 3	56	0	56
3c	Paterson Plank Park, 1811 Paterson Plank Rd, North Bergen	3	Daytime $L_{eq(1h)}$	Based on Site 3	52	49	54
3d	1607 Paterson Plank Rd, North Bergen	2	L_{dn}	Based on Site 3	53	52	56
3e	1706 Paterson Plank Rd, North Bergen	2	L_{dn}	Based on Site 3	52	53	56
4a	2600 Tonnelle Ave, North Bergen	2	L_{dn}	Based on 24-hour at Site 4	64	71	72
4b	2000 Tonnelle Ave, North Bergen	3	Daytime $L_{eq(1h)}$	Based on 24-hour at Site 4	58	67	68
5	Henry St, Secaucus	2	L_{dn}	AM peak, midday, late night	78	0	78
6	200 Penhorn Ave, Secaucus	3	Daytime $L_{eq(1h)}$	AM peak	59	66	66
7a	58 County Ave, Secaucus	2	L_{dn}	24-hour	63	78	78

Note: Field measurements were performed by AKRF, Inc. on October 26 and November 1, 2, 3, 4, 14, 15, and 18, 2016.

12A.3.3 NEW YORK

12A.3.3.1 NOISE RECEPTOR LOCATIONS

In New York, FRA and NJ TRANSIT selected six receptor sites to represent noise-sensitive locations that would have the greatest potential to experience noise level increases resulting from the Preferred Alternative. The receptors are representative of existing land uses in the Project area and provide geographic coverage of the areas where noise impacts may occur. FRA and

NJ TRANSIT selected the six receptor locations at the closest developed land uses to the proposed Twelfth Avenue fan plant in New York, the in-water construction work site, and the construction staging areas in New York. These receptors included one receptor, receptor 8a, at a site where a new residential building was proposed (and is now in construction)(see discussion in Section 12A.4 below). For this reason, each receptor would yield maximum noise impacts (i.e., other potential receptor sites in the general location of the selected receptors would have lesser impacts). The locations of the six receptor sites are listed in **Table 12A-6** and shown in **Figure 12A-3**.

Table 12A-6
Noise Receptor Locations in New York

Site*	Location	Land Use Represented	FTA Land Use Category	Noise Descriptor
8	312 Eleventh Ave	Residential	2	L_{dn}
8a	606 West 30th St (east end of Block 675)	Future Residential	2	L_{dn}
8b	413 Tenth Ave	Residential	2	L_{dn}
8c	450 West 33rd St	Commercial	3	Daytime $L_{eq(1h)}$
9	High Line	Recreational	3	Daytime $L_{eq(1h)}$
10	Hudson River Park	Recreational	3	Daytime $L_{eq(1h)}$

Note: * See **Figure 12A-3** for locations.

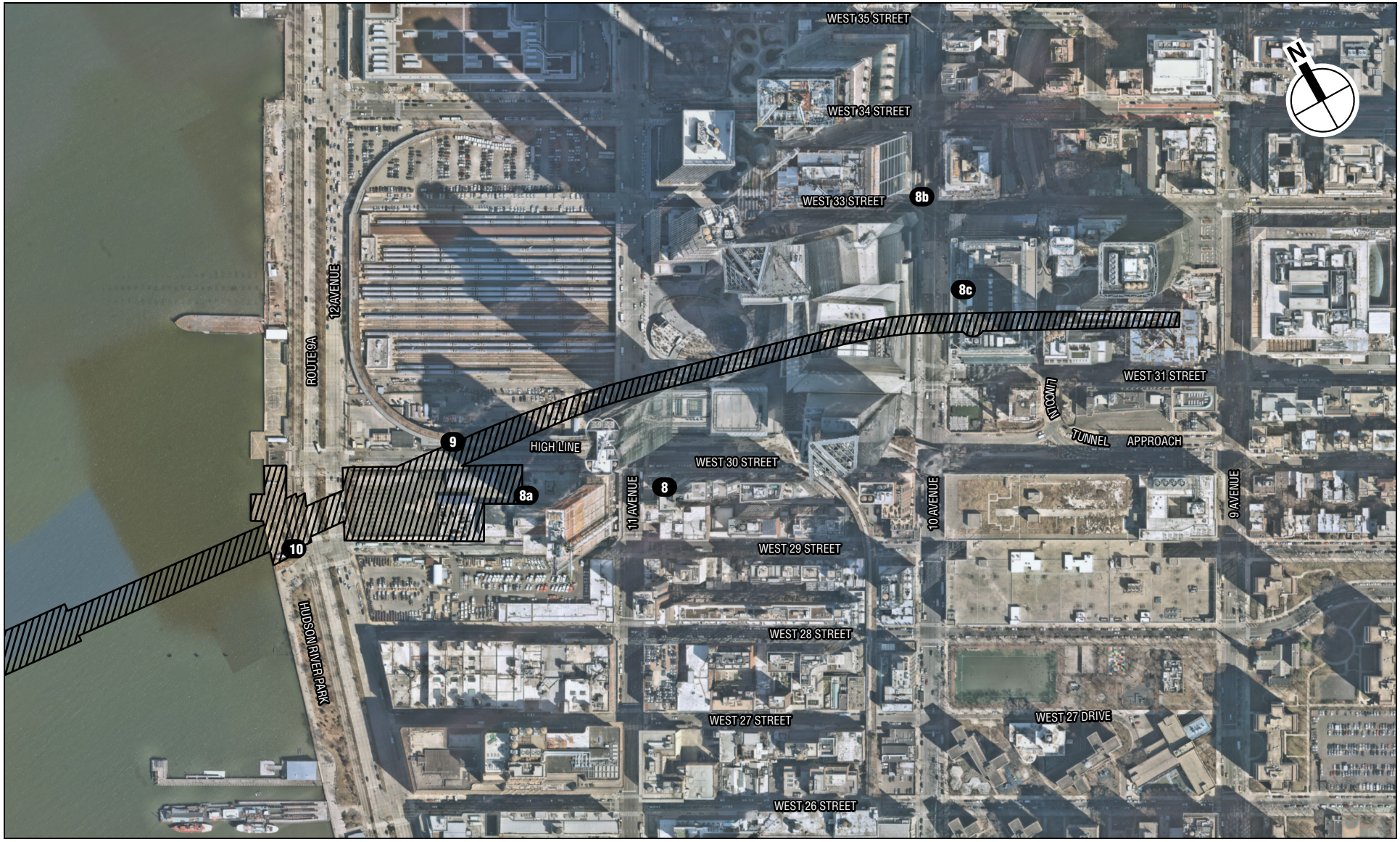
12A.3.3.2 MEASURED NOISE LEVELS

FRA and NJ TRANSIT conducted noise measurements at survey locations to represent each of the receptors in **Table 12A-6** and analyzed data from the surveys to determine existing noise levels according to the FTA guidelines (using the noise level descriptor for each receptor's land use category per **Table 12A-3**). At the receptor sites in New York, FRA and NJ TRANSIT could not conduct 24-hour measurements due to issues of site access and security. Instead, one-hour spot noise measurements were conducted at receptor 8 during the AM peak, midday, and late-night time periods. At receptor sites 9 and 10, one-hour spot noise level measurements were conducted during the peak AM time period. Noise level measurements were conducted on October 26 and November 1, 2, 3, 4, 14, 15, and 18, 2016.

Because the existing rail infrastructure is underground in New York, rail operations do not contribute to existing noise levels at these receptors. Existing noise levels at all receptors include noise generated by vehicular traffic, aircraft overflights, nearby mechanical equipment, etc. At receptor sites 8a, 8b, and 8c, measurements conducted at nearby locations with comparable levels of non-rail noise were used to estimate existing noise levels. In some cases, the measurement location was up to a few hundred feet away from the receptor location.

Table 12A-7 shows the existing noise levels at each New York receptor site.

4/24/2021



Project Site

8 *Noise Receptor*

HUDSON TUNNEL PROJECT

New York Noise Receptor Locations

Figure 12A-3

Table 12A-7
Existing Noise Levels in New York (in dBA)

Site	Location	Land Use Represented	FTA Land Use Category	Noise Descriptor	Measurements Performed	Existing Noise Level
8	312 Eleventh Ave	Residential	2	L_{dn}	AM peak, midday, late night	78
8a	606 West 30th St	Future Residential	2	L_{dn}	Based on Site 8	78
8b	413 Tenth Ave	Residential	2	L_{dn}	Based on Site 8	78
8c	450 West 33rd St	Commercial	3	Daytime $L_{eq(1h)}$	Based on Site 8	72
9	High Line	Recreational	3	Daytime $L_{eq(1h)}$	AM peak	71
10	Hudson River Park	Recreational	3	Daytime $L_{eq(1h)}$	AM peak	73

Note: Field measurements were performed by AKRF, Inc. on October 26 and November 1, 2, 3, 4, 14, 15, and 18, 2016. At all of these sites, rail noise was not a component.

12A.4 AFFECTED ENVIRONMENT: FUTURE CONDITIONS

In the future, absent implementation of the Preferred Alternative, train traffic on the NEC may increase slightly during off-peak periods, as Penn Station New York (PSNY) currently operates at capacity during the peak periods—there is no additional capacity to process trains at the platforms as discussed in Chapter 2, "Project Alternatives and Description of the Preferred Alternative," in Section 2.4; rail speed will remain constant for Amtrak and NJ TRANSIT trains. This will result in very small noise level increases at some of the receptors included in the analysis.

In addition, by the 2033 analysis year, a number of private development and public infrastructure projects will occur in the Project vicinity in New Jersey and New York. In New Jersey, these include the Rebuild By Design project in Hoboken, New Jersey; a new residential development currently under construction on Manhattan Avenue in Union City, adjacent to the proposed Hoboken staging site and fan plant site; and ongoing large-scale waterfront redevelopment within the Lincoln Harbor Redevelopment Area just north of Weehawken Cove, in Weehawken, New Jersey. There will also be numerous new developments in the New York study area, including new development on the same block as the proposed Twelfth Avenue staging area—the block between West 29th and West 30th Streets, Eleventh and Twelfth Avenues (Manhattan Block 675). At the east end of the block, two private developers are constructing new high-rise, predominantly residential buildings for completion in 2022.

12A.5 IMPACTS OF NO ACTION ALTERNATIVE

Under the No Action Alternative, construction of the Preferred Alternative would not occur. The No Action Alternative would not include major sustained construction, and the typical maintenance of the North River Tunnel under the No Action Alternative would also not have the potential to result in adverse noise impacts.

12A.6 CONSTRUCTION IMPACTS OF THE PREFERRED ALTERNATIVE

12A.6.1 OVERVIEW

Construction of the Preferred Alternative would include construction of the new tracks, portal, tunnel, and fan plants for the new Hudson River Tunnel alignment south of the existing North River Tunnel, as well as the rehabilitation of the existing North River Tunnel, as described in detail in

Chapter 3, “Construction Methods and Activities.” During construction, on-site equipment at the construction staging areas would result in construction-related noise in the surrounding areas. In addition, construction-related vehicles (e.g., delivery trucks, dump trucks, etc.) traveling to and from the construction work areas would also result in noise along the truck routes. FRA and NJ TRANSIT examined the potential noise impacts of these sources, using assumptions on the potential layout of the construction staging sites; types, numbers, and usage of equipment on the construction sites; and potential worst-case truck volumes traveling on truck routes to and from the staging areas (see Section 12A.2.3.1 for additional discussion of the methodology).

12A.6.2 NEW JERSEY

12A.6.2.1 SURFACE ALIGNMENT CONSTRUCTION

Construction of the New Jersey surface alignment would include construction of a new embankment section supported by a retaining wall, a 3,100-foot-long viaduct structure and several rail bridges, as discussed in Chapter 3, “Construction Methods and Activities,” Section 3.3.1. Construction of the new right-of-way would last approximately four years. That would include approximately one year of pile driving to create the foundations for retaining walls, bridges, and the viaduct structure. Construction would generally occur on weekdays from 7 AM to 11 PM, but construction activities that would occur close to the existing NEC tracks would occur predominantly on nights and weekends to avoid disruptions to train service.

Construction noise levels at the surrounding noise receptors, i.e., receptors 5, 6, and 7a, were calculated according to the methodology described in Section 12A.2. Calculated construction noise levels are shown in **Table 12A-8**. The analysis has been revised since the DEIS to reflect revisions and refinements to the construction staging approach and more refined information on construction equipment to be used.

Construction of the New Jersey surface alignment would produce noise levels that exceed the impact thresholds identified in **Table 12A-3** at receptor 5, on Henry Street near Secaucus Road on the north side of the NEC and receptor 7a, on County Avenue on the north side of the NEC in Secaucus, New Jersey. Over a period of approximately a year, construction along the New Jersey surface track alignment would use impact pile drivers, which are the dominant source of construction noise. (See **Appendix 12** for a full list of construction equipment assumed for this noise analysis.) The pile hammers used as part of this construction stage would move along the surface track alignment and would operate at the closest point to each receptor only for a limited time. Consequently, the noise levels shown above in **Table 12A-8**, which represent worst-case noise levels with equipment at its closest point to the receptor, would not persist throughout the full duration of construction for this segment of the Preferred Alternative. When pile hammers and associated equipment are operating farther away from the receptors, noise levels would be lower. When pile operations are at least 1,000 feet from the receptors, the construction noise levels at the receptors would be less than the FTA construction impact criteria. Since less than approximately 15 percent of the total area of pile driving for the surface and on-structure track construction is within this distance, noise levels would exceed the impact criteria for only a very limited portion of the construction period at these receptors, likely less than two months at any given receptor.

At receptor 7a on the north side of the NEC in Secaucus, predicted worst-case construction noise levels would exceed the nighttime FTA construction impact criteria by no more than 1 dB(A). Further, total nighttime noise levels during construction would be within 3 dB(A) of existing nighttime noise levels, which represents a barely perceptible change in noise levels. While construction noise may be audible and potentially intrusive at times, because of the limited duration of the predicted FTA impact threshold exceedance and the minimal change predicted in

overall noise levels during construction, construction of the Preferred Alternative would not rise to the level of an adverse construction noise impact at this receptor.

At receptor 5, on Henry Street near the north side of the NEC in Secaucus, worst-case construction noise levels would be in the mid 90s dB(A) for a period of approximately 2 months during pile installation. Notwithstanding the relatively short duration of noise at this receptor, because construction noise associated with the Preferred Alternative would be audible and intrusive and would occur during the nighttime hours, it would constitute an adverse construction noise impact according to FTA criteria at receptor 5. The Project Sponsor will coordinate with the occupants of these buildings regarding appropriate mitigation such as temporary accommodations elsewhere while pile driving is occurring overnight within 1,000 feet of these residences.

Table 12A-8
Worst-Case Construction Noise Levels
Near Surface Alignment (in dBA)

Site	Location	Land Use	Existing Noise Level[1]	8-Hour L_{eq} – Day (7 AM to 10 PM)		8-Hour L_{eq} – Night (10 PM to 7 AM)		30-Day Average L_{dn}	
				Impact Criterion	Project Level[1]	Impact Criterion	Project Level[1]	Impact Criterion	Project Level[1]
Meadowlands Viaduct / Retained Embankment (approximately 3 years for the noisiest activities, with approximately 1 year of pile driving)									
5	Henry St, Secaucus	Residential	78	80	N/A[3]	70	**90***	75	**95***
6	200 Penhorn Ave, Secaucus	Religious[2]	66	85	N/A[3]	85	79	80	75
7a	58 County Ave, Secaucus	Residential	78	80	N/A[3]	70	**71***	75	75
Surface Trackwork / Signals and Communication (approximately 13 months for the noisiest activities)									
5	Henry St, Secaucus	Residential	78	80	**86***	70	**77***	75	**85***
6	200 Penhorn Ave, Secaucus	Religious[2]	66	85	75	85	66	80	73
7a	58 County Ave, Secaucus	Residential	78	80	76	70	67	75	75

Notes:
[1] Noise levels for residential receptors (sites 5 and 7a) are in L_{dn}; noise levels for religious receptors (site 6) are in 24-hour L_{eq}.
[2] For the religious use, the impact criteria for commercial uses were used.
[3] Construction activity during nighttime hours only.
***** Exceedances of the FTA construction noise impact thresholds are shown in **bold** with an asterisk (*****).
See **Figure 12A-2** for receptor locations.

At receptors other than those described above, which would be farther from the construction work areas, construction noise would at times be audible, but the construction noise levels would be lower than those shown in **Table 12A-8** and would not constitute adverse noise impacts according to FTA criteria.

12A.6.2.2 CONSTRUCTION OF NEW TUNNEL AND RELATED ELEMENTS AT THE TONNELLE AVENUE STAGING AREA

The Tonnelle Avenue staging area would be used for approximately seven years to support construction of the surface tracks and the new Hudson River Tunnel. This would include construction of the new underpass beneath Tonnelle Avenue (which involves building a new roadway bridge over the tunnel approach tracks), the below-grade approach tracks leading to the tunnel, and the tunnel portal itself and the initial tunnel in the Palisades. It also includes mining of the new tunnel using a tunnel boring machine (TBM) through the Palisades, beneath Hoboken, and under the Hudson River to New York. In addition, some of the work related to construction of the surface tracks through the Meadowlands would be supported at the Tonnelle Avenue staging

area. Construction would generally occur on weekdays from 7 AM to 11 PM. See Chapter 3, "Construction Methods and Activities," Sections 3.3.1, 3.3.2, and 3.3.4 for more information on this construction.

12A.6.2.2.1 Trucking Activities

Construction at the Tonnelle Avenue staging area would include truck access to the site via Tonnelle Avenue. The construction trucks, including concrete mixer trucks, materials delivery trucks, and dump trucks for spoils removal, would pass by residences on Tonnelle Avenue between 10th Street and Secaucus Road at a rate of up to approximately 13 to 26 trucks per hour in each direction during the daytime and evening hours (i.e., from 7 AM to 10 PM). This would produce L_{eq} noise levels in the mid 80s dBA, which would exceed the construction noise impact threshold for residential uses. Conservatively assuming this level of trucking activity over the whole construction period, this would occur over approximately seven years of construction at the Tonnelle Avenue tunnel portal and staging area and would consequently constitute an adverse noise impact according to FTA criteria at the residences along the truck routes to and from this construction work area, located in the vicinity of Tonnelle Avenue at between 10th Street and Secaucus Road in North Bergen, New Jersey. This estimate of the duration of the adverse impact is conservative, and the actual duration would likely be shorter, since intensive trucking activity would not be required for all stages of construction.

As discussed in Chapter 5A, "Traffic and Pedestrians," Section 5A.6.2.1.8, FRA and NJ TRANSIT have evaluated a potential measure to mitigate the traffic impacts resulting from construction traffic on Tonnelle Avenue. This measure is the introduction of a new traffic signal on Tonnelle Avenue at the driveway of the Tonnelle Avenue staging area, to allow northbound trucks to exit the staging area without heading south to use the U-turn at Secaucus Road in order to travel north. With this measure, the residences along Tonnelle Avenue between 10th Street and Secaucus Road would not experience the truck traffic levels described above and would consequently not be subject to an adverse noise impact due to construction of the Project. Implementation of this mitigation measure requires approval from the New Jersey Department of Transportation (NJDOT), so the analysis in this chapter describes the noise impacts both with and without the new signal.

12A.6.2.2.2 Noise at the Staging Area

Construction at the new tunnel portal along Tonnelle Avenue would include the use of construction equipment at the construction staging area on Tonnelle Avenue close to existing noise receptor locations. Construction noise levels at the surrounding noise receptors, i.e., receptors 3, 3a, 3b, 3d, 3e, 4a, and 4b, were calculated according to the methodology described in Section 12A.2. Calculated construction noise levels are shown in **Table 12A-9**. The analysis has been revised since the DEIS to reflect revisions and refinements to the construction staging approach and more refined information on construction equipment to be used at the site.

Construction at the Tonnelle Avenue tunnel portal would produce noise levels that exceed the residential impact thresholds identified in **Table 12A-3** at receptor 3, 3a, and 3b and the institutional impact thresholds at receptor 4b. Construction activities at the new tunnel portal would include pile driving with vibratory pile drivers at the new Tonnelle Avenue underpass and augured installation of piles at the new tunnel portal, which would be the dominant sources of construction noise. Additional equipment that would contribute to elevated noise levels includes the surface conveyor (for transporting excavated materials from the portal to a stockpile), tractors, compressors, forklifts, cherry pickers, cranes, and front end loaders. (See **Appendix 12** for a full list of construction equipment assumed for this noise analysis.)

Table 12A-9
Worst-Case Construction Noise Levels
Near Tonnelle Avenue Staging Area
During New Tunnel Construction(in dBA)

Site	Location	Land Use	Existing Noise Level[1]	8-Hour L_{eq} – Day (7 AM to 10 PM)		8-Hour L_{eq} – Night (10 PM to 7 AM)		30-Day Average L_{dn}	
				Impact Criterion	Project Level[1]	Impact Criterion	Project Level[1]	Impact Criterion	Project Level[1]
Tunnel Mining and Tonnelle Avenue Underpass (approximately 9 months for the noisiest activities)									
3	2001 Grand Ave, North Bergen	Residential	56	80	73	70	**72***	75	**77***
3a	2215 Grand Ave, North Bergen	Residential	56	80	73	70	**72***	75	**77***
3b	2200 Paterson Plank Rd, North Bergen	Residential	56	80	72	70	69	75	**75***
3d	1607 Paterson Plank Rd, North Bergen	Residential	56	80	63	70	64	75	69
3e	1706 Paterson Plank Rd, North Bergen	Residential	56	80	63	70	64	75	69
4a	2600 Tonnelle Ave, North Bergen	Residential	72	80	67	70	70	75	74
4b	2000 Tonnelle Ave, North Bergen	Religious[2]	68	85	81	85	82	80[2]	**81***
Below Grade and Above Grade Concrete at Portal (approximately 5 months for the noisiest activities)									
3	2001 Grand Ave, North Bergen	Residential	56	80	65	70	67	75	72
3a	2215 Grand Ave, North Bergen	Residential	56	80	65	70	67	75	72
3b	2200 Paterson Plank Rd, North Bergen	Residential	56	80	65	70	62	75	67
3d	1607 Paterson Plank Rd, North Bergen	Residential	56	80	55	70	62	75	67
3e	1706 Paterson Plank Rd, North Bergen	Residential	56	80	55	70	62	75	67
4a	2600 Tonnelle Ave, North Bergen	Residential	72	80	58	70	69	75	73
4b	2000 Tonnelle Ave, North Bergen	Religious[2]	68	85	62	85	80	80	76
Fit Out and Mechanical, Electrical, and Plumbing Finishes (approximately 18 months)									
3	2001 Grand Ave, North Bergen	Residential	56	80	69	70	60	75	68
3a	2215 Grand Ave, North Bergen	Residential	56	80	69	70	60	75	68
3b	2200 Paterson Plank Rd, North Bergen	Residential	56	80	69	70	60	75	67
3d	1607 Paterson Plank Rd, North Bergen	Residential	56	80	59	70	50	75	58
3e	1706 Paterson Plank Rd, North Bergen	Residential	56	80	59	70	50	75	58
4a	2600 Tonnelle Ave, North Bergen	Residential	72	80	62	70	53	75	61
4b	2000 Tonnelle Ave, North Bergen	Religious[2]	68	85	66	85	57	80	65
Tunnel Portal (approximately 10 months)									
3	2001 Grand Ave, North Bergen	Residential	56	80	71	70	62	75	70
3a	2215 Grand Ave, North Bergen	Residential	56	80	71	70	62	75	70
3b	2200 Paterson Plank Rd, North Bergen	Residential	56	80	70	70	61	75	69
3d	1607 Paterson Plank Rd, North Bergen	Residential	56	80	60	70	51	75	59
3e	1706 Paterson Plank Rd, North Bergen	Residential	56	80	60	70	51	75	59
4a	2600 Tonnelle Ave, North Bergen	Residential	72	80	66	70	57	75	65
4b	2000 Tonnelle Ave, North Bergen	Religious[2]	68	85	75	85	66	80	73

Notes: [1] Noise levels for residential receptors (sites 3, 3a, 3b, and 4a) are in L_{dn}; noise levels for religious receptors (site 4b) are in 24-hour L_{eq}.

[2] For the religious use, the impact criteria for commercial uses were used.

***** Exceedances of the FTA construction noise impact thresholds are shown in **bold** with an asterisk (*).

See **Figure 12A-2** for receptor locations.

Pile installation would occur for approximately nine non-consecutive months during work on the Tonnelle Avenue overpass and three months at the new tunnel portal. When pile installation is not occurring, construction noise at these receptors would be lower, but would still exceed FTA construction noise impact criteria as a result of the operation of equipment (e.g., forklifts, loaders, compressors) operating at the Tonnelle Avenue staging area during tunnel mining operations. These pieces of equipment would operate throughout the tunnel boring operations, and therefore noise levels exceeding FTA construction noise impact criteria would persist throughout the approximately two years of tunnel mining from this area. Based on the high levels of noise predicted to occur for an extended duration (approximately 3 years) at receptors 3, 3a, 3b, and 4b, residences in North Bergen, New Jersey, along Paterson Plank Road, and along Grand Avenue between 19th Street and 23rd Street, and the BAPS Shri Swaminarayan Mandir Hindu temple on the east side of Tonnelle Avenue approximately 150 feet east of a portion of the staging area are predicted to experience adverse construction noise impacts.

In the DEIS analysis, FRA and NJ TRANSIT considered noise from construction ventilation fans for tunnel excavation as a primary contributor of noise at receptors 3, 3a, 3b, and 4. The DEIS analysis used an assumption that the tunnel fans would produce a sound pressure level of 85 dBA at a distance of 50 feet from the fans. This noise level was based on supporting data the Federal Highway Administration (FHWA) provides for its Roadway Construction Noise Model,[2] a model for predicting the noise levels from construction projects based on empirical data related to noise from different types of equipment and how that noise propagates. However, FRA and NJ TRANSIT have adjusted this assumption for the analysis in the FEIS. Based on further engineering for the Project design, a 22 dBA reduction to these noise levels is reasonably achievable through proper fan selection and implementation of silencers, resulting in noise levels from fan operation of 63 dBA at 50 feet, which would eliminate the ventilation fans as a primary contributor of noise at these locations.

The new playground/park on Paterson Plank Road is farther from any of the Project construction staging areas than receptors 3, 3a, or 3b and consequently would experience lower levels of construction noise than those receptors. The FTA construction noise analysis guidance does not include an evaluation criterion for open space or playgrounds, but since this playground/park would experience lower levels of construction noise than the other receptors in the construction noise analysis, and the projected levels at those receptors would not exceed the FTA daytime impact criterion (for commercial uses) and these are the hours when parks are typically in use, FRA and NJ TRANSIT have concluded that Project construction activities would not result in an adverse noise impact at the playground/park on Paterson Plank Road based on FTA impact criteria for commercial uses.

At receptors other than those described above, which would be farther from the construction work areas, construction noise may at times be audible, but the construction noise levels would be lower than those shown in **Table 12A-9** and would not constitute adverse noise impacts, as noise levels drop off with increases in distance from noise sources.

12A.6.2.3 HOBOKEN STAGING AREA

The analysis in this FEIS is now revised to incorporate changes to the activities that would occur at the Hoboken staging area. Based on preliminary design, the Hoboken staging area would be used for three different phases of construction activities: (1) construction of the vertical shaft from

[2] U.S. Department of Transportation, Federal Highway Administration, FHWA-HEP-05-054, *Federal Highway Administration Roadway Construction Noise Model User's Guide*, January 2006, pg. 3 - Table 1. CA/T equipment noise emissions and acoustical usage factors database. (CA/T indicates Central Artery Tunnel.) Available at: www.fhwa.dot.gov/Environment/noise/construction_noise/rcnm/rcnm.pdf.

the surface to the depth of the tunnel; (2) as an access point during construction of the new river tunnel segment; and (3) construction of the ventilation fan plant once construction of the tunnel is complete. The construction activities at the Hoboken staging area would last approximately seven years, with the intensity of construction activity varying over that time. Construction would generally occur on weekdays from 7 AM to 11 PM, but no trucking would occur after 10 PM. During the tunnel boring stage, there may be overnight construction activity for up to a year, which was included in this noise analysis. For more information on the construction, see Chapter 3, "Construction Methods and Activities," Section 3.3.3.

12A.6.2.3.1 Trucking Activities

Construction at the Hoboken staging area would include truck access to the site via 19th Street, Willow Avenue, Park Avenue, and an off-street haul route along the north side of the Hudson-Bergen Light Rail (HBLR) right-of-way that would be constructed specifically to allow construction trucks to access the staging area without using local streets.

As discussed in Chapter 3, "Construction Methods and Activities," Section 3.3.3.3, and shown in Figure 3-7, three different routes are evaluated for trucks traveling to and from this off-street truck access road near the staging area. These truck routes, or "haul routes" are as follows:

- Haul route Option 1, using a combination of the Park Avenue service road (along the west side of the Park Avenue viaduct) with the Willow Avenue service road (on the east side of the Willow Avenue viaduct);
- Haul route Option 2, using only the Willow Avenue service road, on both sides of the Willow Avenue viaduct; and
- Haul route Option 3 (added after completion of the DEIS), using an off-street construction road alongside the HBLR right-of-way to 19th Street, avoiding Willow and Park Avenues altogether.

One or more of these routes would be used for truck access to and from the Hoboken staging area and all three routes are evaluated in this chapter.

The construction trucks, including concrete mixer trucks, materials delivery trucks, and large dump trucks for spoils removal, would pass by residences on Willow Avenue south of 19th Street (for haul route Options 1 and 2) and on Park Avenue south of 19th Street (for haul route Option 1), by the residential building between Willow and Park Avenues just north of the HBLR tracks (for haul route Options 1 and 3), and by the public open space at Harbor Path (for haul route Option 3) at a rate of up to 8 trucks per hour in each direction during the daytime hours (which is defined as 7 AM to 10 PM by the FTA noise and vibration impact assessment manual). This would produce L_{eq} noise levels in the high 70s to low 80s dBA, which would exceed the construction noise impact threshold for residential uses but would not exceed the construction noise impact threshold for recreational uses. Conservatively assuming this rate of trucking activity during all tunnel construction, this would occur over the course of the approximately seven years of construction at the Hoboken staging area and would consequently constitute an adverse noise impact at the residences along the truck routes to and from this construction work area—i.e., residences along the Park Avenue service road and Willow Avenue service road and Willow Avenue between the HBLR right-of-way and 19th Street. This estimate of the duration of the adverse impact is conservative, and the actual duration would likely be shorter, since intensive trucking activity would not be required for all stages of construction.

12A.6.2.3.2 Noise at the Staging Area

Construction at the Hoboken staging area would include the use of construction equipment at the staging area, as well as along Willow Avenue south of the HBLR right-of-way along the tunnel alignment where Willow Avenue would be underpinned to move piles from the route of the tunnel alignment. Noise produced by underground construction activities within the tunnel would be

sufficiently shielded from receptors at the surface surrounding the Hoboken staging area such that it would not contribute to construction noise levels there.

Calculated construction noise levels for receptors near the staging area and Willow Avenue underpinning site are shown in **Table 12A-10**. The analysis has been revised since the DEIS to reflect revisions and refinements to the construction staging approach. In addition, the analysis was revised to include the potential influence of reflected noise off the Palisades cliff west of receptor 1a, conservatively assuming a 3 dBA increase in all noise levels due to the additional reflected noise at this receptor.[3]

In the DEIS analysis, FRA and NJ TRANSIT determined that noise from pile installation at the Hoboken shaft was a dominant source of noise resulting in exceedances of the FTA noise impact thresholds at receptors 1a and 2. The DEIS analysis was based on an assumption of impact pile drivers. However, FRA and NJ TRANSIT have revised the noise analysis related to pile installation for the FEIS. Based on further engineering for the Project design, piles would be installed via drilling rather than impact-driven piles at the Hoboken shaft site and staging area. With pile drilling rather than pile driving, noise levels would be 21 dBA lower, which would result in noise levels below the FTA impact criteria at these locations.

The FEIS analysis was updated to include receptors 1d and 1e representing the new residential development currently in construction at 1300 Manhattan Avenue in Union City. In the absence of detailed design information for this residential development is not finalized, this analysis is based on a conservative assumption that the residential receptors would be located on the lot line closest to the construction staging area. If the completed residences are farther from the lot line, noise levels at the residences would be lower than described in this chapter.

Construction at the Hoboken staging area would produce noise levels at receptors 1a, 1b, 1d, 1e, and 2 that would be noticeable and audible, but would be below the FTA impact criteria and would consequently not constitute adverse impacts. Construction at the staging area would use augured piles, which would be the dominant source of construction noise. Additional equipment that contributes to elevated noise levels includes cherry pickers, cranes, and front end loaders. (See **Appendix 12** for a full list of construction equipment assumed for this noise analysis.) This analysis and the noise levels in **Table 12A-10** assume the use of a 25-foot-tall noise barrier along the north boundary of the Hoboken staging area, which would shield the residences in Weehawken along West 18th Street, West 19th Street, and Chestnut Street west of Grand Street, as represented by receptor 1a, from construction noise on the site. This is the height of the wall that was previously proposed by the Access to the Region's Core (ARC) Project.[4] If the noise barrier were constructed at a lower height, the projected noise levels for receptor 1a in **Table 12A-10** would be higher and would exceed FTA noise impact thresholds. Specifically, noise levels would be approximately 2 dBA higher for a 16-foot-tall barrier, approximately 4 dBA higher for a 12-foot-tall barrier, and approximately 6 dBA higher for an 8-foot-tall barrier. These shorter barrier heights would cause the nighttime (i.e., 10 PM-7 AM according to FTA methodology) 8-hour L_{eq} noise level generated by construction to exceed the FTA construction noise impact threshold, and

[3] An increase of 3 dBA represents a doubling of the noise source (i.e., the analysis assumed both the predicted construction noise and that same amount of noise being reflected back from the wall, a very conservative assumption).

[4] The ARC Project was an initiative proposed by NJ TRANSIT to increase passenger rail capacity into Midtown Manhattan. NJ TRANSIT conducted detailed studies and design for the ARC Project from 1995 through 2010, including a Draft, Supplemental Draft, and Final EIS, as well as supplemental studies after completion of the FEIS in support of that project's construction. The ARC Project was cancelled in 2010 shortly after initial construction had begun. Additional information on the ARC Project is provided in the DEIS and FEIS in Chapter 1, "Purpose and Need," Section 1.2.1.

a height of 12 feet or less would cause the daytime 8-hour L_{eq} noise level generated by construction to exceed the FTA construction noise impact threshold. Construction of a noise barrier taller than approximately 12 feet would require foundation construction, and potentially installation of piles for structural support of the barrier, which would itself result in noise at the adjacent residences. However, construction of the noise barrier would occur over a relatively short period of time and would not occur during the nighttime hours when residences are most sensitive to noise.

Table 12A-10
Worst-Case Construction Noise Levels
Near Hoboken Staging Area (in dBA)

Site	Location	FTA Land Use Category	Existing Noise Level[1]	8-Hour L_{eq} – Day (7AM to 10PM)		8-Hour L_{eq} – Night (10PM to 7AM)		30-Day Average L_{dn}	
				Impact Criterion	Project Level[1]	Impact Criterion	Project Level[1]	Impact Criterion	Project Level[1]
Shaft Construction (approximately 23 months)									
1a	78 West 18th St, Weehawken	Residential	60	80	75	70	66	75	74
1d	1300 Manhattan Avenue (Block 187), Union City	Residential	60	80	76	70	67	75	74
1e	1300 Manhattan Avenue (Block 185), Union City	Residential	60	80	71	70	62	75	70
2	1404 Manhattan Ave, Union City	Residential	63	80	67	70	58	75	66
Tunnel Mining (approximately 1 year, potentially including overnight activities)									
1a	78 West 18th St, Weehawken	Residential	60	80	66	70	60	75	67
1d	1300 Manhattan Avenue (Block 187), Union City	Residential	60	80	73	70	66	75	73
1e	1300 Manhattan Avenue (Block 185), Union City	Residential	60	80	67	70	61	75	67
2	1404 Manhattan Ave, Union City	Residential	63	80	64	70	58	75	65
Fan Plant Construction (approximately 3 months for the noisiest activities)									
1a	78 West 18th St, Weehawken	Residential	60	80	75	70	66	75	74
1d	1300 Manhattan Avenue (Block 187), Union City	Residential	60	80	73	70	64	75	72
1e	1300 Manhattan Avenue (Block 185), Union City	Residential	60	80	69	70	60	75	67
2	1404 Manhattan Ave, Union City	Residential	63	80	65	70	56	75	64
Willow Avenue Bridge Underpinning (approximately 2 months; this would occur during the same time period as shaft construction but would affect different receptors)									
1b	1700 Park Ave, Weehawken	Residential	60	80	71	70	62	75	70
1c	1600 Park, Hoboken	Recreation[2]	57	85	**86***	N/A	N/A	N/A	N/A

Notes:
[1] Noise levels for residential receptors (sites 1a, 1b, and 2) are in L_{dn}; noise levels for recreational receptors (site 1c) are in 24-hour L_{eq}.
[2] For the recreational use, the impact criteria for commercial uses were used.
***** Exceedances of the FTA construction noise impact thresholds are shown in **bold** with an asterisk (*****).
See **Figure 12A-2** for receptor locations.

At Willow Avenue south of the HBLR right-of-way in Hoboken, the Preferred Alternative would involve short-term construction activity associated with underpinning (supporting) the foundation of the Willow Avenue viaduct. The underpinning would include installation of piles, which will be drilled into place rather than driven, to reduce noise levels. This would produce noise levels that exceed the impact thresholds at receptor 1c, which represents the park in Weehawken and Hoboken, New Jersey, called 1600 Park. Pile installation at the Willow Avenue underpinning work area would occur over approximately two months, meaning that 1600 Park, represented by receptor 1c, would experience noise levels that exceed the FTA impact criteria for up to approximately two months (see **Table 12A-10**). Noise levels may also exceed the FTA impact criteria at two other parks nearby as a result of this pile installation: a future park to be developed as part of the Rebuild By Design project at Harborside/Hoboken Cove Park, and the Hudson River Waterfront Walkway (see Chapter 8, "Open Space and Recreational Resources"). Outside of this short period when pile installation is occurring, construction noise at these parks may be audible and noticeable but would not exceed the FTA construction noise impact thresholds. Due to the relatively short duration of these exceedances, while construction noise associated with the Preferred Alternative may be audible and intrusive at times, it would not constitute an adverse construction noise impact at these parks.

In addition, as discussed in Chapter 3, "Construction Methods and Activities," Section 3.3.3.3, to accommodate trucks turning from the off-street haul route to Willow Avenue, a support pier for the Willow Avenue viaduct adjacent to the west side of the Gateway building at 1700 Park Avenue) would be moved. This would involve some pile drilling immediately adjacent to the residential building to install a new support pier, which would result in high noise levels while it is occurring.

Receptors other than those described above would be farther from the construction work areas. At those receptors, construction noise may at times be audible, but the construction noise levels would be lower than those shown in **Table 12A-10** and would not constitute adverse noise impacts.

12A.6.2.4 NORTH RIVER TUNNEL REHABILITATION

Rehabilitation work for the North River Tunnel would be accomplished by taking one tube out of service at a time for reconstruction while the other tube remains in service. In each tube, the existing tracks, ballast, and systems, including the concrete bench wall, would be removed and new trackbed, tracks, and systems would be installed. This work would be staged from the Tonnelle Avenue staging sites and would last approximately four years, assuming construction six days a week (Monday through Saturday) from 7 AM to 3:30 AM. For more information, see Chapter 3, "Construction Methods and Activities," Section 3.3.10.

12A.6.2.4.1 Trucking Activities

Rehabilitation of the North River Tunnel would include truck access to the site via Tonnelle Avenue. The construction trucks, including concrete mixer trucks, materials delivery trucks, and dump trucks for debris removal, would pass by residences on Tonnelle Avenue between 10th Street and Secaucus Road at a rate of up to approximately 13 to 17 trucks per hour in each direction throughout daytime and nighttime hours (i.e., from 7 AM to 3:30 AM). This would produce L_{eq} noise levels in the mid to high 80s dBA, which would exceed the construction noise impact threshold for residential uses. This would occur over the course of the approximately four years of rehabilitation of the North River Tunnel and would consequently constitute an adverse noise impact at the residences along the truck routes to and from this construction work area. This estimate of the duration of the adverse impact is conservative, and the actual duration would likely be shorter, since intensive trucking activity would not be required for all stages of construction.

12A.6.2.4.2 Noise at the Construction Sites

Rehabilitation of the North River Tunnel would include the use of construction equipment at the construction staging area on Tonnelle Avenue close to existing noise receptor locations. Construction noise levels at the surrounding noise receptors, i.e., receptors 3, 3a, 3b, 3d, 3e, 4a, and 4b, were calculated according to the methodology described in Section 12.2. Calculated construction noise levels are shown in **Table 12A-11**. FRA and NJ TRANSIT revised this analysis for the FEIS to reflect more refined information on construction equipment to be used at the site.

Table 12A-11
Worst-Case Construction Noise Levels
During North River Tunnel Rehabilitation (in dBA)

Site	Location	Land Use	Existing Noise Level[1]	8-Hour L_{eq} – Day (7 AM to 10 PM)		8-Hour L_{eq} – Night (10 PM to 7 AM)		30-day Average L_{dn}	
				Impact Criterion	Project Level[1]	Impact Criterion	Project Level[1]	Impact Criterion	Project Level[1]
3	2001 Grand Ave, North Bergen	Residential	56	80	69	70	67	75	**75***
3a	2215 Grand Ave, North Bergen	Residential	56	80	72	70	69	75	**77***
3b	2200 Paterson Plank Rd, North Bergen	Residential	56	80	70	70	67	75	**75***
3d	1607 Paterson Plank Rd, North Bergen	Residential	56	80	63	70	60	75	68
3e	1706 Paterson Plank Rd, North Bergen	Residential	56	80	63	70	60	75	68
4a	2600 Tonnelle Ave, North Bergen	Residential	72	80	69	70	67	75	**75***
4b	2000 Tonnelle Ave, North Bergen	Religious[2]	68	85	75	85	73	80	74

Notes: [1] Noise levels for residential receptors (sites 3, 3a, 3b, and 4a) are in L_{dn}; noise levels for religious receptors (site 4b) are in 24-hour L_{eq}.

[2] For the religious use, the impact criteria for commercial uses were used.

***** Exceedances of the FTA guidance manual construction noise impact thresholds are shown in **bold** with an asterisk (*****).

See **Figure 12A-2** for receptor locations.

Rehabilitation work at the Tonnelle Avenue tunnel portal would produce noise levels that exceed the residential impact thresholds identified in **Table 12A-3** at receptors 3, 3a, 3b, and 4a. Equipment that contributes to elevated noise levels includes tractors, compressors, forklifts, cherry pickers, cranes, and front end loaders. (See **Appendix 12** for a full list of construction equipment assumed for this noise analysis.) The predicted noise levels shown in **Table 12A-11** would occur throughout the approximately four years of rehabilitation work for the North River Tunnel. Based on the high levels of noise predicted to occur for an extended duration at receptors 3, 3a, 3b, and 4a, residential receptors in North Bergen, New Jersey, along Paterson Plank Road, along Grand Avenue between 19th Street and 23rd Street, and along Tonnelle Avenue approximately 550 feet to the north of the existing North River Tunnel portal are predicted to experience adverse construction noise impacts during the repair and restoration work for the North River Tunnel.

In the DEIS analysis, noise from ventilation fans for tunnel excavation was also considered to be a primary contributor of noise at receptors 3, 3a, 3b, and 4. In the DEIS analysis, FRA and NJ TRANSIT used an assumption that the tunnel fans would produce a sound pressure level of 85 dBA at a distance of 50 feet from the fans. This noise level was based on supporting data that FHWA provides for its Roadway Construction Noise Model, a model for predicting the noise levels from construction projects based on empirical data related to noise from different types of equipment and how that noise propagates. FRA and NJ TRANSIT revised the analysis for the FEIS. Based on further engineering for the Project design, a 22 dBA reduction to these noise levels is reasonably achievable through proper fan selection and implementation of silencers,

resulting in noise levels from fan operation of 63 dBA at 50 feet, which would eliminate the ventilation fans as a primary contributor of noise at these locations.

12A.6.3 NEW YORK

Construction activities in New York would be staged from the Twelfth Avenue staging area and would potentially include tunneling using the Sequential Excavation Method (SEM) between the Twelfth Avenue shaft and the Hudson River bulkhead, including ground freezing in advance of the tunneling; construction of the Twelfth Avenue shaft on the staging area; SEM tunneling across West 30th Street, including excavation for relocation of a large sewer located in the streetbed; and construction of the tunnel across Tenth Avenue. This activity would take approximately seven years, with construction on weekdays from 7 AM to 11 PM. For more information, see Chapter 3, "Construction Methods and Activities," Section 3.3.6, 3.3.7, and 3.3.8.

12A.6.3.1 TRUCKING ACTIVITIES

Construction at the Manhattan waterfront area and Twelfth Avenue shaft site would include truck access to the work areas via Twelfth Avenue, Eleventh Avenue, Tenth Avenue, Dyer Avenue, West 40th Street, West 34th Street, West 30th Street, and West 29th Street. The construction trucks, including concrete mixer trucks, materials delivery trucks, and dump trucks for spoils removal, would pass by residences and open space receptors (i.e., Hudson River Park and the High Line) on these roadways at a rate of up to approximately 24 trucks per hour (total for both directions) on Eleventh and Twelfth Avenues, 14 trucks per hour on West 30th Street, and 4 trucks per hour on Tenth Avenue during the daytime hours (i.e., from 7 AM to 10 PM). This level of truck activity would constitute at most a 62 percent increase in the number of Noise PCEs[5] on roadways adjacent to noise receptors. Such an increase in noise PCEs would result in no more than a 2 dBA noise level increase, which would not be perceptible and would also not exceed the *CEQR Technical Manual* noise impact criteria. If construction activities in this area include the use of Sequential Excavation Method (SEM) mining together with ground freezing in Hudson River Park, there would be additional truck trips in this area. In this case, during the periods with the greatest volume of trucks (which would occur for a period of about two months), the total truck activity on roadways accessing construction work areas would constitute at most a 93 percent increase in the number of Noise PCEs on roadways adjacent to noise receptors. Such an increase in noise PCEs would result in an increase in noise levels less than 3 dBA, which would not be perceptible and would also not exceed the *CEQR Technical Manual* noise impact criteria. Consequently, construction truck activity associated with this construction work area would not have the potential to result in adverse construction noise impacts in New York.

12A.6.3.2 NOISE AT THE CONSTRUCTION SITES

Construction at the waterfront and Twelfth Avenue shaft site would include the use of construction equipment along the proposed tunnel alignment close to existing noise receptor locations. FRA and NJ TRANSIT calculated construction noise levels at the surrounding noise receptors, i.e., receptors 8, 8a, 8b, 8c, 9, and 10 according to the methodology described above in Section 12A.2.3.1. This analysis assumes the use of a 15-foot-tall noise barrier around the construction sites. Calculated construction noise levels are shown in **Table 12A-12** and discussed below.

[5] Noise PCEs are "noise passenger car equivalents," referring to the noise levels produced by passenger cars; see Section 12A.2.3.1 of this chapter for more information.

Table 12A-12
Worst-Case Construction Noise Levels
Near Manhattan Construction Sites (in dBA)

Site	Location	Land Use	Existing Noise Level[1]	8-Hour L_{eq} – Day (7AM to 10PM)		8-Hour L_{eq} – Night (10PM to 7AM)		30-Day Average L_{dn}	
				Impact Criterion[1]	Project Level[1]	Impact Criterion[1]	Project Level[1]	Impact Criterion[1]	Project Level[1]
Twelfth Avenue Shaft and SEM Construction Option, Including Sewer Relocation, in West 30th Street (approximately 15 months for the noisiest activities)[3]									
8	312 Eleventh Ave	Residential	78	80	69	70	60	75	68
8a	606 West 30th St	Residential	78	80	80	70	**71***	75	**79***
9	High Line	Recreation[2]	71	85	79	N/A	N/A	N/A	N/A
10	Hudson River Park	Recreation[2]	73	85	66	N/A	N/A	N/A	N/A
Twelfth Avenue Shaft and West 30th Street Cut & Cover Construction Option, Including Sewer Relocation, in West 30th Street (approximately 7 months for the noisiest activities)[3]									
8	312 Eleventh Ave	Residential	78	80	77	70	68	75	**76***
8a	606 West 30th St	Residential	78	80	**88***	70	**79***	75	**87***
9	High Line	Recreation[2]	71	85	**94***	N/A	N/A	N/A	N/A
10	Hudson River Park	Recreation[2]	73	85	77	N/A	N/A	N/A	N/A
Fan Plant Construction / Trackwork (approximately 10 months for the noisiest activities):									
8	312 Eleventh Ave	Residential	78	80	66	70	57	75	65
8a	606 West 30th St	Residential	78	80	78	70	69	75	**77***
9	High Line	Recreation[2]	71	85	77	N/A	N/A	N/A	N/A
10	Hudson River Park	Recreation[2]	73	85	65	N/A	N/A	N/A	N/A
Mechanical, Electrical, and Plumbing Finishes and Rail Systems (approximately 7 months for the noisiest activities)									
8	312 Eleventh Ave	Residential	78	80	65	70	56	75	64
8a	606 West 30th St	Residential	78	80	78	70	69	75	**77***
9	High Line	Recreation[2]	71	85	76	N/A	N/A	N/A	N/A
10	Hudson River Park	Recreation[2]	73	85	64	N/A	N/A	N/A	N/A
Tenth Avenue Cut and Cover; Underpin 450 West 33rd Street (approximately 1 year; this would occur during the same time period as fan plant construction but would affect different receptors)									
8b	413 Tenth Ave	Residential	78	80	65	70	56	75	64
8c	450 West 33rd St	Commercial	72	85	78	85	69	80	76

Notes:
[1] Noise levels for residential receptors (sites 8, 8a, and 8b) are in L_{dn}; noise levels for recreation and commercial receptors (sites 8c, 9, and 10) are in 24-hour L_{eq}.
[2] For the recreational use, the impact criteria for commercial uses were used.
[3] West 30th Street cut & cover construction would replace a comparable duration of SEM construction.
* Exceedances of the FTA construction noise impact thresholds are shown in **bold** with an asterisk (*).
See **Figure 12A-3** for receptor locations.

12A.6.3.2.1 Receptor 10 (Hudson River Park)

As described in Chapter 3, "Construction Methods and Activities," Section 3.3.6, the Project Partners are evaluating two potential construction methods for ground improvement in the Manhattan waterfront area prior to boring the tunnel with TBMs. With the option that would involve SEM mining together with ground freezing, construction activity in this work area would include

the construction of a shaft in the Hudson River Park heliport area, SEM construction, spoils removal, and backfilling. This construction would have a duration of approximately 18 months and would include the use of cranes, cherry pickers, and front end loaders as the dominant sources of noise. This construction area would include a 15-foot-tall noise barrier around the construction site.

Although the FTA guidance manual does not include a construction noise impact criterion for parks, FRA and NJ TRANSIT used the daytime construction noise impact criterion for commercial uses for this park, since daytime is when parks are typically in use. Projected construction noise levels would be below the FTA daytime construction noise impact criterion at locations more than 40 feet from the construction work area. Noise from construction may be audible and potentially disruptive at Hudson River Park, represented by receptor 10, but there are no areas of the park used for passive recreation within 40 feet of this construction area, which would be the zone most likely to be adversely affected by noise. The duration of this construction would be approximately 18 months, which is considered short-term according to the *CEQR Technical Manual*, indicating that a detailed analysis of construction noise is not required and that no adverse impact would occur using CEQR impact thresholds.

12A.6.3.2.2 Receptor 8a (Residential Development on Block 675)

Construction at the Manhattan waterfront and Twelfth Avenue shaft site would produce noise levels that exceed the residential impact thresholds identified in **Table 12A-3** at receptor 8a. Construction at the Manhattan waterfront and Twelfth Avenue shaft site would include use of cranes, cherry pickers, compressors, and front end loaders, which contribute to elevated noise levels.

Pile installation at the Twelfth Avenue shaft and as part of the relocation of the sewer line under West 30th Street would occur over approximately 12 months. As discussed in Chapter 6A, "Land Use, Zoning, and Public Policy," Section 6A.4.3.1.2, two new residential buildings are in construction at the east end of the block between West 29th and West 30th Streets (606 West 30th Street, which is receptor 8a, and the adjacent 601 West 29th Street) and will be complete when this construction occurs. Noise levels at residences in these buildings would exceed the FTA construction noise impact threshold for up to approximately 12 months. In addition, even when pile installation is not occurring, construction noise resulting from the overlap of several construction activities at the Twelfth Avenue staging area would be audible and noticeable at these buildings, and would continue to exceed the FTA construction noise impact threshold for the 30-day average L_{dn} descriptor for an additional 1.5 years, resulting in a total of 2.5 years of noise that exceeds the FTA construction noise impact threshold at these residential receptors. Noise levels at the new residential buildings represented by receptor 8a resulting from construction activity would also exceed the *CEQR Technical Manual* noise impact criteria (i.e., would result in noise level increases of 3 dBA or greater) for approximately 2.5 years during the construction period. These exceedances would constitute significant adverse construction noise impacts according to *CEQR Technical Manual* noise impact criteria.

Construction activities at West 30th Street could also include cut-and-cover excavation, with up to approximately 7 months of impact pile driving (in addition to the 12 months of pile installation within the Twelfth Avenue shaft). In this case, the pile driving would result in construction noise levels that would exceed the FTA construction noise impact thresholds at receptor 8a at times throughout the duration of the cut-and-cover work. Depending on the schedule for the pile driving in West 30th Street, this would potentially increase the total duration of FTA construction noise impact threshold exceedances at the new residential buildings at 606 West 30th Street and 601 West 29th Street beyond the 2.5 years resulting from other construction activities. (See **Appendix 12** for a full list of construction equipment assumed for this noise analysis.)

In recognition of the planned construction associated with the Hudson Tunnel Project on the same block as the new residential buildings represented by receptor 8a, in the approval of the zoning change that permitted these new buildings the New York City Planning Commission required that these buildings be constructed with contemporary façade construction techniques, including insulated glass windows, that would provide approximately 30 dBA window/wall attenuation, resulting in substantially lower noise levels inside the residential units when the windows are closed. With these measures, interior noise levels during construction of the Project would be in the low to mid 40s dBA during nighttime hours, which would be considered acceptable for residential use according to *CEQR Technical Manual* noise exposure guidelines. Consequently, no receptor mitigation measures would be warranted.

As described in Chapter 3, "Construction Methods and Activities," Section 3.3.7.2, it is possible that construction at the Twelfth Avenue staging area would delay the construction of a potential Emergency Medical Services (EMS) station or one-story garage that will be part of the private development project under construction at 601 West 29th Street. In that event, construction of the potential EMS facility or garage would occur after completion of construction for the Hudson River Tunnel on the Twelfth Avenue shaft site (2029). The delay in the construction schedule for the potential EMS facility or garage would extend the duration of construction activities occurring adjacent to the two new residential buildings at the east end of Block 675 for approximately 18 months, the estimated construction schedule for the EMS facility or garage. Based on information provided by the private developer, 12 months of that construction schedule would include excavation and concrete operations. These activities would produce noise levels in the mid to high 70s dBA at the two new residential buildings (601 West 29th Street and 606 West 30th Street). These noise levels would be less than the maximum levels shown in **Table 12A-12**, but would still likely result in a noticeable increase over baseline noise levels for the new residences (as represented by receptor 8a). The adverse noise impacts at that receptor would occur for up to approximately 12 months longer than without this EMS facility or garage construction, i.e., a total of up to approximately 3.5 years including both the Preferred Alternative and the EMS facility construction.

12A.6.3.2.3 Receptor 8 (312 Eleventh Avenue)

At receptor 8, representing residences at 312 Eleventh Avenue, construction noise levels would be below the FTA residential construction noise impact thresholds during all phases of construction, with the exception of during impact pile driving associated with the potential cut-and-cover excavation on West 30th Street, as shown in **Table 12A-12**. This construction phase would have a duration of approximately 3 years, including approximately 7 months of possible impact pile driving associated with the cut-and-cover construction option in West 30th Street. Construction noise levels would only exceed the FTA 30-day average L_{dn} impact threshold by up to 1 dBA and only during pile driving. Existing noise levels at this receptor are in the high 70s dBA and construction would result in incremental changes in noise of up to 2 dBA, which would be imperceptible. Additionally, this residential building is constructed with modern façade construction techniques, including insulated glass windows, which would provide approximately 30 dBA window/wall attenuation, resulting in substantially lower noise levels inside the residential units when the windows are closed. Consequently, while noise levels would exceed the FTA residential construction noise impact threshold during pile driving, they would not rise to the level of an adverse impact at this receptor.

12A.6.3.2.4 Receptor 9 (The High Line)

Although the FTA guidance manual does not include a construction noise impact criterion for parks, FRA and NJ TRANSIT used the daytime construction noise impact criterion for commercial uses for parks, since daytime is when parks are typically in use. At receptor 9, representing the High Line, construction noise levels would be below the FTA daytime construction noise impact

thresholds for commercial receptors during all phases of construction except during impact pile driving associated with the potential cut-and-cover excavation on West 30th Street, as shown in **Table 12A-12**.

Throughout the duration of construction at the Twelfth Avenue shaft (including 12 months of pile installation within the shaft), SEM construction in West 30th Street, and the Twelfth Avenue fan plant construction, construction noise levels would not exceed the FTA construction noise impact criteria. However, worst-case noise levels associated with construction of the Preferred Alternative would result in incremental changes in noise levels that are greater than 3 dBA and would exceed the *CEQR Technical Manual* noise threshold. The maximum predicted total noise level at the High Line with this construction option, 79 dBA, would exceed nuisance levels as defined by the *CEQR Technical Manual*, and may interfere with speech. The exceedances of the *CEQR Technical Manual* noise threshold would occur within 400 feet of the construction work areas. Because in the noise level increments would be greater than 3 dBA for more than 24 consecutive months, this would constitute an adverse impact according to the *CEQR Technical Manual* guidelines. Most of the High Line, including the area east of Eleventh Avenue, would be substantially farther from the construction zone and noise levels would not exceed the *CEQR Technical Manual* noise threshold.

In addition, if cut-and-cover excavation with pile driving occurs in West 30th Street, the pile driving would result in noise levels that exceed FTA noise impact criterion for approximately seven months at the High Line as shown in **Table 12A-12**. This would occur in a small area of the park (i.e., the area within 200 feet of pile driving activities). The maximum predicted total noise level at the High Line, i.e., 94 dBA, would exceed nuisance levels, as defined by the *CEQR Technical Manual*, and may interfere with speech while impact pile driving is occurring. This noise level would not constitute an adverse impact on the High Line according to FTA impact thresholds, because of the relatively short duration of the activity (i.e., less than 12 months). As noted above, most of the High Line, including the area east of Eleventh Avenue, would be substantially farther from the construction zone.

12A.6.3.2.5 Receptors 8b and 8c (413 Tenth Avenue and 450 West 33rd Street)

At Receptors 8b and 8c, representing residential and commercial buildings along Tenth Avenue near the Tenth Avenue construction activities for the Preferred Alternative between West 31st and West 33rd Streets would be noticeable and audible, but would be below the FTA impact criteria as shown in **Table 12A-12**. Consequently, construction associated with the Preferred Alternative would not constitute an adverse impact.

12A.6.3.2.6 Other Receptors

Receptors other than those described above would be farther from the Manhattan construction work areas. At those receptors, construction noise may at times be audible, but the construction noise levels would be lower than those shown in the construction noise analysis and would not constitute adverse noise impacts.

12A.7 PERMANENT IMPACTS OF THE PREFERRED ALTERNATIVE

12A.7.1 OVERVIEW

The Preferred Alternative would consist of a new two-track tunnel, parallel to the North River Tunnel, extending from the NEC in Secaucus, New Jersey, beneath the Palisades (North Bergen and Union City) and the Hoboken waterfront area, and beneath the Hudson River to connect to the existing approach tracks at PSNY. Potential sources of noise included in the Preferred

Alternative would be the new surface and on-structure track extending from Secaucus east of County Road to the new tunnel portal and the new ventilation shafts and associated fan plants located above the tunnel on West 18th Street in Hoboken and at Twelfth Avenue in Manhattan. The new Hudson River Tunnel and the rehabilitated North River Tunnel would incorporate a low-vibration track system, which would reduce not only the vibration but also the potential noise from train operations.

FRA and NJ TRANSIT examined the potential effects of these sources in the noise analysis described below.

At each of the noise receptor sites identified and described in Section 12A.3 above, FRA and NJ TRANSIT calculated Project noise exposure associated with the Preferred Alternative based on the contribution of each element of the Preferred Alternative (e.g., surface or on-structure rail tracks, ventilation fan plants) within the screening distance from the receptor. FRA and NJ TRANSIT compared the Project noise exposure at each receptor to FTA's noise impact criteria to identify potential impacts.

The analysis of noise from the ventilation fan plants assumes the fan plants would produce an L_{eq} of 65 dBA at 50 feet from the plant, consistent with the FTA guidance manual's screening distance for ventilation shafts. The design for the fan plants included in the Preferred Alternative includes fan silencers. The final design of the fan plants would need to ensure that the silencers' performance results in noise emission of 65 dBA or less at a distance of 50 feet from the fan plant for the design to be consistent with the results of this analysis.

12A.7.2 NEW JERSEY

FRA and NJ TRANSIT analyzed the potential noise effects of the Preferred Alternative at the receptors in the New Jersey using the methodology described above. **Table 12A-13** shows the noise levels and incremental change in noise levels for the Preferred Alternative. Noise levels shown for the Preferred Alternative in **Table 12A-13** are the sum of the rail noise components (i.e., surface or on-structure railway and ventilation fan plant) and the non-rail noise component (which is assumed to be the same level calculated for existing conditions). The Preferred Alternative noise exposure is the level of noise that would be produced by operation of the Preferred Alternative, and is compared to the impact criteria to determine whether this alternative could potentially result in a noise impact. FRA and NJ TRANSIT have revised the noise calculations presented in **Table 12A-13** for the FEIS to include noise associated with train horns as trains approach the existing North River Tunnel.

12A.7.2.1 SURFACE ALIGNMENT

During the public comment period for the DEIS, residents of North Bergen commented that the noise of train horns as trains approach the North River Tunnel is intrusive and should be included in the noise analysis. At that time, Amtrak required that eastbound trains approaching the North River Tunnel sound their horns at a point approximately 1,320 feet before (west of) the tunnel portal. This was a safety requirement to protect railroad workers who might be using a pedestrian crossing close to Tonnelle Avenue, an area where Amtrak maintenance employees sometimes stage and mobilize maintenance activities. More recently, Amtrak has shifted the location where eastbound horns must sound their horns to a point closer to Tonnelle Avenue. With the Preferred Alternative, these requirements for trains using the North River Tunnel would remain in place and there would be no requirement for trains approaching the new Hudson River Tunnel to sound their horns, since there would be no worker crossing over the new tracks. In response to comments from residents in North Bergen, FRA and NJ TRANSIT revised the noise analysis for this FEIS to account for the noise effects from train horns.

With the Preferred Alternative, the same number of trains would operate on the NEC between New Jersey and New York as in the No Action Alternative (see Chapter 2, "Alternatives and Description of the Preferred Alternative," Section 2.5.7.2). However, with two additional tracks between the surface alignment at approximately Frank R. Lautenberg Secaucus Junction Station and PSNY, Amtrak and NJ TRANSIT would have increased flexibility in how trains operate between New Jersey and New York, and some trains would shift from the North River Tunnel to the new Hudson River Tunnel. Trains using the new tunnel would not sound their horns as they approach the tunnel. Consequently, the Preferred Alternative has the potential to result in a decrease in horn noise along the surface alignment. However, to be conservative, this analysis assumes for each receptor that all trains enter and exit the tunnel closest to the receptor, and therefore the analysis does not show the reduction in train horn noise at the North River Tunnel portal that would occur if some trains instead enter the new Hudson River Tunnel.

As shown in **Table 12A-13**, the Project noise exposure (i.e., the noise generated by the Project) for the Preferred Alternative at receptors near the new and existing tunnel portal (receptor sites 3, 3a, 3b, 3c, 3d, 3e, 4a, 4b) and near the new surface alignment (receptors 5, 6, and 7a) would not constitute a moderate or a severe impact according to FTA noise impact criteria. Additionally, incremental changes in noise levels between the Preferred Alternative and existing condition would be less than 3 dBA at these receptors, which would be just perceptible. Consequently, the Preferred Alternative would not result in any adverse noise impacts at these receptor sites.

Receptor 7, near the surface alignment and included in the construction noise analysis, is not within the screening distance of any permanent noise-producing Project elements and would consequently not experience an adverse noise impact as a result of the Preferred Alternative.

12A.7.2.2 HOBOKEN FAN PLANT

At receptor site 1a, which is representative of the residences along West 18th Street in Hoboken within 200 feet of the Hoboken fan plant, and receptors 1d and 1e, which are representative of residences in the future development at 1300 Manhattan Avenue in Union City, FRA and NJ TRANSIT evaluated the effects of noise generated by the Hoboken fan plant on nearby residences. The Hoboken fan plant would operate passively during normal conditions: fans would not run and ventilation would occur naturally through train movement in the tunnel. One low-pressure fan would operate during congested train conditions when the tunnel is hot, to clear hot air from the tunnel. Multiple high-pressure fans would also operate during emergencies to exhaust smoke from the tunnel. One fan at a time would also be tested regularly to ensure they remain operational. Sound attenuators would be included in the fan plant to reduce fan noise and meet applicable noise requirements. For more information of the Preferred Alternative's ventilation system, see Chapter 2, "Alternatives and Description of the Preferred Alternative," Section 2.5.2.6.

FRA and NJ TRANSIT evaluated operation of the Hoboken fan plant with one fan operating at maximum load (which would occur during congested conditions in the tunnel). At receptor 1a, which is representative of the residences along West 18th Street in Hoboken, and receptors 1d and 1e, representative of future residences at 1300 Manhattan Avenue in Union City, New Jersey, Project noise exposure (i.e., Project-generated noise) would not exceed the FTA threshold for operational noise impacts (see **Table 12A-13**). Consequently, operation of the fan during normal operations would not result in any adverse noise impacts at these receptors.

Table 12A-13
New Jersey Preferred Alternative Noise Levels (in dBA)

	Receptor Site	FTA Land Use Category	Existing Noise Level	FTA Impact Thresholds[1]		Preferred Alternative Noise Exposure (Project-Generated Noise)	Total Noise Level with the Preferred Alternative Complete	Preferred Alternative Noise Level Increment	Impact[2]?
				Moderate Impact	Severe Impact				
1a	78 West 18th St, Weehawken	2	60	58	63	28	60	0	No Impact
1d	1300 Manhattan Avenue (Block 187), Union City	2	60	58	63	33	60	0	No Impact
1e	1300 Manhattan Avenue (Block 185), Union City	2	60	58	63	25	60	0	No Impact
3	2001 Grand Ave, North Bergen	2	56	56	61	39	56	0	No Impact
3a	2215 Grand Ave, North Bergen	2	56	56	61	43	56	0	No Impact
3b	2200 Paterson Plank Rd, North Bergen	2	56	56	61	55	59	3	No Impact
3c	Paterson Plank Park, 1811 Paterson Plank Rd, North Bergen	3	54	60	66	41	54	0	No Impact
3d	1607 Paterson Plank Rd, North Bergen	2	56	56	61	36	56	0	No Impact
3e	1706 Paterson Plank Rd, North Bergen	2	56	56	61	35	56	0	No Impact
4a	2600 Tonnelle Ave, North Bergen	2	72	65	71	53	72	0	No Impact
4b	2000 Tonnelle Ave, North Bergen	3	68	68	73	56	68	0	No Impact
5	Henry St, Secaucus	2	78	65	75	0	78	0	No Impact
6	200 Penhorn Ave, Secaucus	3	66	67	72	52	67	0	No Impact
7a	58 County Ave, Secaucus	2	78	65	75	0	78	0	No Impact

Notes: [1] Impact criteria are based on the existing noise level, as shown in **Figure 12A-1**.

[2] The noise exposure for the Preferred Alternative is compared to the FTA moderate impact and severe impact thresholds to determine whether a moderate impact and/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.

12A.7.2.3 OTHER LOCATIONS

Other receptors in New Jersey included in the construction noise analysis (including receptors 1b, 1c, and 2) were not within the screening distance from any permanent noise-producing Project elements and would consequently also not experience an adverse noise impact as a result of the Preferred Alternative.

12A.7.3 NEW YORK

The potential noise effects of the Preferred Alternative at the receptors in the New York were analyzed using the methodology described in Section 12A.2. **Table 12A-14** shows the noise levels and incremental change in noise levels for the Preferred Alternative. Noise levels shown for the Preferred Alternative in **Table 12A-14** result from the operation of the new Twelfth Avenue ventilation fan plant, which is the primary above-ground noise-producing Project element in New York, together with the measured existing conditions noise level. The noise calculations presented in **Table 12A-14** have been revised since the DEIS to reflect the potential location of the new ventilation building relative to receptor 8a.

Table 12A-14
New York Preferred Alternative Noise Levels (in dBA)

Site		FTA Land Use Category	Existing Noise Level	FTA Impact Threshold[1]		Preferred Alternative Noise Exposure (Project-Generated Noise)	Total Noise Level with the Preferred Alternative Complete	Preferred Alternative Noise Level Increment	Impact?[2]
				Moderate Impact	Severe Impact				
8a	606 West 30th St	2	78	65	75	62	78	0	No Impact
9	High Line	3	71	70	75	61	71	0	No Impact
10	Hudson River Park	3	73	70	77	59	73	0	No Impact

Notes:
[1] Impact criteria are based on the existing noise level, as shown in **Figure 12A-1**.
[2] The noise exposure for the Preferred Alternative is compared to the FTA moderate impact and severe impact thresholds to determine whether a moderate impact and/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.

The Twelfth Avenue fan plant would operate passively during normal conditions: fans would not run and ventilation would occur naturally through train movement in the tunnel. One low-pressure fan would operate during congested train conditions when the tunnel is hot, to clear hot air from the tunnel. Additional high-pressure fans would operate during emergencies, such as a fire in the tunnel, so that smoke could be exhausted at high velocity from the tunnel. The fans would also be tested regularly to ensure they remain operational. The fan plant would have sound attenuators to reduce fan noise and meet applicable noise requirements. For more information of the Preferred Alternative's ventilation system, see Chapter 2, "Alternatives and Description of the Preferred Alternative," Section 2.5.2.6.

When the Twelfth Avenue fan plant fans are operating, as shown in **Table 12A-14**, the Project noise exposure predicted for the Preferred Alternative at Hudson River Park, the High Line, and the proposed residential buildings at the east end of the block between West 29th and 30th Streets, Eleventh and Twelfth Avenues (receptor sites 10, 9, and 8a, respectively) would not result in a moderate or a severe impact according to FTA noise impact criteria. Additionally, incremental changes in noise levels between the Preferred Alternative and existing conditions would be less than 1 dBA at these receptors, which would be imperceptible. Consequently, operation of the new Twelfth Avenue fan plant would not result in any adverse noise impacts at these receptor sites. Moreover, the fan plant will include silencers that will effectively reduce noise levels from this operation.

Other receptors in New York were not within the screening distance of the Twelfth Avenue fan plant and would consequently also not experience an adverse noise impact as a result of operation of the Preferred Alternative.

In addition to the Twelfth Avenue fan plant, the Preferred Alternative would also include a smaller fan plant at Tenth Avenue beneath the building at 450 West 33rd Street. Like the Twelfth Avenue fan plant, the Tenth Avenue fan plant would operate predominantly in passive mode and would include silencers to reduce noise emissions when the fans are operating.

Consequently, operation of the Preferred Alternative would not have the potential to result in any adverse noise impacts at receptors in New York.

12A.8 CONCLUSIONS

After conducting the detailed construction noise analysis according to FTA guidance, FRA and NJ TRANSIT found that there would be the potential for adverse construction noise impacts at receptors both in New Jersey and New York. The adverse construction noise impacts are described below and summarized in **Table 12A-15**. Section 12A.9 of this chapter describes the mitigation measures the Project Sponsor will implement to address these impacts.

- Pile driving conducted overnight along the NEC would result in noise levels that exceed the FTA residential construction noise impact threshold for approximately two months for the residences near the NEC on Henry Street at Secaucus Road in Secaucus, New Jersey, during overnight hours. This would constitute an adverse impact despite its short duration because it would occur overnight.
- Construction activities at the Tonnelle Avenue staging area related to the new Hudson River Tunnel, pile installation at the Tonnelle Avenue portal and underpass, and tunnel mining would have the potential to result in adverse construction noise impacts at residential receptors along Paterson Plank Road and along Grand Avenue between 19th Street and 23rd Street, and the BAPS Shri Swaminarayan Mandir Hindu temple on the east side of Tonnelle Avenue, in North Bergen, New Jersey, for up to approximately three years, including overnight, during new tunnel construction.
- Construction activities at the Tonnelle Avenue staging area related to the rehabilitation of the North River Tunnel would have the potential to result in adverse construction noise impacts, including overnight, for up to four years, at residential receptors in North Bergen, New Jersey along Paterson Plank Road, along Grand Avenue between 19th Street and 23rd Street, and along Tonnelle Avenue extending approximately 550 feet north of the existing North River Tunnel portal.
- Trucks traveling to and from the Tonnelle Avenue staging area would have the potential to result in an adverse noise impact at the residences along Tonnelle Avenue between 10th Street and Secaucus Road in North Bergen, New Jersey, for up to approximately seven years during construction of the new tunnel and four additional years during rehabilitation of the North River Tunnel. This estimate of the duration of the adverse impact is conservative, and the actual duration would likely be shorter, since intensive trucking activity would not be required for all stages of construction. As discussed in Chapter 5A, “Traffic and Pedestrians,” Section 5A.6.2.1.8, FRA and NJ TRANSIT evaluated a potential new traffic signal on Tonnelle Avenue to mitigate the traffic impacts resulting from construction traffic associated with the Tonnelle Avenue staging area. With this measure, truck traffic associated with the construction of the Preferred Alternative would no longer head southward on Tonnelle Avenue to make a U-turn, and heavy volumes of construction trucks would no longer pass the residences on Tonnelle Avenue between 10th Street and Secaucus Road. This would eliminate the adverse noise impact due to construction of the Project at these receptors and no sound-reducing windows would be required. Implementation of this mitigation measure requires approval from the NJDOT, so the analysis in this chapter describes the noise impacts both with and without the new signal.

- Trucks traveling to and from the Hoboken staging area would have the potential to result in an adverse noise impact at the residences in Weehawken, New Jersey, along the truck routes used for access to and from the Hoboken staging site for up to seven years. Depending on the routes used, this would include residences on Willow Avenue south of 19th Street, on Park Avenue south of 19th Street, and along Harbor Boulevard south of 19th Street. This estimate of the duration of the adverse impact is conservative, and the actual duration would likely be shorter, since intensive trucking activity would not be required for all stages of construction.
- Pile installation in the Twelfth Avenue shaft site and as part of the relocation of the sewer line under West 30th Street as well as the overlap of multiple construction activities at the Twelfth Avenue staging area would result in noise levels that exceed the FTA construction noise impact threshold for up to approximately 2.5 years at the residential buildings currently under construction at 606 West 30th Street and 601 West 29th Street. If the potential EMS facility (or one-story garage) on West 29th Street (Block 675 Lot 12) is delayed because of construction activities for the Preferred Alternative and its construction occurs later, the total duration when noise levels would exceed impact thresholds would increase by a year, to approximately 3.5 years. These noise levels would constitute adverse noise impacts at these buildings according to FTA noise impact criteria and significant adverse impacts according to *CEQR Technical Manual* noise impact criteria. However, because these buildings would be constructed with contemporary standard façade construction techniques resulting in at least 30 dBA façade attenuation, interior noise levels during construction of the Project would be in the low to mid 40s dBA during nighttime hours, which would be considered acceptable for residential use according to *CEQR Technical Manual* noise exposure guidelines. Consequently, no mitigation measures would be warranted.
- Pile installation at the Twelfth Avenue shaft site and as part of the relocation of the sewer line under West 30th Street, as well as the overlap of multiple construction activities at the Twelfth Avenue staging area, would result in noise levels that exceed the CEQR impact threshold within 400 feet of the construction zone for approximately four years in New York at the High Line, which would constitute a significant adverse impact according to *CEQR Technical Manual* noise impact criteria. This noise level would not exceed the FTA construction noise impact threshold. The predicted noise impact would not extend throughout the full length of the High Line, most of which would be substantially farther from the construction zone. If cut-and-cover excavation with pile driving occurs in West 30th Street, the pile driving would result in noise levels that exceed the FTA noise impact threshold within 200 feet of the construction zone for approximately seven months at the High Line. This noise level would not constitute an adverse impact on the High Line according to the FTA impact threshold, because of the relatively short duration of the activity (i.e., less than 12 months).

Table 12A-15
Summary of Construction Noise Impacts
Based on FTA Impact Criteria

Receptor Number	Location/Area	Construction Noise Impact
5	Residences on Henry Street at Secaucus Rd, in Secaucus, NJ	Surface alignment construction during pile driving within 1,000 feet of residences
3b	Residences along Paterson Plank Rd, North Bergen, NJ	Hudson River Tunnel (new portal construction, tunnel mining, and Tonnelle Avenue underpass) and North River Tunnel rehabilitation
3, 3a	Residences along Grand Avenue between 19th Street and 23rd Street, North Bergen, NJ	Hudson River Tunnel (new portal construction, tunnel mining, and Tonnelle Avenue underpass) and North River Tunnel rehabilitation
4b	BAPS Shri Swaminarayan Mandir Hindu temple on the east side of Tonnelle Avenue, North Bergen, NJ	Hudson River Tunnel (new portal construction, tunnel mining, and Tonnelle Avenue underpass)
4a	Residences along Tonnelle Avenue approximately 550 feet to the north of the existing North River Tunnel portal, North Bergen, NJ	North River Tunnel rehabilitation
N/A	Residences along the Tonnelle Avenue truck route between 10th St and Secaucus Rd, North Bergen, NJ	Construction at the Tonnelle Avenue staging area for Hudson River Tunnel and North River Tunnel rehabilitation (at times for up to approximately 11 years)
N/A	Residences along the truck routes in Weehawken, NJ: on Willow Ave south of 19th St, on Park Ave south of 19th St, and at 800 Harbor Blvd	Construction at the Hoboken staging area (at times for up to approximately 11 years)
8a	Residences on Block 675 between W 30th and W 29th Sts and Twelfth and Eleventh Aves in Manhattan, NY	Twelfth Avenue staging area construction: Twelfth Avenue shaft and SEM construction, including sewer relocation in W 30th St; fan plant construction; W 30th St cut and cover

The construction noise analysis found that at other receptors, noise resulting from construction of the Preferred Alternative would result in noticeable levels of noise, but the noise would occur over only a limited period of time or would not rise to the level of an adverse impact.

12A.9 MEASURES TO AVOID, MINIMIZE, AND MITIGATE IMPACTS

The Project Sponsor will implement the following measures to avoid, minimize, and mitigate potential adverse noise impacts of the Project. The lead Federal agency will be responsible for ensuring that the Project Sponsor implements these measures, which will be identified in the ROD.

12A.9.1 GENERAL CONSTRUCTION PRACTICES

- At each construction site, the Project Sponsor will implement a comprehensive, active and responsive community outreach program during construction that will include a staffed local neighborhood outreach office at each construction staging area (i.e., the Tonnelle Avenue, Hoboken, and Twelfth Avenue staging areas); a dedicated Project liaison who will coordinate with the community about construction activities, address concerns, and work with the community to accommodate special events where possible; a 24-hour hotline for emergencies and construction complaints; and regular meetings and notifications about construction status and upcoming activities.
- During construction, the Project Sponsor will coordinate construction activities with affected municipalities in New Jersey, New York City, and nearby property owners to schedule construction to avoid or minimize adverse impacts where practicable.

- The Project Sponsor will establish a noise complaint procedure to promptly address community concerns and implement additional control methods where necessary.
- Noise from construction equipment will comply with noise emission standards of FTA, the New Jersey Department of Environmental Preservation (NJDEP), and New York City, where feasible and practicable. These Federal, state, and New York City requirements 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.
- The Project Sponsor will require that noise emissions of the various pieces of equipment to be used on site are independently certified for compliance with the applicable noise emission standards and codes.
- The Project Sponsor will establish a program to certify that all noise control measures specified in the EIS will be fully and properly implemented.
- The Project Sponsor will develop and implement a noise monitoring plan to conduct noise monitoring at sensitive receptors nearest to the construction staging areas. The plan will include spot noise emission level checks of the most noise-intensive equipment and construction activities (e.g., pile installation, concrete operations, truck loading), inspections of noise control measures to ensure that they are implemented properly, and spot checks of noise levels at surrounding receptors during various phases of construction. If equipment noise emissions or receptor noise levels are substantially greater than those presented in this chapter, the Project Sponsor will examine construction means and methods to consider additional noise control measures that may be feasible and practicable.
- To the extent practicable given space constraints at the work sites, construction will use acoustical noise tent and/or enclosures surrounding jackhammers or pavement breakers that can provide up to 15 dBA of noise reduction during any demolition activities. For additional noise reduction, jackhammer noise mufflers that can provide up to an additional 10 dBA of noise reduction can also be used.
- To minimize the noise from the backup warning alarms on trucks, vehicles will be routed through the construction sites to minimize the use of alarms. In addition, vehicles will also be equipped with Occupational Safety and Health Administration (OSHA)-approved quieter backup alarms.

12A.9.2 CONSTRUCTION FOR SURFACE ALIGNMENT

- The Project Sponsor will coordinate with the occupants of the residential buildings on Henry Street at Secaucus Road in Secaucus, New Jersey, regarding appropriate mitigation such as temporary accommodations elsewhere while pile driving is occurring overnight within 1,000 feet of these residences.

12A.9.3 CONSTRUCTION AT TONNELLE AVENUE STAGING AREA

- The Project Sponsor will require that the ventilation fans to be used during construction of the new Hudson River Tunnel and the rehabilitation of the North River Tunnel achieve a maximum acceptable sound pressure level from fan operation of 63 dBA at a distance of 50 feet. This maximum sound level is reasonably achievable through proper fan selection and implementation of silencers; the Project Sponsor will include this requirement in the construction equipment specifications so that the ventilation fans do not emit noise above this maximum level.
- The Project Sponsor will require that the generators and light plants to be used during new tunnel construction and the rehabilitation of the North River Tunnel achieve a maximum sound

pressure level of 70 dBA at a distance of 50 feet. This maximum sound level is reasonably achievable through proper generator/light plant selection and implementation of enclosures or available manufacturer attenuation options; the Project Sponsor will include this requirement in the construction equipment specifications so that the generators and light plants do not emit noise above this maximum level.

- The Project Sponsor will require that the conveyors used to transport tunnel spoils from the tunnel during tunnel mining along with any associated pumps will be enclosed in a structure that would provide approximately 25 dBA attenuation to these pieces of equipment. It is expected that this would be a 24-gauge corrugated steel structure with insulation on the interior. The Project Sponsor will include this requirement in the construction equipment specifications so that the conveyors and associated pumps are housed in enclosures providing this level of attenuation.
- Blasting will not be conducted after 6 PM except under special circumstances, and only if permission from the appropriate local regulatory agency (i.e., North Hudson Regional Fire and Rescue) is provided. The Project Sponsor will provide advance notice of blasting events nearby to residents of Paterson Plank Road and Grand Avenue in North Bergen near the tunnel portal and alignment.
- At residential receptors along Paterson Plank Road, along Grand Avenue between 19th Street and 23rd Street, and on Tonnelle Avenue between 10th Street and Secaucus Road in North Bergen, New Jersey, the Project Sponsor will offer to provide façade improvements in the form of sound-reducing windows together with air conditioning units to allow for the maintenance of a closed-window condition.[6] Such measures would result in lower levels of construction-generated noise inside these residential buildings, although they would not completely eliminate the predicted construction noise impacts. The effectiveness of these measures would depend on specific building construction (i.e. façade type and type of air conditioning), but generally would reduce indoor noise levels by an estimated 5 to 20 dBA.
- The Project Sponsor will further evaluate during final design, in cooperation with the Project Partners and in coordination with NJDOT, the potential for introduction of a new traffic signal at the proposed location of the access driveway to the Tonnelle Avenue staging area, to avoid unnecessary vehicle movements on Tonnelle Avenue from construction vehicles that would otherwise use the nearest U-turn (see Chapter 5A, “Traffic and Pedestrians,” Section 5A.6.2.1.8). If this signal is provided, a noise impact would no longer occur at residential receptors on Tonnelle Avenue as a result of truck traffic and no mitigation would be needed there.
- In the DEIS, a noise barrier was proposed at the southern boundary of the staging area on Tonnelle Avenue as a potential mitigation option to be further investigated. This noise barrier was analyzed and was found not to provide a substantial reduction in construction noise for the BAPS Shri Swaminarayan Mandir Hindu temple along Tonnelle Avenue. The large distance between the equipment operating at the staging area and the proposed wall, combined with the height of the BAPS Shri Swaminarayan Mandir Hindu temple’s second story windows, prevents this barrier from serving as an effective mitigation method.

[6] Sound-reducing windows can include acoustical interior windows consisting of laminated glass at least ¼ inch thick with at least 2-inch airgap from the primary (existing) window, along with re-gasketing the existing window; or replacement windows in the existing opening with at least a 1-inch insulated glass unit.

12A.9.4 CONSTRUCTION AT HOBOKEN STAGING AREA

- The Project Sponsor will offer to provide façade improvements in the form of sound-reducing windows together with air conditioning units to allow for the maintenance of a closed-window condition at residences in Weehawken, New Jersey, across from the Hoboken staging area (including those residences that are west of Hackensack Plank Road and south of West 19th Street) and residences in Weehawken along the selected haul routes (potentially including residences on the Park Avenue service road and the Willow Avenue service road between the HBLR and 19th Street). Such measures would result in lower levels of construction-generated noise inside these residential buildings, although they would not completely eliminate the predicted construction noise impacts. The effectiveness of these measures would depend on specific building construction (i.e. façade type and type of air conditioning), but generally would reduce indoor noise levels by an estimated 5 to 20 dBA.
- Blasting will not be conducted after 6 PM except under special circumstances and only if permission from the appropriate local regulatory agency (i.e., North Hudson Regional Fire and Rescue) is provided. The Project Sponsor will provide advance notice of blasting events nearby to residents of the Shades neighborhood of Weehawken.
- The Project Sponsor will require that the ventilation fans to be used during construction of the new Hudson River Tunnel and the rehabilitation of the North River Tunnel achieve a maximum acceptable sound pressure level from fan operation of 63 dBA at a distance of 50 feet. This maximum sound level is reasonably achievable through proper fan selection and implementation of silencers; the Project Sponsor will include this requirement in the construction equipment specifications so that the ventilation fans do not emit noise above this maximum level.
- The Project Sponsor will require that the generators and light plants to be used during new tunnel construction and the rehabilitation of the North River Tunnel achieve a maximum sound pressure level of 70 dBA at a distance of 50 feet. This maximum sound level is reasonably achievable through proper generator and light plant selection and implementation of enclosures or available manufacturer attenuation options; the Project Sponsor will include this requirement in the construction equipment specifications so that the generators and light plants do not emit noise above this maximum level.
- At the Hoboken staging area, the Project Sponsor will require that there be a maximum (cap) of no more than 8 trucks per hour in each direction traveling to and from the Hoboken staging area.
- The Project Sponsor will require that no construction-related trucks will use local roads in Weehawken or Hoboken between 10 PM and 7 AM.
- At the Hoboken staging area, construction for the Preferred Alternative will include a noise barrier along the full northern boundary of the site on West 18th Street and wrapping on the western side at least 100 feet and on the eastern side to the truck haul route. The Project Sponsor will determine the height of the noise wall at the Hoboken staging area in consultation with representatives of the local community. The analysis presented in this chapter demonstrates that a wall up to 25 feet high would provide the level of noise mitigation needed to avoid adverse noise impacts according to FTA noise criteria, such that exterior noise levels at the residences nearest to the construction site do not exceed an average Leq of 76 dBA during daytime hours (i.e., 7 AM to 10 PM) or an average Leq of 67 dBA during nighttime hours (i.e., 10 PM to 7 AM).
- At the Hoboken shaft site and staging area, if the noise wall is lower than 25 feet high, other noise-reducing measures will also be employed so that the same exterior noise levels can be achieved at the nearest residences on West 18th Street and adverse noise impacts do not occur: exterior noise levels at the residences nearest to the construction site should not

exceed an average Leq of 76 dBA during daytime hours (i.e., 7 AM to 10 PM) or an average Leq of 67 dBA during nighttime hours (i.e., 10 PM to 7 AM). These additional noise-reducing measures might include, for example, the use of quieter equipment, use of noise dampening measures in spoils trucks, placement of the noisiest equipment on the site farther from West 18th Street, and use of shields or covers for noise-generating equipment and activities. If noise levels cannot be reduced to those specified here, an adverse noise impact would occur.

- At the Hoboken staging area, the Project Sponsor will locate the grout plant, slurry plant, and compressors within enclosures or buildings capable of providing 25 dBA attenuation (e.g., corrugated steel with spray-on insulation). Any ventilation for such enclosures or buildings would be required to maintain the acoustical performance of the building in the direction of the receptors to the north and west.
- At the Hoboken staging area, the Project Sponsor will enclose concrete pumps using temporary acoustical curtains or barriers at all times during concrete operations.
- Construction of the Hoboken shaft will be accomplished using drilled piles rather than driven piles to the extent practicable, to reduce resulting noise levels.
- Underpinning of the Willow Avenue viaduct will be accomplished using drilled piles rather than driven piles to the extent practicable, to reduce resulting noise levels.
- The Project Sponsor will coordinate with the City of Hoboken and Township of Weehawken regarding pile installation for the underpinning of the Willow Avenue viaduct, to avoid disruption to special events in nearby parks and will provide advance notification to the extent practicable of when pile installation would occur, so that the city and township can provide public notification of this activity and its expected duration.

12A.9.5 CONSTRUCTION IN NEW YORK

- For construction sites in New York, construction under the Preferred Alternative will include sufficient mitigation to meet the New York City Noise Control Code construction noise limit of an L_{max} of 85 dBA at the exteriors of any adjacent residential properties. This would reduce the construction noise from the sites to the levels presented in this chapter. The analyses described above determined that the use of site enclosures or temporary noise barriers (e.g., ¾-inch thick plywood) 15 feet high would provide this level of noise mitigation and would avoid adverse impacts according to FTA noise impact criteria during most construction activities. At excavation locations in New York City streets, barriers will be constructed along the curbline while the lane nearest the curb will remain open to accept equipment to complete the excavation across the street.
- Blasting activities will occur in Manhattan only between 9 AM and 7 PM, except under special circumstances, and only with permission from the Fire Department of the City of New York (FDNY). A blasting schedule will be provided to neighboring building owners and occupants.
- Installation of piles for the tunnel alignment between the Manhattan bulkhead and Tenth Avenue, including in Hudson River Park (if needed), at the Twelfth Avenue shaft, and in West 30th Street, if needed, will be accomplished using drilled piles rather than driven piles, where practicable, to reduce resulting noise levels.

12A.9.6 OPERATION OF THE PREFERRED ALTERNATIVE

- The new Hudson River Tunnel and the rehabilitated North River Tunnel would incorporate a low-vibration track system, which would reduce the potential noise and vibration from train operations.

- Equipment included in the new Hoboken fan plant and Twelfth Avenue fan plant would be designed to produce noise levels no greater than shown in the noise analysis included in this chapter—65 dBA at the façade of the nearest residential building. ✷