Chapter 11: Noise

A. INTRODUCTION

Noise pollution in an urban area comes from many sources. Some sources are activities essential to the health, safety, and welfare of a city's inhabitants, such as noise from emergency vehicle sirens, garbage collection operations, and construction and maintenance equipment. Other sources, such as traffic, stem from the movement of people and goods, activities that are essential to the viability of a city as a place to live and do business. Although these and other noise-producing activities are necessary to a city, the noise they create is, at times, undesirable. Urban noise detracts from the quality of the living environment, and there is increasing evidence that excessive noise may represent a threat to public health.

The noise analysis of the proposed project consists of two parts:

- An analysis at locations where traffic generated by the proposed project would have the potential to result in significant adverse noise impacts to determine the magnitude of the increase in noise level; and
- An analysis to determine the level of building attenuation necessary to ensure that interior noise levels within the Armory would satisfy applicable interior noise criteria.

PRINCIPAL CONCLUSIONS

As described in detail below, the level of interior noise within the commercial portion of the proposed project along the south façade of the Armory building resulting from exterior sources may be greater than the 50 dBA $L_{10(1)}$ level for commercial uses as prescribed by *City Environmental Quality Review (CEQR)* interior noise level criteria. Between the Draft Environmental Impact Statement (DEIS) and Final Environmental Impact Statement (FEIS), noise levels will be measured inside the Armory building along the south façade in order to determine whether interior $L_{10(1)}$ noise levels resulting from exterior noise sources would actually exceed 50 dBA. If the interior $L_{10(1)}$ noise levels resulting from exterior noise sources would exceed 50 dBA, this would constitute an unmitigated significant adverse noise impact.

The analysis finds that the proposed project could result in a significant adverse noise impact at residences along the west side of Reservoir Avenue between West 195th Street and West Kingsbridge Road. Existing and No Build noise levels at this location are relatively low and project-generated traffic would cause significant increases in noise levels on this street. However, the noise levels in the future with the proposed project would be considered "marginally unacceptable" according to CEQR criteria, which is not unusual for residential areas in New York City. Furthermore, these noise level increases are expected to be during limited hours of the day, would not occur during the nighttime periods, and are only expected to occur in the hour before and after high attendance events at the Armory.

B. ACOUSTICAL FUNDAMENTALS

Sound is a fluctuation in air pressure. Sound pressure levels are measured in units called "decibels" ("dB"). The particular character of the sound that we hear (a whistle compared with a French horn, for example) is determined by the speed, 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 (e.g., a whistle) are more easily discernible and therefore more intrusive than many of the lower frequencies (e.g., the lower notes on the French horn).

"A"-WEIGHTED SOUND LEVEL (DBA)

In order to establish 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 it is the descriptor of noise levels most often used for community noise. As shown in **Table 11-1**, the threshold of human hearing is defined as 0 dBA; very quiet conditions (as in a library, for example) are approximately 40 dBA; levels between 50 dBA and 70 dBA define the range of noise levels generated by normal daily activity; levels above 70 dBA would be considered noisy, and then loud, intrusive, and deafening as the scale approaches 130 dBA.

Table 11-1
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	80–90
Busy city street, loud shout	80
Busy traffic intersection	70–80
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	50–60
Background noise in an office	50
Suburban areas with medium-density transportation	40–50
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.

In considering these values, it is important to note that the dBA scale is logarithmic, meaning that each increase of 10 dBA describes a doubling of perceived loudness. Thus, the background noise in an office, at 50 dBA, is perceived as twice as loud as a library at 40 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. Generally, changes in noise levels less than 3 dBA are barely perceptible to most listeners.

SOUND LEVEL DESCRIPTORS

Because the sound pressure level unit of dBA describes a noise level at just one moment and very few noises are constant, other ways of describing noise over extended periods have been developed. One way of describing fluctuating sound is to describe the fluctuating noise heard over a specific time period as if it had been a steady, unchanging sound. 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 time 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. Statistical sound level descriptors such as L_1, L_{10}, L_{50}, L_{90}, and L_x, are used to indicate noise levels that are exceeded 1, 10, 50, 90 and x percent of the time, respectively.

The relationship between L_{eq} and levels of exceedance is worth noting. Because L_{eq} is defined in energy rather than straight numerical terms, it is not simply related to the levels of exceedance. If the noise fluctuates very little, L_{eq} will approximate L_{50} or the median level. If the noise fluctuates broadly, the L_{eq} will be approximately equal to the L_{10} value. If extreme fluctuations are present, the L_{eq} will exceed L_{90} or the background level by 10 or more decibels. Thus the relationship between L_{eq} and the levels of exceedance will depend on the character of the noise. In community noise measurements, it has been observed that the L_{eq} is generally between L_{10} and L_{50}.

For purposes of the proposed project, the 1-hour L_{10} descriptor ($L_{10(1)}$) has been selected as the noise descriptor to be used in this noise impact evaluation. The 1-hour L_{10} is the noise descriptor used in the 2012 *CEQR Technical Manual* noise exposure guidelines for city environmental impact review classification.

C. NOISE STANDARDS AND CRITERIA

NEW YORK *CEQR* NOISE STANDARDS

The *CEQR Technical Manual* sets external noise exposure standards; these standards are shown in **Table 11-2**. Noise exposure is classified into four categories: acceptable, marginally acceptable, marginally unacceptable, and clearly unacceptable.

The *CEQR Technical Manual* defines attenuation requirements for buildings based on exterior noise levels (see **Table 11-3**). Recommended noise attenuation values for buildings are designed to maintain interior noise levels of 45 dBA or lower for residential and classroom uses and 50 dBA or lower for commercial uses, and are determined based on exterior $L_{10(1)}$ noise levels.

Table 11-2
Noise Exposure Guidelines For Use in City Environmental Impact Review

Receptor Type	Time Period	Acceptable General External Exposure	Airport[3] Exposure	Marginally Acceptable General External Exposure	Airport[3] Exposure	Marginally Unacceptable General External Exposure	Airport[3] Exposure	Clearly Unacceptable General External Exposure	Airport[3] Exposure
Outdoor area requiring serenity and quiet[2]		$L_{10} \leq 55$ dBA		**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
Hospital, nursing home		$L_{10} \leq 55$ dBA		$55 < L_{10} \leq 65$ dBA		$65 < L_{10} \leq 80$ dBA		$L_{10} > 80$ dBA	
Residence, residential hotel, or motel	7 AM to 10 PM	$L_{10} \leq 65$ dBA		$65 < L_{10} \leq 70$ dBA		$70 < L_{10} \leq 80$ dBA		$L_{10} > 80$ dBA	
	10 PM to 7 AM	$L_{10} \leq 55$ dBA		$55 < L_{10} \leq 70$ dBA		$70 < L_{10} \leq 80$ dBA		$L_{10} > 80$ dBA	
School, museum, library, court, house of worship, transient hotel or motel, public meeting room, auditorium, outpatient public health facility		Same as Residential Day (7 AM-11 PM)		Same as Residential Day (7 AM-11 PM)		Same as Residential Day (7 AM-11 PM)		Same as Residential Day (7 AM-11 PM)	
Commercial or office		Same as Residential Day (7 AM-11 PM)		Same as Residential Day (7 AM-11 PM)		Same as Residential Day (7 AM-11 PM)		Same as Residential Day (7 AM-11 PM)	
Industrial, public areas only[4]	Note 4	Note 4		Note 4		Note 4		Note 4	

Airport[3] Exposure: Ldn ≤ 60 dBA (Acceptable); 60 < Ldn ≤ 65 dBA (Marginally Acceptable); (i) 65 < Ldn ≤ 70 dBA, (ii) 70 ≤ Ldn (Marginally Unacceptable); Ldn ≤ 75 dBA (Clearly Unacceptable)

Notes:

(i) In addition, any new activity shall not increase the ambient noise level by 3 dBA or more; (ii) *CEQR Technical Manual* noise criteria for train noise are similar to the above aircraft noise standards: the noise category for train noise is found by taking the L_{dn} value for such train noise to be an L_{dn}^{y} (L_{dn} contour) value.

Table Notes:

[1] Measurements and projections of noise exposures are to be made at appropriate heights above site boundaries as given by American National Standards Institute (ANSI) Standards; all values are for the worst hour in the time period.

[2] Tracts of land where serenity and quiet are extraordinarily important and serve an important public need, and where the preservation of these qualities is essential for the area to serve its intended purpose. Such areas could include amphitheaters, particular parks or portions of parks, or open spaces dedicated or recognized by appropriate local officials for activities requiring special qualities of serenity and quiet. Examples are grounds for ambulatory hospital patients and patients and residents of sanitariums and nursing homes.

[3] One may use FAA-approved L_{dn} contours supplied by the Port Authority, or the noise contours may be computed from the federally approved INM Computer Model using flight data supplied by the Port Authority of New York and New Jersey.

[4] External Noise Exposure standards for industrial areas of sounds produced by industrial operations other than operating motor vehicles or other transportation facilities are spelled out in the New York City Zoning Resolution, Sections 42-20 and 42-21. The referenced standards apply to M1, M2, and M3 manufacturing districts and to adjoining residence districts (performance standards are octave band standards).

Source: New York City Department of Environmental Protection (adopted policy 1983).

Table 11-3
Required Attenuation Values to Achieve Acceptable Interior Noise Levels

	Marginally Acceptable				Clearly Unacceptable
Noise Level With Proposed Project	$70 < L_{10} \leq 73$	$73 < L_{10} \leq 76$	$76 < L_{10} \leq 78$	$78 < L_{10} \leq 80$	$L_{10} < 80$
Attenuation*	(I) 28 dBA	(II) 31 dBA	(III) 33 dBA	(IV) 35 dBA	$36 + (L_{10} - 80)^{B}$ dBA

Notes: [A] The above composite window-wall attenuation values are for residential dwellings. Commercial office spaces and meeting rooms would be 5 dB(A) less in each category. All the above categories require a closed window situation and hence an alternate means of ventilation.

Required attenuation values increase by 1 dB(A) increments for L_{10} values greater than 80 dBA.

Source: New York City Department of Environmental Protection

IMPACT DEFINITION

The determination of significant adverse noise impacts in this analysis is informed by the use of both absolute noise level limits and relative impact criteria. The 2012 *CEQR Technical Manual* states that "it is reasonable to consider 65 dBA $L_{eq(1)}$ as an absolute noise level that should not be significantly exceeded." Therefore, the determination of impacts first considers whether a projected noise increase would result in noise levels exceeding 65 dBA $L_{eq(1)}$. Where appropriate, this study also consults the following relative impact criteria to define a significant adverse noise impact, as recommended in the *CEQR Technical Manual*:

- An increase of 5 dBA, or more, in Build $L_{eq(1)}$ noise levels at sensitive receptors (including residences, play areas, parks, schools, libraries, and houses of worship) over those calculated for the No Build condition, if the No Build levels are less than 60 dBA $L_{eq(1)}$ and the analysis period is not a nighttime period.
- An increase of 4 dBA, or more, in Build $L_{eq(1)}$ noise levels at sensitive receptors over those calculated for the No Build condition, if the No Build levels are 61 dBA $L_{eq(1)}$ and the analysis period is not a nighttime period.
- An increase of 3 dBA, or more, in Build $L_{eq(1)}$ noise levels at sensitive receptors over those calculated for the No Build condition, if the No Build levels are greater than 62 dBA $L_{eq(1)}$ and the analysis period is not a nighttime period.
- An increase of 3 dBA, or more, in Build $L_{eq(1)}$ noise levels at sensitive receptors over those calculated for the No Build condition, if the analysis period is a nighttime period (defined by the *CEQR Technical Manual* criteria as being between 10 PM and 7 AM).

D. EXISTING NOISE LEVELS

SELECTION OF NOISE RECEPTOR LOCATIONS

A total of eight receptor locations within the project area were selected for impact assessment, five of which were also used for evaluation of noise attenuation requirements. These locations are shown below in **Table 11-4** and shown in **Figure 11-1**.

Sites 1 through 7 were located at grade, while site A was located on the roof of a one story building on Jerome Avenue directly north of the Armory building. Site A has a clear line of sight to the elevated No. 4 train along Jerome Avenue, with no shielding from the train by the Armory building, and is representative of conditions at the Armory building façade immediately adjacent to the train.

Receptors sites 1 through 7 were used for the assessment of potential mobile source noise impacts, and receptor sites 1, 2, 4, 5, and A were used for the evaluation of noise attenuation requirements.

NOISE MONITORING

At all receptor sites, existing noise levels were determined by field measurements. Noise monitoring was performed on April 27, 2013 and May 14, 2013. At sites 1, 3, 4, 5, 6, and 7, 20-minute spot measurements were taken. At sites 2 and A, 1-hour spot measurements were taken. All measurements were performed during the weekday and Saturday peak periods—Midday (MD) [1:30 PM to 3:30 PM], and PM (5:30 PM to 7:30 PM).

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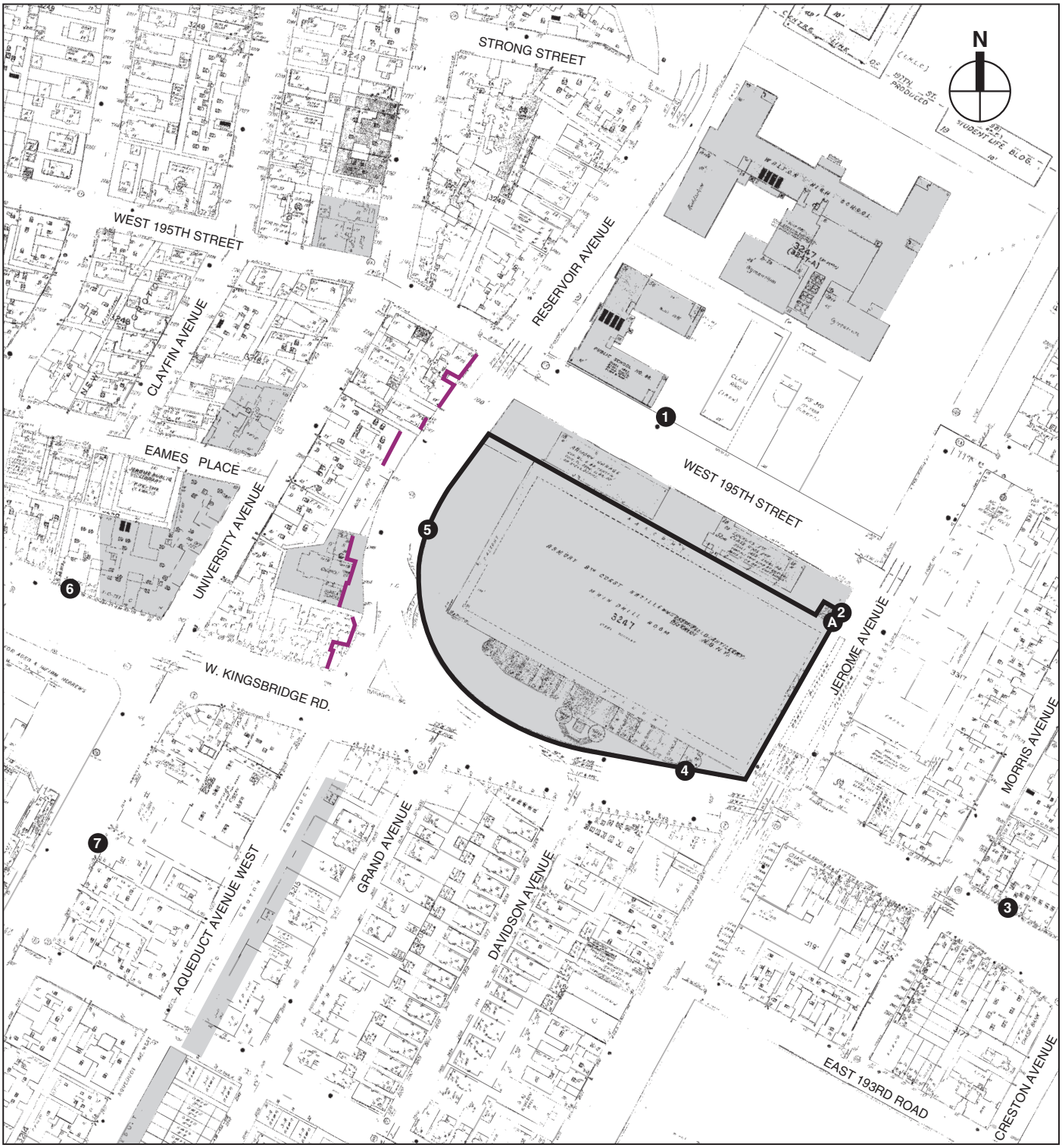

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SCALE

Project Site Boundary

A *Elevated Noise Receptor*

1 *At-Grade Noise Receptor*

Significant Adverse Noise Impact Locations

Kingsbridge Armory National Ice Center

Noise Receptor Locations
Figure 11-1

Table 11-4
Noise Receptor Locations

Receptor	Location	Associated Land Use
1	West 195th Street between Reservoir and Jerome Avenues	Institutional
2	Jerome Avenue between West 195th Street and West Kingsbridge Road	Commercial/Institutional
3	East Kingsbridge Road between Morris and Creston Avenues	Residential with Commercial Below
4	West Kingsbridge Road between Davidson and Jerome Avenues	Commercial
5	Reservoir Avenue between West 195th Street and West Kingsbridge Road	Residential/Commercial
6	West Kingsbridge Road between Webb and University Avenues	Residential with Commercial Below
7	University Avenue between West Kingsbridge Road and West 192nd Street	Residential
A	Jerome Avenue Rooftop facing Elevated No. 4 Train	Commercial/Institutional

EQUIPMENT USED DURING NOISE MONITORING

Measurements were performed using Brüel & Kjær Sound Level Meters (SLM) Type 2250 and 2260, Brüel & Kjær ½-inch microphones Type 4189, and Brüel & Kjær Sound Level Calibrators Type 4231. The Brüel & Kjær SLMs are Type 1 instruments according to ANSI Standard S1.4-1983 (R2006). The SLMs had a laboratory calibration date within one year of the time of use. The microphones at sites 1 though 7 were mounted at a height of approximately five feet above the ground surface on a tripod and approximately six feet or more away from any large sound-reflecting surface to avoid major interference with sound propagation. The microphone at site A was mounted on a pole from the roof of a one story building on Jerome Avenue directly north of the Armory building and approximately 3 feet out from the Armory façade. The SLMs were calibrated before and after readings with a Brüel & Kjær Type 4231 Sound Level Calibrator using the appropriate adaptor. The data were digitally recorded by the SLMs and displayed at the end of the measurement period in units of dBA. Measured quantities included the L_{eq}, L_1, L_{10}, L_{50}, and L_{90} values. A windscreen was used during all sound measurements except for calibration. All measurement procedures were based on the guidelines outlined in ANSI Standard S1.13-2005.

EXISTING NOISE LEVELS AT NOISE RECEPTOR LOCATIONS

MEASURED NOISE LEVELS

The results of the measurements of existing noise levels are summarized in **Table 11-5**. Traffic was the dominant noise source for receptor sites 1, 3, 4, 5, 6, and 7. Noise from the elevated No. 4 train was included in the measurements at receptor sites 1, 3, and 4, but was not considered a dominant source. Noise from the elevated No. 4 train was the dominant source of noise at receptor sites 2 and A. Traffic noise was included at these receptor sites as well, but was not considered a dominant source. Noise levels are moderate to high and reflect the level of traffic and/or rail activity present adjacent to the receptors.

Table 11-5
Existing Noise Levels (in dBA)

Receptor	Measurement Location	Day	Time	L_{eq}	L_1	L_{10}	L_{50}	L_{90}
1	West 195th Street between Reservoir and Jerome Avenues	Weekday	MD	67.8	76.8	70.7	63.7	58.4
			PM	66.6	73.9	70.2	64.2	59.9
		Saturday	MD	65.4	74.0	69.7	60.6	50.5
			PM	70.9	82.6	72.6	64.0	53.8
2	Jerome Avenue between West 195th Street and West Kingsbridge Road	Weekday	MD	77.1	88.9	79.1	69.6	64.1
			PM	75.1	87.4	78.2	66.3	61.0
		Saturday	MD	77.7	90.7	78.4	67.9	62.0
			PM	77.0	89.9	77.8	67.4	62.4
3	East Kingsbridge Road between Morris and Creston Avenues	Weekday	MD	68.1	77.1	71.1	65.6	61.8
			PM	68.1	75.5	70.9	66.6	63.2
		Saturday	MD	71.8	78.0	71.3	66.7	63.5
			PM	69.2	79.0	72.0	66.2	61.8
4	West Kingsbridge Road between Davidson and Jerome Avenues	Weekday	MD	67.7	76.3	70.8	65.0	60.2
			PM	66.2	74.6	69.3	64.1	60.2
		Saturday	MD	68.9	79.9	70.4	63.9	59.8
			PM	70.7	82.8	72.9	66.6	61.7
5	Reservoir Avenue between West 195th Street and West Kingsbridge Road	Weekday	MD	62.2	71.3	65.4	59.5	53.5
			PM	64.0	73.0	66.4	61.7	57.3
		Saturday	MD	63.8	74.7	65.6	58.6	52.3
			PM	62.7	70.7	66.3	60.1	54.9
6	West Kingsbridge Road between Webb and University Avenues	Weekday	MD	75.9	83.9	79.4	71.5	64.5
			PM	73.6	83.7	76.3	69.8	64.3
		Saturday	MD	72.1	80.2	76.4	69.2	64.4
			PM	72.9	83.1	75.4	70.1	65.5
7	University Avenue between West Kingsbridge Road and West 192nd Street	Weekday	MD	67.1	76.9	69.6	64.8	60.9
			PM	67.3	78.0	68.5	62.7	55.4
		Saturday	MD	64.6	73.1	67.2	62.6	59.0
			PM	66.9	77.8	69.5	63.7	59.6
A	Jerome Avenue Rooftop facing Elevated No. 4 train	Weekday	MD	75.4	87.5	76.3	67.5	62.3
			PM	76.6	87.7	78.2	66.9	61.2
		Saturday	MD	76.3	89.3	77.2	65.8	59.6
			PM	77.1	88.8	76.7	65.1	60.1

In terms of *CEQR Technical Manual* criteria, existing noise levels at receptor sites 5 and 7 would be in the "marginally acceptable" category, and existing noise levels at receptor sites 1, 2, 3, 4, 6, and A would be in the "marginally unacceptable" category.

E. NOISE PREDICTION METHODOLOGY

GENERAL METHODOLOGY

Future noise levels were calculated using either a proportional modeling technique or the Federal Highway Administration (FHWA) *Traffic Noise Model* (TNM) Version 2.5. Both the proportional modeling technique and the TNM are methodologies recommended for analysis purposes in the *CEQR Technical Manual*. The noise impact analysis examined the MD and PM peak hours for both the weekday and weekend conditions at receptor sites 1 through 7. The selected time periods are the periods expected to be the peak periods of traffic generation (based on the traffic studies presented in Chapter 8, "Transportation") for the proposed project and therefore result in the maximum potential for significant adverse noise impacts.

The proportional modeling and TNM procedures used for the noise analysis are described below.

PROPORTIONAL MODELING

Proportional modeling was used to determine locations with the potential for having significant noise impacts. Proportional modeling is one of the techniques recommended in the *CEQR Technical Manual* for mobile source analysis.

Using this technique, the prediction of future noise levels where traffic is the dominant noise source is based on a calculation using measured existing noise levels and predicted changes in traffic volumes to determine noise levels in the future without the proposed project (the No Build condition) and with the proposed project (the Build condition). Vehicular traffic volumes are converted into Noise Passenger Car Equivalent (Noise PCE) values, for which one medium-duty truck (having a gross weight between 9,900 and 26,400 pounds) is assumed to generate the noise equivalent of 13 cars, and one heavy-duty truck (having a gross weight of more than 26,400 pounds) is assumed to generate the noise equivalent of 47 cars, and one bus (vehicles designed to carry more than nine passengers) is assumed to generate the noise equivalent of 18 cars. Future noise levels are calculated using the following equation:

$F\ NL - E\ NL = 10 * \log_{10} (F\ PCE / E\ PCE)$

where:

F NL = Future Noise Level

E NL = Existing Noise Level

F PCE = Future Noise PCEs

E PCE = Existing Noise PCEs

Sound levels are measured in decibels and therefore increase logarithmically with sound source strength. In this case, the sound source is traffic volumes measured in Noise PCEs. For example, if the existing traffic volume on a street is 100 Noise PCE and if the future traffic volume were increased by 50 Noise PCE to a total of 150 PCE, the noise level would increase by 1.8 dBA (assuming that traffic is the dominant noise source at this particular location). Similarly, if the future traffic were increased by 100 Noise PCE, or doubled to a total of 200 Noise PCE, the noise level would increase by 3.0 dBA.

TRAFFIC NOISE MODEL (TNM)

At Site 5, preliminary modeling studies using the proportional modeling technique indicated that the future traffic may have the potential to cause noticeable increases in noise levels due to large increases in auto and bus traffic. Therefore, at this location, a refined analysis was performed using the TNM (described below).

The TNM is a computerized model developed for the FHWA that calculates the noise contribution of each roadway segment to a given noise receptor. The noise from each vehicle type is determined as a function of the reference energy-mean emission level, corrected for vehicle volume, speed, roadway grade, roadway segment length, and source-receptor distance. Further considerations included in modeling the propagation path include identifying the shielding provided by rows of buildings, analyzing the effects of different ground types, identifying source and receptor elevations, and analyzing the effects of any intervening noise barriers. The existing TNM noise levels were subtracted from the measured existing noise levels and added to the predicted TNM No Build and Build noise levels to account for background noise not attributable to vehicular traffic. The less refined proportional modeling technique does

not account for the noise contributions from adjacent roadways, and thus, over predicts the project-generated traffic noise levels by attributing all of the noise due to traffic and traffic changes to the immediately adjacent street.

F. THE FUTURE WITHOUT THE PROPOSED PROJECT

Using the methodology previously described, noise levels in the No Build condition were calculated at the seven mobile source noise analysis receptors for the 2018 analysis year. These No Build values are shown in **Table 11-6**.

Table 11-6
2018 No Build Condition Noise Levels (in dBA)

Receptor	Location	Day	Time	Existing $L_{eq(1)}$	No Build $L_{eq(1)}$	$L_{eq(1)}$ Change	No Build $L_{10(1)}$
1	West 195th Street between Reservoir and Jerome Avenues	Weekday	MD	67.8	67.9	0.1	70.8
			PM	66.6	66.7	0.1	70.3
		Weekend	MD	65.4	65.5	0.1	69.8
			PM	70.9	71.0	0.1	72.7
2	Jerome Avenue between West 195th Street and West Kingsbridge Road	Weekday	MD	77.1	77.2	0.1	79.2
			PM	75.1	75.2	0.1	78.3
		Weekend	MD	77.7	77.8	0.1	78.5
			PM	77.0	77.1	0.1	77.9
3	East Kingsbridge Road between Morris and Creston Avenues	Weekday	MD	68.1	68.2	0.1	71.2
			PM	68.1	68.3	0.2	71.1
		Weekend	MD	71.8	71.9	0.1	71.4
			PM	69.2	69.3	0.1	72.1
4	West Kingsbridge Road between Davidson and Jerome Avenues	Weekday	MD	67.7	67.8	0.1	70.9
			PM	66.2	66.3	0.1	69.4
		Weekend	MD	68.9	69.0	0.1	70.5
			PM	70.7	70.8	0.1	73.0
5	Reservoir Avenue between West 195th Street and West Kingsbridge Road	Weekday	MD	62.2	62.3	0.1	65.5
			PM	64.0	64.5	0.5	66.9
		Weekend	MD	63.8	63.8	0.0	65.6
			PM	62.7	62.7	0.0	66.3
6	West Kingsbridge Road between Webb and University Avenues	Weekday	MD	75.9	76.0	0.1	79.5
			PM	73.6	73.7	0.1	76.4
		Weekend	MD	72.1	72.2	0.1	76.5
			PM	72.9	73.0	0.1	75.5
7	University Avenue between West Kingsbridge Road and West 192nd Street	Weekday	MD	67.1	67.2	0.1	69.7
			PM	67.3	67.4	0.1	68.6
		Weekend	MD	64.6	64.7	0.1	67.3
			PM	66.9	67.0	0.1	69.6

Notes:
Noise levels at Receptor Sites 1, 2, 3, 4, 6, and 7 were calculated using proportional modeling. Noise levels at Receptor Site 5 was calculated using TNM.

In 2018, the maximum increase in $L_{eq(1)}$ noise levels for the No Build condition would be 0.5 dBA at all of the mobile source noise analysis receptors. Changes of this magnitude would be imperceptible. In terms of CEQR noise exposure guidelines, noise levels at receptor sites 5 and 7 would remain in the "marginally acceptable" category and noise levels at receptor sites 1, 2, 3, 4, and 6 would remain in the "marginally unacceptable" category.

G. PROBABLE IMPACTS OF THE PROPOSED PROJECT

Using the methodology previously described, noise levels in the Build condition were calculated at the seven mobile source noise analysis receptors for the 2018 analysis year. These No Build values are shown in **Table 11-7**.

Table 11-7
2018 Build Condition Noise Levels (in dBA)

Receptor	Location	Day	Time	No Build $L_{eq(1)}$	Build $L_{eq(1)}$	$L_{eq(1)}$ Change	Build $L_{10(1)}$
1	West 195th Street between Reservoir and Jerome Avenues	Weekday	MD	67.9	68.3	0.4	71.2
			PM	66.7	68.3	1.5	71.9
		Weekend	MD	65.5	67.3	1.9	71.6
			PM	71.0	72.4	1.5	74.1
2	Jerome Avenue between West 195th Street and West Kingsbridge Road	Weekday	MD	77.2	77.4	0.2	79.4
			PM	75.2	75.5	0.3	78.6
		Weekend	MD	77.8	78.1	0.4	78.8
			PM	77.1	77.5	0.4	78.3
3	East Kingsbridge Road between Morris and Creston Avenues	Weekday	MD	68.2	68.3	0.2	71.3
			PM	68.3	68.8	0.5	71.6
		Weekend	MD	71.9	72.5	0.6	72.0
			PM	69.3	70.0	0.8	72.8
4	West Kingsbridge Road between Davidson and Jerome Avenues	Weekday	MD	67.8	67.9	0.1	71.0
			PM	66.3	66.6	0.3	69.7
		Weekend	MD	69.0	69.3	0.4	70.8
			PM	70.8	71.2	0.5	73.4
5	Reservoir Avenue between West 195th Street and West Kingsbridge Road	Weekday	MD	62.3	64.3	2.1	67.5
			PM	64.5	68.2	**4.2**	70.6
		Weekend	MD	63.8	67.8	**4.0**	69.6
			PM	62.7	68.6	**5.9**	72.2
6	West Kingsbridge Road between Webb and University Avenues	Weekday	MD	76.0	76.1	0.2	79.6
			PM	73.7	74.8	1.0	77.5
		Weekend	MD	72.2	73.3	1.1	77.6
			PM	73.0	74.2	1.2	76.7
7	University Avenue between West Kingsbridge Road and West 192nd Street	Weekday	MD	67.2	67.3	0.1	69.8
			PM	67.4	67.7	0.3	68.9
		Weekend	MD	64.7	64.9	0.3	67.5
			PM	67.0	67.4	0.4	70.0

Notes:
Noise levels at Receptor Sites 1, 2, 3, 4, 6, and 7 were calculated using proportional modeling. Noise levels at Receptor Site 5 was calculated using TNM.
CEQR Technical Manual noise level exceedances of relative impact criteria are marked in **bold**.

In terms of CEQR noise exposure guidelines, noise levels at receptor site 7 would remain in the "marginally acceptable" category, noise levels at receptor site 5 would change from the "marginally acceptable" category to the "marginally unacceptable" category, and noise levels at receptor sites 1, 2, 3, 4, and 6 would remain in the "marginally unacceptable" category.

In 2018, comparing the No Build condition to the Build condition, the maximum increase in $L_{eq(1)}$ noise levels at receptor sites 1, 2, 3, 4, 6, and 7 would be 1.9 dBA. Changes of this magnitude would be barely perceptible and would fall below the CEQR threshold for a significant adverse noise impact.

In 2018, when the proposed project would be complete and operational, $L_{eq(1)}$ noise levels from project-generated traffic would exceed the *CEQR Technical Manual* impact criteria and result in significant adverse noise impacts during the weekday PM, weekend MD, and weekend PM time

periods at receptor site 5. This location is on Reservoir Avenue between West 195th Street and West Kingsbridge Road, which would be the principal feeder street to and from the parking facility for the proposed project. The maximum increase in noise levels at this location would be 5.9 dBA during the weekend PM time period.

Based upon these site specific results it can be forecast that noise levels due to project-generated traffic could exceed the *CEQR Technical Manual* impact criteria and result in significant adverse noise impacts at residences and the church along the west side of Reservoir Avenue between West 195th Street and West Kingsbridge Road. Existing and No Build noise levels at this location are relatively low, and project-generated traffic would cause significant increases in noise levels on this street. However, noise levels in the future with the proposed project would be considered "marginally unacceptable" according to CEQR criteria, which is not unusual for residential areas in New York City. Furthermore, these noise level increases are expected to occur only during the hour preceding and following high attendance events at the proposed project, when most of the participants and spectators would be arriving and departing. As such these exceedances would occur during limited hours of the day and would not occur during the nighttime periods. At all other times, noise levels along this roadway would be expected to be similar to conditions predicted in the future without the proposed project.

The noise levels predicted in this assessment are based on conservative assumptions regarding traffic generation and mode of transportation for users of the proposed project. Noise levels would be lower if the traffic generation is less than forecast in this assessment. Therefore, since the significant noise level increases described above are expected to occur during only limited times of day and only in the hour before and after high attendance events at the Armory, a post-construction noise monitoring program would be enacted to determine whether the proposed project would result in a significant increase in noise levels. The applicant would prepare a monitoring protocol for review and approval by the New York City Department of Environmental Protection (DEP). The monitoring protocol would include noise measurements at various locations along the west side of Reservoir Avenue between West 195th Street and Kingsbridge Avenue on a day or days when an event is occurring at the proposed project that would correspond with heavy usage of the project's parking garage as analyzed in Chapter 8, "Transportation." Measurements would be taken during each of the time periods predicted to experience a significant impact at this location. The applicant would perform post-construction noise monitoring as approved by DEP and submit the results for DEP consideration. If, based on the post-construction noise monitoring program, the predicted increase in noise levels materialize, measures to mitigate the significant adverse noise impacts predicted at the residences and church along the west side of Reservoir Avenue between West 195th Street and Kingsbridge Avenue would be made available, as described in Chapter 14, "Mitigation." Mitigation measures, should they be necessary, would include the offer of storm windows and/or window air-conditioning units for residential units and church spaces that do not already have them. The requirement for the post-construction monitoring protocol, post-construction monitoring, and mitigation measures (if they are shown to be necessary by the post-construction monitoring) would be set forth in the project's commitments letter and enforced via the project's land lease agreement or other legally binding instrument.

NOISE FROM THE OPERATION OF THE PROPOSED PROJECT

The dominant source of noise from events associated with the proposed project would be from the building's public address system. Events with extensive amplified sound (e.g., concerts,

movie screenings, etc.) are not anticipated. The building's public address system would be designed to meet the New York City Noise Control Code Subchapter 5, §24-231 which states:

"Commercial music. (a) No person shall make or cause or permit to be made or cause any music originating from or in connection with the operation of any commercial establishment or enterprise when the level of sound attributable to such music, as measured inside any receiving property dwelling unit:

(1) is in excess of 42 dB(A) as measured with a sound level meter; or
(2) is in excess of 45 dB in any one-third octave band having a center frequency between 63 hertz and 500 hertz (ANSI band numbers 18 through 27, Inclusive), in accordance with American National Standards Institute standard S1.6-1984; or
(3) cause a 6 dB(C) or more increase in the total sound level above the ambient sound level as measured in decibels in the "C" weighting network provided that the ambient sound level is in excess of 62 dB(C)."

NOISE ATTENUATION MEASURES FOR THE PROPOSED PROJECT

The *CEQR Technical Manual* has set noise attenuation requirements for buildings based on exterior noise levels. Recommended noise attenuation values for buildings are designed to maintain interior noise levels of 45 dBA or lower for residential and classroom uses and 50 dBA or lower for commercial uses, and are determined based on exterior $L_{10(1)}$ noise levels. Based on measured exterior noise levels and *CEQR* criteria, the necessary attenuation for each façade of the Armory building has been calculated. The required attenuation levels at each of the receptor sites used for evaluation of noise attenuation requirements are shown in **Table 11-8**.

Table 11-8
Required Attenuation at Noise Measurement Locations Under *CEQR* Criteria

Receptor #	Location	Highest Calculated Build $L_{10(1)}$ Value	Minimum Required Attenuation (dBA)
1	West 195th Street between Reservoir and Jerome Avenues	74.1	26
2	Jerome Avenue between West 195th Street and West Kingsbridge Road	79.4	30
4	West Kingsbridge Road between Davidson and Jerome Avenues	73.4	26
5	Reservoir Avenue between West 195th Street and West Kingsbridge Road	72.2	23
A	Jerome Avenue Rooftop facing Elevated No. 4 train	78.2	30

Note:
Attenuation values are shown for commercial uses; residential or classroom uses would be 5 dBA more.

Attenuation would be required at one receptor location to achieve interior noise levels of 45 dBA or lower for residential and classroom uses and 50 dBA or lower for commercial uses. Based on the values shown in **Table 11-8**, required attenuation levels were determined for all building sites. These values are shown in **Table 11-9**.

Table 11-9
Required Attenuation at the Armory Building

Façade(s)	Representative Receptor Site	*CEQR* Minimum Required Attenuation (in dBA)
North	1	26[1]
East (commercial space)	2, A	30[1]
East (community facility space)	2, A	35[2]
South	4	26[1]
West	5	23[1]

Note:
[1]Attenuation values are shown for commercial uses; residential or community facility uses would be 5 dBA more.
[2]Attenuation values are shown for community facility uses; commercial uses would be 5 dBA less.

BUILDING ATTENUATION IMPLEMENTATION

The attenuation of a composite structure is a function of the attenuation provided by each of its component parts and how much of the area is made up of each part. Normally, a building façade is composed of the wall, glazing, and any vents or louvers for heating, ventilation, and air conditioning (HVAC) systems in various ratios of area.

The existing Armory building façades along Jerome Avenue and Reservoir Avenue (east and west façades, respectively) would not provide sufficient attenuation in spaces along these façades to achieve interior noise levels considered acceptable for commercial or community facility uses according to *CEQR* criteria. The existing corrugated opaque fiberglass panels on these facades are not original and would be replaced as part of the proposed project. In addition, it is anticipated that if necessary, the non-original ground-floor windows on the Jerome Avenue façade (behind ironwork framework) that would face onto the proposed community facility space would be replaced with new windows or supplemented with interior storm-type windows, in order to ensure the composite attenuation of the façades are equal to or greater than the values shown in **Table 11-9**. This would ensure that noise levels within the proposed community facility space are acceptable according to CEQR interior noise level criteria for community facilities (i.e., $L_{10(1)}$ values less than or equal to 45 dBA).

The existing façade of the Armory along West Kingsbridge Road (the south façade) may not provide sufficient attenuation to achieve interior noise levels considered acceptable for commercial uses according to *CEQR* criteria inside the commercial ice rink spaces along this façade. This is because of the old single-glazed windows along this façade. As shown in **Table 11-9** above, the required attenuation on the south façade would be 26 dBA, which reflects typical noise levels in an urban environment and is commonly achieved in other buildings that are built using standard construction techniques. Typically, a project involving the reuse of an existing structure would meet the attenuation requirements by replacing existing windows with well-sealed double-glazed windows and alternate means of ventilation. However, the Kingsbridge Armory is listed on the State/National Registers of Historic Places (S/NR), and the windows on the façade along West Kingsbridge Road are a significant element of the structure's design. Thus, the removal and replacement of the windows on the façade facing West Kingsbridge Road would adversely affect one of the Armory's essential physical features that convey its historic identity (i.e., its integrity). Furthermore, the project is seeking federal historic preservation tax credits, and to receive the credits the Armory must be rehabilitated to the Secretary of the Interior’s Standards for Rehabilitation of Historic Properties. The Secretary of the Interior's Standards for Rehabilitation of Historic Properties state that “the removal of distinctive materials or alteration of features, spaces, and spatial relationships that characterize a

property will be avoided." Removal of the Armory's existing windows would not conform to the Secretary's Standards, and therefore an alteration of the building's façade elements (i.e., by replacing the existing windows) to provide the required amount of attenuation would likely result in the project's inability to receive federal historic preservation tax credits. To the extent practicable, the proposed project would undertake measures to improve the noise attenuation of the existing structure while preserving the building's historic integrity. All existing windows requiring replacement would be replaced with well-sealed windows, and all existing windows to remain would be repaired/resealed to be weather-tight. Other openings in the façade would be tightly sealed as required.

The level of interior noise within the commercial portion of the proposed project along the south façade of the Armory building resulting from exterior sources may be greater than the 50 dBA $L_{10(1)}$ level considered acceptable for commercial use according to *CEQR* interior noise level guidelines. Between the DEIS and FEIS, noise levels will be measured inside the Armory building along the south façade in order to determine whether interior $L_{10(1)}$ noise levels resulting from exterior noise sources would actually exceed 50 dBA. If the interior $L_{10(1)}$ noise levels resulting from exterior noise sources would exceed 50 dBA, this would constitute a significant adverse impact based on *CEQR* interior noise level criteria. For the reasons described above, there would be no feasible or practicable measures to mitigate this impact. Consequently, this would constitute an unmitigated significant adverse noise impact.

MECHANICAL EQUIPMENT

It is assumed that the building's mechanical systems (i.e., HVAC systems) would be designed to meet all applicable noise regulations (i.e., Subchapter 5, §24-227 of the New York City Noise Control Code, the New York City Department of Buildings [DOB] Code) and to avoid producing levels that would result in any significant increase in ambient noise levels. Therefore, the proposed project would not result in any significant adverse noise impacts related to building mechanical equipment. ✷