Chapter 17: Noise

A. INTRODUCTION

The noise analysis for the proposed project consists of three components—a screening analysis to determine whether traffic generated by the proposed project would have the potential to result in significant noise impacts; an analysis to determine whether the proposed project's Wheel-related activities (i.e., operation of the Wheel) would have the potential to result in significant noise impacts; and an analysis to determine the level of building attenuation necessary to ensure that the proposed project's interior noise levels satisfy applicable interior noise criteria.

PRINCIPAL CONCLUSIONS

With the proposed project completed in 2016, the increase in $L_{eq(1)}$ noise levels would be less than 3 dBA at all five receptor sites. Changes of these magnitudes would be considered imperceptible to barely perceptible, and they would be below the City Environmental Quality Review (CEQR) threshold for a significant adverse impact. In terms of CEQR Noise Exposure Guidelines, noise levels at receptor sites 1, 2, and 3 would remain in the "marginally unacceptable" category, noise levels would remain above the 55 dBA $L_{10(1)}$ noise level guideline for outdoor areas requiring serenity and quiet provided in the *CEQR Technical Manual* noise exposure guidelines at receptor Site 4, and noise levels would remain in the "marginally acceptable" category at Site 5. These values are based on the predicted $L_{10(1)}$ values.

For the open space locations (i.e., North Shore Waterfront Esplanade), existing noise levels are currently above the 55 dBA $L_{10(1)}$ *CEQR Technical Manual* noise level for outdoor areas. While the proposed project would exacerbate these exceedances, the noise levels would remain comparable to noise levels in portions of other public open spaces in this area (i.e., Tompkinsville Play Center, Nicholas Memorial Park, Mahoney Playground, and Davis Playground). This condition would also be expected for the new open spaces that would be created by the proposed project. Although the 55 dBA $L_{10(1)}$ guideline is a worthwhile goal for outdoor areas requiring serenity and quiet, this relatively low noise level is typically not achieved in parks and open space areas in New York City. Therefore, the change is not considered a significant adverse impact and no mitigation is proposed.

In terms of noise attenuation, the *CEQR Technical Manual* has set noise attenuation quantities for buildings based on exterior $L_{10(1)}$ noise levels, and in order to maintain interior noise levels of 45 dBA $L_{10(1)}$ or lower for residential or hotel uses and 50 dBA $L_{10(1)}$ or lower for commercial uses. The west facing facades of the North and South Sites (including the hotel) would require noise attenuation of between 28 and 31 dBA.

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 discernable 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 17-1**, 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 17-1
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, background noise at 50 dBA is perceived as twice as loud as 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.

ABILITY TO PERCEIVE CHANGES IN NOISE LEVELS

The average ability of an individual to perceive changes in noise levels is well-documented (see **Table 17-2**). Generally, changes in noise levels of less than 3 dBA are barely perceptible to most listeners, whereas changes in noise levels of 10 dBA are normally perceived as doubling (or

halving) of noise loudness. These guidelines permit direct estimation of an individual's probable perception of changes in noise levels.

Table 17-2
Average Ability to Perceive Changes in Noise Levels

Change (dBA)	Human Perception of Sound
2–3	Barely perceptible
5	Readily noticeable
10	A doubling or halving of the loudness of sound
20	A "dramatic change"
40	Difference between a faintly audible sound and a very loud sound

Source: Bolt Beranek and Neuman, Inc., *Fundamentals and Abatement of Highway Traffic Noise*, Report No. PB-222-703. Prepared for Federal Highway Administration, June 1973.

EFFECTS OF DISTANCE ON SOUND

Sound 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. This decrease is known as "drop-off." The outdoor drop-off rate for line sources, such as traffic, is a decrease of approximately 4.5 dBA (for soft ground) for every doubling of distance between the noise source and receiver (for hard ground the outdoor drop-off rate is 3 dBA for line sources). Assuming soft ground, for point sources, such as amplified rock music, the outdoor drop-off rate is a decrease of approximately 7.5 dBA for every doubling of distance between the noise source and receiver (for hard ground the outdoor drop-off rate is 6 dBA for point sources).

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 that fluctuates over extended periods have been developed. One way is to describe the fluctuating sound 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 by $L_{eq(24)}$), 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 maximum 1-hour equivalent sound level ($L_{eq(1)}$) has been selected as the noise descriptor to be used in this noise impact evaluation. $L_{eq(1)}$ is the noise descriptor recommended for use in the *CEQR Technical Manual* for vehicular traffic and construction noise impact evaluation, and is used to provide an indication of highest expected

sound levels. The 1-hour L_{10} is the noise descriptor used in the *CEQR Technical Manual* noise exposure guidelines for City environmental impact review classification.

C. NOISE STANDARDS AND CRITERIA

Noise levels associated with the operation of the proposed project would be subject to Performance Standards for Manufacturing Districts contained in the New York City Zoning Resolution, noise standards contained in the New York City Noise Control Code, and to noise impact criteria set forth in the *CEQR Technical Manual.*

PERFORMANCE STANDARDS FOR MANUFACTURING DISTRICTS

The City of New York's Zoning Resolution Section 42-213 states that in all manufacturing districts, the sound pressure level resulting from any activity within the project site (an M1 zone), whether open or enclosed, shall not exceed, at any point on or beyond any lot line, the maximum permitted sound level for the designated octave band indicated in **Table 17-3**.

Table 17-3
City of New York Noise Performance Standards for M1 Manufacturing District

Old Octave Bands		Current Octave Bands	
Octave Band (Hz)	**M1 District (dB)**	**Octave Band (Hz)**	**M1 District (dB)**
20 to 75	79	63	78
75 to 150	74	125	72
150 to 300	66	250	64
300 to 600	59	500	58
600 to 1200	53	1000	52
1200 to 2400	47	2000	46
2400 to 4800	41	4000	41
Above 4800	39	8000	39

Source: City of New York Performance Standards for Manufacturing Districts Section 42-213.

The Performance Standards are specified in "old" octave bands. These bands have not been used in almost 40 years, and instrumentation is no longer available to measure per these specifications. The American National Standards Institute (ANSI) has promulgated a standard on the conversion of old octave bands to the current preferred values (and vice versa), to allow measurement and assessment. This conversion was done and the converted criteria are also provided in **Table 17-3**.

NEW YORK CITY NOISE CONTROL CODE

The New York City Noise Control Code, amended in December 2005, contains prohibitions regarding unreasonable noise, requirements for noise due to construction activities, and specific noise standards, including plainly audible criteria for specific noise sources. In addition, the amended code specifies that no sound source operating in connection with any commercial or business enterprise may exceed the decibel levels in the designated octave bands shown in **Table 17-4** at the specified receiving properties.

Table 17-4
New York City Noise Code

Octave Band Frequency (Hz)	Maximum Sound Pressure Levels (dB) as Measured Within a Receiving Property as Specified Below	
	Residential receiving property for mixed-use building and residential buildings (as measured within any room of the residential portion of the building with windows open, if possible)	*Commercial receiving property (as measured within any room containing offices within the building with windows open, if possible)*
31.5	70	74
63	61	64
125	53	56
250	46	50
500	40	45
1000	36	41
2000	34	39
4000	33	38
8000	32	37

Source: Section 24-232 of the Administrative Code of the City of New York, as amended December 2005.

NEW YORK CEQR NOISE CRITERIA

The 2012 *CEQR Technical Manual* sets external noise exposure standards; these standards are shown in **Table 17-5**. Noise exposure is classified into four categories: acceptable, marginally acceptable, marginally unacceptable, and clearly unacceptable. The noise level specified for outdoor areas requiring serenity and quiet is 55 dBA $L_{10(1h)}$.

The 2012 *CEQR Technical Manual* also defines attenuation requirements for buildings based on exterior noise level (see **Table 17-6**). Recommended noise attenuation values for buildings are designed to maintain interior noise levels of 45 dBA or lower for noise sensitive uses and 50 dBA or lower for commercial/office uses and are determined based on exterior $L_{10(1)}$ noise levels.

In addition, the *2012 CEQR Technical Manual* compares the proposed project's With-Action condition $L_{eq(1)}$ noise levels to those calculated for the No-Action condition, for receptors potentially affected by the project using the following criteria to determine whether a proposed project would result in a significant adverse noise impact:

- An increase of 5 dBA, or more, in With-Action $L_{eq(1)}$ noise levels at sensitive receptors (including residences, play areas, parks, schools, libraries, and houses of worship) over those calculated for the No-Action condition, if the No-Action levels are less than or equal to 60 dBA $L_{eq(1)}$ and the analysis period is not a nighttime period.
- An increase in With-Action $L_{eq(1)}$ noise levels at sensitive receptors of such that the total Build $L_{eq(1)}$ noise levels would be 65 dBA or greater, if the No-Action levels are between 60 and 62 dBA $L_{eq(1)}$ and the analysis period is not a nighttime period.
- An increase of 3 dBA, or more, in With-Action $L_{eq(1)}$ noise levels at sensitive receptors over those calculated for the No-Action condition, if the No-Action levels are greater than or equal to 62 dBA $L_{eq(1)}$ and the analysis period is not a nighttime period.
- An increase of 3 dBA, or more, in With-Action $L_{eq(1)}$ noise levels at sensitive receptors over those calculated for the No-Action condition, if the analysis period is a nighttime period (defined by the *CEQR Technical Manual* criteria as being between 10 PM and 7 AM).

Table 17-5
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	---------- Ldn ≤ 60 dBA ----------	NA	---------- 60 < Ldn ≤ 65 dBA ----------	NA	(i) 65 < Ldn ≤ 70 dBA, (II) 70 ≤ Ldn	NA	---------- Ldn ≤ 75 dBA ----------
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	

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^{y}_{dn} (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.

[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 17-6
Required Attenuation Values to Achieve Acceptable Interior Noise Levels

	Marginally Unacceptable				Clearly Unacceptable
Noise Level With the proposed project	$70 < L_{10} \leq 73$	$73 < L_{10} \leq 76$	$76 < L_{10} \leq 78$	$78 < L_{10} \leq 80$	$80 < L_{10}$
Attenuation[A]	(I) 28 dB(A)	(II) 31 dB(A)	(III) 33 dB(A)	(IV) 35 dB(A)	$36 + (L_{10} - 80)$[B] dB(A)

Notes:

[A] The above composite window-wall attenuation values are for residential dwellings and community facility development. Commercial office spaces, retail, 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.

[B] 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

For purposes of impact assessment, the proposed project would have a significant noise impact if one or more of the following criteria are exceeded: the *CEQR Technical Manual* relative noise criteria; the octave band noise levels specified in the Performance Standards for Manufacturing Districts contained in the New York City Zoning Resolution; or the octave band noise levels specified in the City of New York Noise Control Code.

D. NOISE PREDICTION METHODOLOGY

The noise impact assessment predicted separately the effects of noise from the project-generated traffic and the proposed project's Wheel-related activities (i.e., operation of the Wheel and people noise). Total noise levels with the proposed project (With-Action values) were obtained by adding noise due to the project-generated traffic and the project's Wheel-related activities to noise levels without the proposed project (No-Action values). The methodologies used to determine noise effects from the project-generated traffic and the project's Wheel-related activities are discussed below. Impacts were determined based upon the combined effects of both of these noise sources.

MOBILE NOISE SOURCES

Proportional modeling was used to determine locations which had the potential for having significant noise impacts and to quantify the magnitude of those potential 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 No-Action and With-Action levels. Using this methodology, vehicular traffic volumes were converted into passenger car equivalent (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; 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 PCEs

E PCE = Existing PCEs

With this methodology, assuming traffic is the dominant noise source at a particular location if the existing traffic volume on a street is 100 PCE and if the future traffic volume were increased by 50 PCE to a total of 150 PCE, the noise level would increase by 1.8 dBA. Similarly, if the future traffic were increased by 100 PCE, or doubled to a total of 200 PCE, the noise level would increase by 3.0 dBA.

STATIONARY NOISE SOURCES

In the study area, noise from the proposed project's Wheel-related activities is one of the major noise sources that would contribute to the total ambient noise levels. The major noise sources include the Wheel's operation. For the Wheel's operation, a total of 32 electric motor gear boxes would be expected to run simultaneously. Since the Wheel's drive system has been neither designed nor selected, the designated octave band sound pressure levels for the Wheel's drive system are not available. However, an emission level generated by each gear box would be less than 70 dBA at a distance of 3 feet, provided by Starneth (the engineer of the Observation Wheel). Conservatively, 70 dBA at 3 feet for each gear box was used for noise analysis. Calculations of noise levels from the Wheel's operation on receptor sites in the study area are based on the emission levels using the following equation:

$$L_{eq1} = L_{eq2} - 10 * \text{Log} (d_1/d_2) - A_{screen}$$

where:

L_{eq1} is the noise level at the receptor location;
L_{eq2} is the emission noise level;
d_1 is the distance from the emission source to the receptor;
d_2 is the reference distance; and
A_{screen} is the attenuation due to screening.

It is noted that using the equation above for the noise impact analysis would be conservative since attenuation effects from environmental factors (i.e., atmospheric absorption, terrain, and meteorological conditions) were not included in calculations.

E. EXISTING NOISE LEVELS

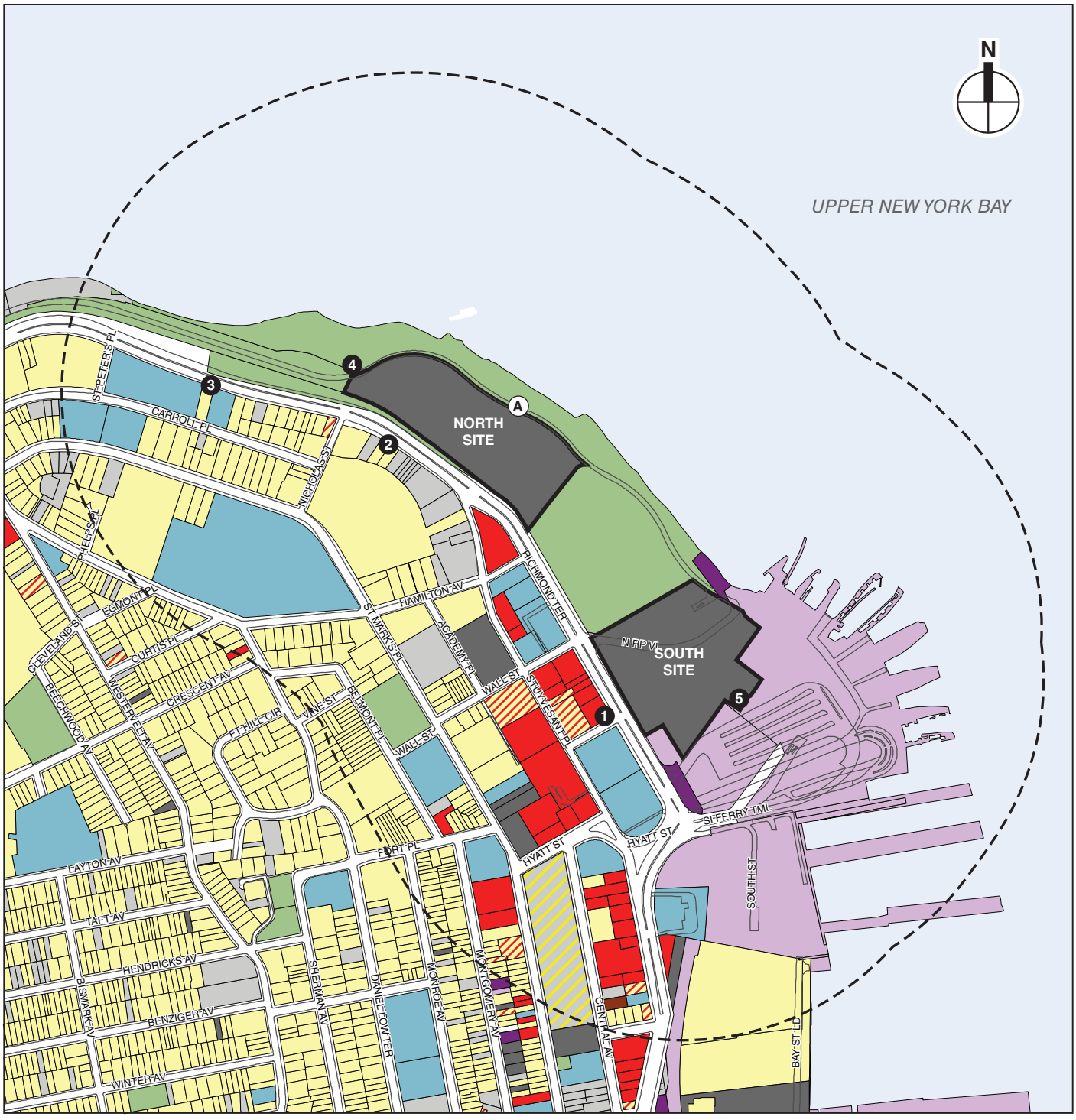
Existing noise levels were measured at five (5) locations near the project sites (see **Figure 17-1**). **Table 17-7** lists the receptor site locations and their representative uses. All five receptor sites were used to evaluate potential noise impacts due to the project-generated traffic and the proposed project's Wheel-related activities. Receptor sites 1, 2, 4, and 5 were also used to determine CEQR building attenuation requirements for the project's buildings. These five receptors, due to their proximity to the project sites, represent the nearby sensitive noise receptors with the greatest potential to experience significant noise increases as a result of the proposed project. Sensitive receptors further from the project sites would be less likely to experience significant noise increases as a result of the proposed project.

Table 17-7
Noise Receptor Locations

Receptor	Location	Land Use
1	Richmond Terrace between Schuyler and Wall Streets	Commercial
2	Richmond Terrace between Stuyvesant Place and Nicholas Street	Residential
3	Richmond Terrace between Nicholas Street and St. Peter's Place	Residential and School
4	North Shore Waterfront Esplanade	Open Space
5	Parking lot near the Staten Island Ferry	Transportation and Utility

At receptor sites 1, 2, 3, and 4, noise monitoring was conducted for three weekday conditions: AM, midday, and PM time periods, and two Saturday conditions: midday and PM time periods. At

4.3.13



Noise Receptor Locations

Figure 17-1

these receptor sites, existing noise levels were measured for 20-minute periods during three weekday periods—AM (8:00 AM to 9:30 AM), midday (MD) (1:00 PM to 2:30 PM), and PM (4:30 to 6:00 PM)—as well as two Saturday periods—midday (MD) (1:00 PM to 2:30 PM), and PM (6:00 PM to 7:30 PM). Measurements were taken on June 11 and 16, 2012. At receptor Site 5, 11-hour (8:00 AM to 7:00 PM) continuous noise monitoring was performed to determine existing noise levels at the parking lot near the Staten Island Ferry. Measurements were taken on October 6 (Saturday) and 16 (Weekday), 2012. The selected time periods are when the proposed project would have maximum traffic generation and/or the maximum potential for significant adverse noise impacts based on the traffic studies presented in Chapter 14, "Transportation."

EQUIPMENT USED DURING NOISE MONITORING

Measurements were performed using a Brüel & Kjær Sound Level Meter (SLM) Type 2260, a Brüel & Kjær ½-inch microphone Type 4189), and a Brüel & Kjær Sound Level Calibrator Type 4231. The Brüel & Kjær SLM is a Type 1 instrument according to ANSI Standard S1.4-1983 (R2006). For all receptor sites the instrument/microphone was mounted on a tripod at a height of approximately 5 feet above the ground. Microphones were mounted at least approximately 5 feet away from any large reflecting surfaces. The SLM was calibrated before and after readings with a Brüel & Kjær Type 4231 Sound Level Calibrator using the appropriate adaptor. Measurements at each location were made on the A-scale (dBA). The data were digitally recorded by the sound level meter and displayed at the end of the measurement period in units of dBA. Measured quantities included L_{eq}, L_1, L_{10}, L_{50}, L_{90}, and 1/3 octave band levels. 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.

RESULTS

The results of the existing noise level measurements are summarized in **Table 17-8** for receptor sites 1 through 4 and **Table 17-9** for receptor Site 5. At all receptor sites, vehicular traffic noise on adjacent roadways was the dominant noise source. Measured levels were moderate to relatively high and reflect the level of vehicular activity on the adjacent streets. In terms of the CEQR criteria, the existing noise levels are in the "marginally unacceptable" category at sites 1, 2, and 3, the existing noise levels exceed the 55 dBA $L_{10(1)}$ noise level guideline for outdoor areas requiring serenity and quiet provided in the *CEQR Technical Manual* noise exposure guidelines at Site 4, and the existing noise levels are in the "marginally acceptable" category at Site 5.

Table 17-8
Existing Noise Levels (in dBA)

Site	Measurement Location			L_{eq}	L_1	L_{10}	L_{50}	L_{90}
1	Richmond Terrace between Schuyler and Wall Streets	Weekday	AM	68.5	77.0	72.8	64.0	53.2
			MD	68.1	74.6	71.2	66.9	62.0
			PM	68.5	76.5	72.6	65.4	55.0
		Saturday	MD	67.2	76.0	71.5	61.6	56.0
			PM	66.4	75.8	70.3	61.5	53.9
2	Richmond Terrace between Stuyvesant Place and Nicholas Street	Weekday	AM	64.2	73.5	68.1	60.9	54.2
			MD	69.4	79.0	73.5	65.2	54.1
			PM	70.3	79.9	74.2	66.4	50.1
		Saturday	MD	67.1	77.3	70.9	61.6	49.1
			PM	66.7	75.1	71.3	62.2	49.4
3	Richmond Terrace between Nicholas Street and St. Peter's Place	Weekday	AM	66.1	76.0	70.9	58.8	51.1
			MD	66.0	75.3	70.8	58.3	51.9
			PM	68.5	77.0	72.8	64.0	53.2
		Saturday	MD	66.1	75.7	71.5	57.7	51.9
			PM	67.5	77.3	71.3	55.6	50.5
4	North Shore Waterfront Esplanade	Weekday	AM	58.0	64.7	61.7	55.9	52.8
			MD	59.4	67.2	62.7	57.4	53.6
			PM	58.7	65.7	62.6	56.4	52.2
		Saturday	MD	60.5	70.2	63.3	57.5	54.6
			PM	60.3	68.3	64.6	56.9	53.5

Note: Field measurements were performed by AKRF, Inc. on June 11 and 16, 2012.

Table 17-9
Receptor Site 5— Existing Noise Levels (in dBA)

Start Time	Measurement Location	Leq	L_1	L_{10}	L_{50}	L_{90}
Saturday (October 6, 2012)						
8 AM	Parking lot near the Staten Island Ferry	62.3	65.4	64.1	61.9	60.7
9 AM		62.3	66.4	64.0	61.7	60.6
10 AM		62.5	71.6	64.0	61.0	59.6
11 AM		61.9	67.4	63.7	60.7	59.2
Noon		61.4	65.5	63.5	60.7	59.5
1 PM		61.5	66.0	63.5	60.8	58.9
2 PM		60.6	65.7	62.1	59.7	58.1
3 PM		60.4	64.3	61.6	59.6	58.2
4 PM		60.9	64.3	62.4	60.3	59.3
5 PM		61.4	68.3	62.6	60.2	59.2
6 PM		59.7	64.6	61.5	58.8	57.5
7 PM		58.3	62.7	60.2	57.6	56.2
Weekday (October 16, 2012)						
8 AM	Parking lot near the Staten Island Ferry	61.9	69.5	63.7	60.4	58.9
9 AM		63.4	70.2	64.7	62.5	61.0
10 AM		66.5	78.2	66.3	63.1	61.5
11 AM		66.7	78.6	67.9	62.6	61.0
Noon		61.9	67.2	62.9	61.1	60.4
1 PM		65.5	76.7	66.2	63.1	60.8
2 PM		64.3	71.4	65.9	63.3	59.9
3 PM		60.9	71.1	62.9	57.3	54.8
4 PM		57.6	63.5	59.2	56.6	55.1
5 PM		59.8	72.9	61.6	56.4	52.6
6 PM		59.0	67.0	62.2	56.6	52.7
7 PM		63.0	73.2	63.5	61.8	56.7

Notes: Field measurements were performed by AKRF, Inc. on October 6 and 16, 2012.

F. THE FUTURE WITHOUT THE PROPOSED PROJECT

Using the methodology previously described—adding expected background traffic growth to existing noise levels—future noise levels without the proposed project were calculated for the five analysis receptors for the 2016 analysis year. These No-Action values are shown in **Table 17-10**.

Table 17-10
The Future without the Proposed Project Noise Levels (in dBA)

Receptor	Location	Date	Time	Existing Noise Levels		No-Action Noise Levels		
				$L_{eq(1)}$	$L_{10(1)}$	$L_{eq(1)}$	$L_{10(1)}$	Change
1	Richmond Terrace between Schuyler and Wall Streets	Weekday	MD	68.1	71.2	69.5	72.6	1.4
			PM	68.5	72.6	70.0	74.1	1.5
		Saturday	MD	67.2	71.5	69.1	73.4	1.9
			PM	66.4	70.3	67.7	71.6	1.3
2	Richmond Terrace between Stuyvesant Place and Nicholas Street	Weekday	MD	69.4	73.5	70.3	74.4	0.9
			PM	70.3	74.2	71.0~~71.1~~	74.9~~75.0~~	0.7~~0.8~~
		Saturday	MD	67.1	70.9	68.3	72.1	1.2
			PM	66.7	71.3	67.5	72.1	0.8
3	Richmond Terrace between Nicholas Street and St. Peter's Place	Weekday	MD	66.0	70.8	66.9	71.7	0.9
			PM	68.5	72.8	69.2~~69.3~~	73.5~~73.6~~	0.7~~0.8~~
		Saturday	MD	66.1	71.5	67.3	72.7	1.2
			PM	67.5	71.3	68.3	72.1	0.8
4	North Shore Waterfront Esplanade	Weekday	MD	59.4	62.7	59.8	63.1	0.4
			PM	58.7	62.6	59.5	63.4	0.8
		Saturday	MD	60.5	63.3	61.1	63.9	0.6
			PM	60.3	64.6	60.8	65.1	0.5
5	Parking lot near the Staten Island Ferry	Weekday	MD	64.3	65.9	64.3	65.9	0.0
			PM	63.0	63.5	63.0	63.5	0.0
		Saturday	MD	60.6	62.1	60.6	62.1	0.0
			PM	61.4	62.6	61.4	62.6	0.0

In 2016, the increase in $L_{eq(1)}$ noise levels without the proposed project would be less than 2 dBA at all five receptor sites. Changes of these magnitudes would be considered imperceptible, and they would be below the CEQR threshold for a significant adverse impact. In terms of CEQR Noise Exposure Guidelines, noise levels at receptor sites 1, 2, and 3 would remain in the "marginally unacceptable" category, noise levels would remain above the 55 dBA $L_{10(1)}$ noise level guideline for outdoor areas requiring serenity and quiet provided in the *CEQR Technical Manual* noise exposure guidelines at receptor Site 4, and noise levels would remain in the "marginally acceptable" category at Site 5. These values are based on the predicted $L_{10(1)}$ values.

G. THE FUTURE WITH THE PROPOSED PROJECT

CEQR IMPACT CRITERIA

Using the methodology previously described, future noise levels with the proposed project were calculated for the five analysis receptors for the 2016 analysis year. These With-Action values are shown in **Table 17-11**.

Table 17-11
The Future with the Proposed Project Noise Levels (in dBA)

Receptor	Location	Date	Time	No-Action Noise Levels		With-Action Noise Levels		
				$L_{eq(1)}$	$L_{10(1)}$	$L_{eq(1)}$	$L_{10(1)}$	Change
1	Richmond Terrace between Schuyler and Wall Streets	Weekday	MD	69.5	72.6	70.7	73.8	1.2
			PM	70.0	74.1	70.8	74.9	0.8
		Saturday	MD	69.1	73.4	70.9	75.2	1.8
			PM	67.7	71.6	68.7	72.6	1.0
2	Richmond Terrace between Stuyvesant Place and Nicholas Street	Weekday	MD	70.3	74.4	70.9	75.0	0.6
			PM	71.0~~71.1~~	74.9~~75.0~~	71.5	75.4	0.5~~0.4~~
		Saturday	MD	68.3	72.1	69.5	73.3	1.2
			PM	67.5	72.1	68.5	73.1	1.0
3	Richmond Terrace between Nicholas Street and St. Peter's Place	Weekday	MD	66.9	71.7	67.3	72.1	0.4
			PM	69.2~~69.3~~	73.5~~73.6~~	69.5~~69.6~~	73.8~~73.9~~	0.3
		Saturday	MD	67.3	72.7	68.2~~68.3~~	73.6~~73.7~~	0.9~~1.0~~
			PM	68.3	72.1	69.1	72.9	0.8
4	North Shore Waterfront Esplanade	Weekday	MD	59.8	63.1	61.6~~62.1~~	64.9~~65.4~~	1.8~~2.3~~
			PM	59.5	63.4	61.5~~62.0~~	65.4~~65.9~~	2.0~~2.5~~
		Saturday	MD	61.1	63.9	63.9~~64.4~~	66.7~~67.2~~	2.8~~3.3~~
			PM	60.8	65.1	62.2~~62.6~~	66.5~~66.9~~	1.4~~1.8~~
5	Parking lot near the Staten Island Ferry	Weekday	MD	64.3	65.9	64.3	65.9	0.0
			PM	63.0	63.5	63.0	63.5	0.0
		Saturday	MD	60.6	62.1	60.6	62.1	0.0
			PM	61.4	62.6	61.4	62.6	0.0
A*	Open Space adjacent to the Wheel	Weekday	MD	59.8	63.1	62.0~~62.5~~	65.3~~65.8~~	2.2~~2.7~~
			PM	59.5	63.4	61.9~~62.4~~	65.8~~66.3~~	2.4~~2.9~~
		Saturday	MD	61.1	63.9	64.2~~64.6~~	67.0~~67.4~~	3.1~~3.5~~
			PM	60.8	65.1	62.6~~62.9~~	66.9~~67.2~~	1.8~~2.1~~

* No-Action noise levels at Site 4 were used at Site A.

In 2016, the increase in $L_{eq(1)}$ noise levels with the proposed project would be less than 3~~2~~ dBA at all five receptor sites~~ 1, 2, 3, and 5~~. Changes of these magnitudes would be considered imperceptible to barely perceptible, and they would be below the CEQR threshold for a significant adverse impact. ~~At receptor site 4, the increase in $L_{eq(1)}$ noise levels with the proposed project would be up to 3.3 dBA. Changes of these magnitudes would be considered barely perceptible, and they would be below the CEQR threshold for a significant adverse impact.~~ In terms of CEQR Noise Exposure Guidelines, noise levels at receptor sites 1, 2, and 3 would remain in the "marginally unacceptable" category, noise levels would remain above the 55 dBA $L_{10(1)}$ noise level guideline for outdoor areas requiring serenity and quiet provided in the *CEQR Technical Manual* noise exposure guidelines at receptor Site 4, and noise levels would remain in the "marginally acceptable" category at Site 5. These values are based on the predicted $L_{10(1)}$ values.

Regarding open space locations (i.e., North Shore Waterfront Esplanade), noise levels at these locations are currently above the 55 dBA $L_{10(1)}$ *CEQR Technical Manual* noise level for outdoor areas. The proposed project would exacerbate these exceedances. To identify a worst case of noise increases due to the proposed project, noise levels were calculated at the nearest open space location adjacent to the proposed Wheel (i.e., Site A). As a result, the maximum increase in noise levels at Site A would be up to 3.1~~3.5~~ dBA compared with No-Action noise levels. Changes of these magnitudes would be considered barely perceptible, and they would be below the CEQR threshold for a significant adverse impact. More information on the noise calculations is provided in **Appendix G~~F~~**.

In summary, the noise magnitudes due to the project on any of the closest sensitive receptor locations would be below the CEQR threshold for a significant adverse impact.

In addition, as described in Chapter 1, "Project Description," it is possible that the project sites could be developed with a No Catering Facility Scenario. Future noise levels for the No Catering Facility Scenario were also calculated for all analysis receptor sites for the 2016 analysis year. Similar to the predicted noise levels with the proposed project, the predicted noise levels for the No Catering Facility Scenario would be below the CEQR threshold for a significant adverse impact at all analysis receptor sites. More information on the noise calculations for this scenario is provided in **Appendix G**.

PERFORMANCE STANDARDS FOR MANUFACTURING DISTRICTS CONTAINED IN THE NEW YORK CITY ZONING RESOLUTION

The City of New York's Zoning Resolution has set sound pressure levels resulting from the Wheel's operation within the project site (an M1 zone) that shall not exceed the maximum permitted sound level for the designated octave band indicated in **Table 17-3**. Since the Wheel's drive system has been neither designed nor selected, the designated octave band sound pressure levels for the Wheel's drive system are not available. However, the Wheel's drive system would be designed to meet the maximum permitted sound levels of the City of New York's Zoning Resolution Section 42-213 and to avoid producing levels by the Wheel's drive system that would result in any significant adverse noise impacts.

NEW YORK CITY NOISE CODE

As shown in **Table 17-4,** the New York City Noise Control Code has set that no sound source operating in connection with any commercial or business enterprise may exceed the decibel levels in the designated octave bands shown in **Table 17-4** at the specified receiving properties. Since the Wheel's drive system has been neither designed nor selected, the designated octave band sound pressure levels for the Wheel's drive system are not available. However, the Wheel's drive system would be designed to meet the maximum permitted sound levels of the New York City Noise Control Code and to avoid producing levels that would result in any significant adverse noise impacts.

NOISE ATTENUATION MEASURES

As shown in **Table 17-6**, the *CEQR Technical Manual* has set noise attenuation quantities for buildings, based on exterior $L_{10(1)}$ noise levels, and in order to maintain interior noise levels of 45 dBA $L_{10(1)}$ or lower for residential or hotel uses and 50 dBA $L_{10(1)}$ or lower for commercial uses. The results of the proposed building attenuation analysis are summarized in **Table 17-12**.

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 comprised of the wall, glazing, and any vents or louvers for air conditioning units in various ratios of area. At the specific locations identified in **Table 17-12** where a CEQR attenuation requirement is necessary, the proposed building would include acoustically rated windows and an alternate means of ventilation. At these specific locations, the proposed building would need to be designed to provide a composite Outdoor-Indoor Transmission Class (OITC) rating greater than or equal to the attenuation requirements listed in **Table 17-12**. The OITC classification is defined by ASTM International (ASTM E1332-10a) and provides a single-number rating that is used for designing a building façade including walls, doors, glazing, and combinations thereof. The OITC rating is designed to evaluate building elements by their ability to reduce the overall loudness of ground and air transportation noise. By adhering to these design requirements, the proposed project will provide sufficient attenuation to achieve the CEQR interior noise level requirements.

Table 17-12
CEQR Attenuation Requirements

Building Façade Location	Applicable Noise Receptor	Maximum Predicted L_{10} (in dBA)	Attenuation Required (in dBA)
North Site (Wheel Terminal Building)			
North, South	4	66.7~~67.2~~	N/A[2]
East	A[3]	67.0~~67.4~~	N/A[2]
West	2	75.4	28
South Site (Hotel)			
North, South, East	5	67.9[1]	N/A[2]
West	1	75.2	31
South Site (Commercial)			
North, South, East	5	67.9[1]	N/A[2]
West	1	75.2	28

Notes:
(1) Based on the measured L_{10} values.
(2) "N/A" indicates that the L_{10} value is less than 70 dB(A) for residential or hotel uses and less than 73 dBA for commercial uses. The *CEQR Technical Manual* does not specify noise attenuation requirements when noise levels are less than 70 dBA for residential or hotel uses and 73 dBA for non-noise sensitive uses such as the Wheel Terminal Building. Therefore, there is no minimum attenuation requirement necessary at these locations.
(3) Noise levels were calculated at the nearest open space location adjacent to the proposed Wheel (i.e., Receptor A)

MECHANICAL SYSTEMS

The building mechanical system (i.e., heating, ventilation, and air conditioning systems) would be designed to meet all applicable noise regulations (i.e., Subchapter 5, §24-227 of the New York City Noise Control Code and the New York City Department of Buildings Code) and to avoid producing levels that would result in any significant increase in ambient noise levels. ✷