Chapter 19: 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 the 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 the city as a place to live and do business. Although these and other noise-producing activities are necessary to a city, the noise they produce is undesirable. Urban noise detracts from the quality of the living environment and there is increasing evidence that excessive noise represents a threat to public health.

The proposed actions would not generate sufficient traffic to have the potential to cause a significant noise impact (i.e., it would not result in a doubling of passenger car equivalents [PCEs] which would be necessary to cause a 3 dBA increase in noise levels). However, ambient noise levels adjacent to the projected and potential development sites also must be examined in order to address any noise attenuation requirements, as found in the *City Environmental Quality Review (CEQR) Technical Manual*, for interior noise levels. This assessment is presented below.

NOISE FUNDAMENTALS

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. Although it is possible to study these effects on people on an average or statistical basis, it must be remembered that all the stated effects of noise on people vary greatly with the individual. 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.

"A"-WEIGHTED SOUND LEVEL (dBA)

Noise is typically measured in units called decibels (dB), which are ten times the logarithm of the ratio of the sound pressure squared to a standard reference pressure squared. Because loudness is important in the assessment of the effects of noise on people, the dependence of loudness on frequency must be taken into account in the noise scale used in environmental assessments. Frequency is the rate at which sound pressures fluctuate in a cycle over a given quantity of time, and is measured in Hertz (Hz), where 1 Hz equals 1 cycle per second. Frequency defines sound in terms of pitch components. In the measurement system, one of the simplified scales that accounts for the dependence of perceived loudness on frequency is the use of a weighting network—known as A-weighting—that simulate response of the human ear. For most noise assessments the A-weighted sound pressure level in units of dBA is used in view of its widespread recognition and its close correlation with perception. In this analysis, all measured noise levels are reported in dBA or A-weighted decibels. Common noise levels in dBA are shown in Table 19-1.

Table 19-1
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.
Source: Cowan, James P. *Handbook of Environmental Acoustics*. Van Nostrand Reinhold, New York, 1994. Egan, M. David, Architectural Acoustics. McGraw-Hill Book Company, 1988.

COMMUNITY RESPONSE TO CHANGES IN NOISE LEVELS

The average ability of an individual to perceive changes in noise levels is well documented (see Table 19-2). Generally, changes in noise levels less than 3 dBA are barely perceptible to most listeners, whereas 10 dBA changes are normally perceived as doublings (or halvings) of noise levels. These guidelines permit direct estimation of an individual's probable perception of changes in noise levels.

Table 19-2
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.

It is also possible to characterize the effects of noise on people by studying the aggregate response of people in communities. The rating method used for this purpose is based on a statistical analysis of the fluctuations in noise levels in a community, and integrates the fluctuating sound energy over a known period of time, most typically during 1 hour or 24 hours. Various government and research institutions have proposed criteria that attempt to relate changes in noise levels to community response. One commonly applied criterion for estimating this response is incorporated into the community response scale proposed by the International Standards Organization (ISO) of the United Nations (see Table 19-3). This scale relates changes in noise level to the degree of community response and permits direct estimation of the probable response of a community to a predicted change in noise level.

Table 19-3
Community Response to Increases in Noise Levels

Change (dBA)	Category	Description
0	None	No observed reaction
5	Little	Sporadic complaints
10	Medium	Widespread complaints
15	Strong	Threats of community action
20	Very strong	Vigorous community action

Source: International Standards Organization, *Noise Assessment with Respect to Community Responses*, ISO/TC 43 (New York: United Nations, November 1969).

NOISE DESCRIPTORS USED IN IMPACT ASSESSMENT

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 sometimes used to indicate noise levels that are exceeded 1, 10, 50, 90 and x percent of the time, respectively. Discrete event peak levels are given as L_1 levels. L_{eq} is used in the prediction of future noise levels, by adding the contributions from new sources of noise (i.e., increases in traffic volumes) to the existing levels and in relating annoyance to increases in noise levels.

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}. The relationship between L_{eq} and exceedance levels has been used in this analysis to characterize the noise sources and to determine the nature and extent of their impact at all receptor locations.

For the purposes of this project, the maximum 1-hour equivalent sound level ($L_{eq(1)}$) has been selected as the noise descriptor to be used in the noise impact evaluation. $L_{eq(1)}$ is the noise descriptor used in *CEQR* for noise impact evaluation, and is used to provide an indication of highest expected sound levels. $L_{10(1)}$ is the noise descriptor used in the *CEQR Technical Manual* for building attenuation. Hourly statistical noise levels (particularly L_{10} and L_{eq} levels) were used to characterize the relevant noise sources and their relative importance at each receptor location (see Figure 19-1).

B. NOISE STANDARDS AND CRITERIA

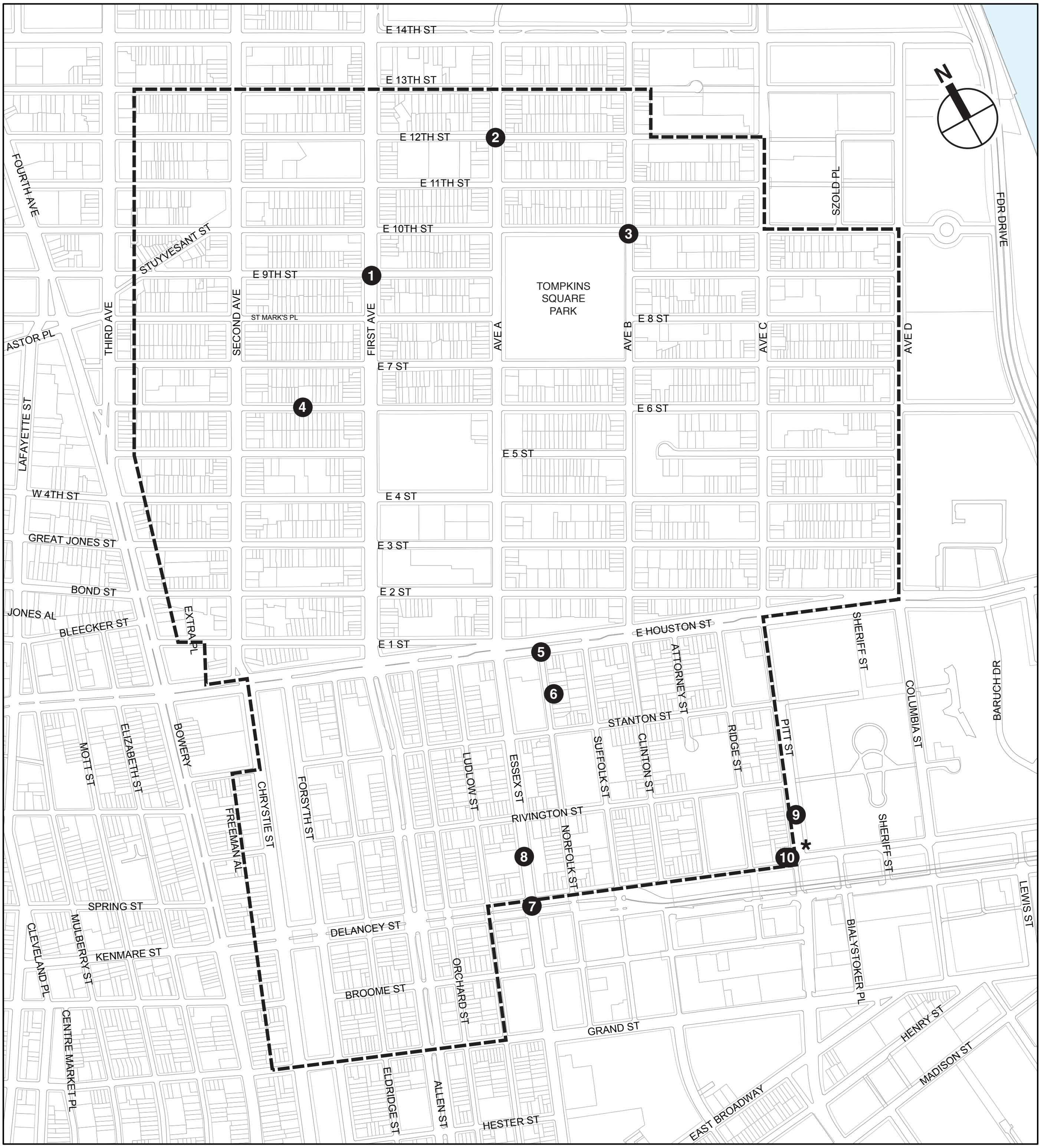
NEW YORK CEQR NOISE STANDARDS

CEQR defines attenuation requirements for buildings based on exterior noise level (see Table 19-4, "Required Attenuation Values to Achieve Acceptable Interior Noise Levels"). Recommended noise attenuation values for buildings are designed to maintain interior noise levels of 45 dBA or lower, and are determined based on exterior $L_{10(1)}$ noise levels.

Table 19-4
Required Attenuation Values to Achieve Acceptable Interior Noise Levels

	Marginally Acceptable		Marginally Unacceptable		Clearly Unacceptable	
Noise Level With Proposed Actions	65 < L10 ≤ 70	70 < L10 ≤ 75	75 < L10 ≤ 80	80 < L10 ≤ 85	85 < L10 ≤ 90	90 < L10 ≤ 95
Attenuation*	25 dB(A)	(I) 30 dB(A)	(II) 35 dB(A)	(I) 40 dB(A)	(II) 45 dB(A)	(III) 50 dB(A)

Note: * 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.
Source: New York City Department of Environmental Protection



Study Area Boundary

Noise Receptor Location

* Elevated Measurement Location

0 1000 FEET

SCALE

Noise Receptor Locations

Figure 19-1

C. EXISTING NOISE LEVELS

Existing noise levels were measured for 20-minute periods during the three weekday peak periods—AM (8:00 to 9:00 AM), midday (MD) (12:00 to 2:00 PM), and PM (5:00 to 6:00 PM) between March 12 and 25, 2008, at ten receptor sites within the primary study area.

- Site 1 is located at the intersection of First Avenue and East 9th Street. This site would represent locations along First and Second Avenues, and along Forsyth and Chrystie Streets.
- Site 2 is located at the intersection of East 12th Street and Avenue A. This site would represent locations along Avenues A, B, C, and D and locations along East 8th, 9th, 11th, 12th, and 13th Streets.
- Site 3 is located at the intersection of Avenue B and 10th Street. This site would represent locations along East 10th Street where the M8 bus runs.
- Site 4 is located on East 6th Street between First and Second Avenues. This site would represent locations along East 1st, 2nd, 3rd, 4th, 5th, 6th, and 7th Streets.
- Site 5 is located at the intersection of East Houston and Norfolk Streets. This site would represent locations along East Houston and Grand Streets.
- Site 6 is located on Norfolk Street between East Houston and Stanton Streets. This site would represent locations on Eldridge, Orchard, Ludlow, Norfolk, and Suffolk Streets.
- Site 7 is located at the intersection of Delancey Street and Essex Street. This site would represent at-grade locations along Delancey Street west of Suffolk Street.
- Site 8 is located on Essex Street between Rivington and Delancey Streets. This site would represent locations along Essex, Allen, Stanton and Rivington Streets.
- Site 9 is at an elevated location on Pitt Street between Delancey and Rivington Streets. This site would represent locations along Clinton, Attorney, Ridge, and Pitt Streets and would also assist—along with Site 10—in identifying the amount of decrease in noise with distance from the Williamsburg Bridge.
- Site 10 is at an elevated location at the intersection of Delancey Street and Pitt Street. This site would represent elevated locations along Delancey Street that are directly adjacent to traffic entering and exiting the Williamsburg Bridge and would also assist—along with Site 9—in identifying the amount of decrease in noise with distance from the Williamsburg Bridge.

Noise generated by traffic and train activities on the Williamsburg Bridge were expected to be the dominant noise source at locations along side streets that have a direct line of sight to the bridge. The noise levels at these locations were estimated based on measured levels at Sites 9 and 10.

The instrumentation used for the 20-minute noise measurements was a Brüel & Kjær Type 4189 ½-inch microphone connected to a Brüel & Kjær Model 2260 Type 1 (according to ANSI Standard S1.4-1983) sound level meter. This assembly was mounted at least 6 feet away from any large sound-reflecting surface to avoid major interference with sound propagation. The meter 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}, and L_{90}. A windscreen was used during all sound measurements except for calibration. All measurement procedures conformed with the requirements of ANSI Standard S1.13-1971 (R2005).

The results of the measurements of existing noise levels are summarized in Table 19-5.

Table 19-5
Existing Noise Levels (in dBA)

Site	Measurement Location	Time	L_{eq}	L_1	L_{10}	L_{50}	L_{90}
1	East 9th Street and First Avenue	AM	71.3	79.5	74.9	67.8	58.8
		MD	70.9	80.5	75.0	67.0	61.2
		PM	71.0	78.5	72.8	67.2	60.4
2	East 12th Street and Avenue A	AM	68.5	78.1	71.9	65.1	59.5
		MD	67.1	77.6	69.4	63.5	56.7
		PM	69.0	80.1	71.1	63.7	57.1
3	East 10th Street and Avenue B	AM	69.2	80.0	71.4	65.2	58.3
		MD	69.3	81.0	72.1	63.7	57.1
		PM	69.2	80.8	71.3	64.7	58.4
4	East 6th Street between First and Second Avenues	AM	63.4	73.9	66.4	55.6	52.2
		MD	62.9	73.7	66.5	57.5	53.0
		PM	63.2	73.1	66.5	58.4	54.7
5	East Houston Street and Norfolk Street	AM	70.6	78.4	73.9	68.0	61.6
		MD	71.7	78.8	75.3	70.0	61.9
		PM	71.7	79.9	75.3	68.5	62.8
6	Norfolk Street between East Houston and Stanton Streets	AM	66.8	75.9	70.0	62.0	57.7
		MD	62.9	73.8	66.1	58.4	55.4
		PM	62.9	73.3	66.6	58.0	54.9
7	Delancey Street and Essex Street	AM	78.3	88.1	81.2	75.3	69.6
		MD	75.5	83.8	78.8	73.1	68.7
		PM	72.5	81.0	75.3	70.8	65.2
8	Essex Street between Rivington and Delancey Streets	AM	74.6	83.5	77.5	72.6	67.1
		MD	70.8	79.7	73.9	68.5	65.2
		PM	69.3	78.3	71.2	67.1	64.1
9	Pitt Street between Rivington and Delancey Streets*	AM	66.1	73.3	70.3	63.2	60.3
		MD	65.9	73.9	70.2	63.1	60.4
		PM	70.0	74.3	72.1	69.5	67.3
10	Delancey Street between Ridge and Pitt Streets*	AM	72.6	80.8	78.0	66.6	63.0
		MD	71.0	80.7	76.5	64.9	61.6
		PM	74.6	81.1	78.6	72.3	69.1

Note: * Measurement performed at an elevated location adjacent to the Williamsburg Bridge.
Source: Field measurements were performed by AKRF, Inc. between March 13 and March 25, 2008.

At all monitoring sites, traffic noise was the dominant noise source. Measured noise levels at these locations are moderate to relatively high and reflect the level of vehicular activity on the adjacent streets.

In terms of CEQR criteria, receptor 4 is in the "marginally acceptable" category; receptors 1, 2, 3, 5, 6, 8, 9, and 10 are in the "marginally unacceptable" category, and receptor 7 is in the "clearly unacceptable" category.

D. NOISE ATTENUATION MEASURES

As shown in Table 19-4, *CEQR* 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 or lower.

Table 19-6 shows the minimum window/wall attenuation necessary to meet CEQR requirements for internal noise levels at each of the noise measurement locations.

Table 19-6
Required Attenuation at Noise Measurement Locations

Site	Location	Maximum Measured $L_{10(1)}$ Value	Minimum Required Attenuation
1	East 9th Street and First Avenue	75.0	35
2	East 12th Street and Avenue A	71.9	30
3	East 10th Street and Avenue B	72.1	30
4	East 6th Street between First and Second Avenues	66.5	25
5	East Houston Street and Norfolk Street	75.3	35
6	Norfolk Street between East Houston and Stanton Streets	70.0	30
7	Delancey Street and Essex Street	81.2	40
8	Essex Street between Rivington and Delancey Streets	77.5	35
9	Pitt Street between Rivington and Delancey Streets*	72.1	30
10	Delancey Street between Ridge and Pitt Streets*	78.6	35

Notes:
* Measurement performed at an elevated location adjacent to the Williamsburg Bridge.
Attenuation values are shown for residential uses; commercial uses would be 5 dBA less.

To achieve 30 dBA of building attenuation, double glazed windows with good sealing properties as well as alternate means of ventilation such as well sealed through-the-wall air conditioning, would be necessary; to achieve 35 dBA of building attenuation, double glazed windows with good sealing properties, as well as alternate ventilation such as central air conditioning, would be necessary, and to achieve 40 dBA of building attenuation, special design features that go beyond the normal double-glazed windows and central air conditioning is necessary and may include using specially designed windows (i.e., windows with small sizes, windows with air gaps, windows with thicker glazing, etc.), and additional building insulation.

Based on the values shown in Table 19-6, required attenuation levels were determined at each projected and potential development site. These values are shown in Tables G-1 through G-2 in Appendix G.

To implement these attenuation requirements, an E-designation for noise would be applied to the sites listed in these tables specifying the appropriate amount of window/wall attenuation.[1]

It is assumed that the building mechanical systems (i.e., heating, ventilation, and air conditioning systems) would be designed to meet all applicable noise regulations. Therefore, the proposed actions would not result in any significant increase in ambient noise levels. ✷

[1] Prior to publication of the FEIS, DCP learned that certain development sites within the rezoning area no longer met the criteria for a development site within the RWCDS (see notes in Tables 1-3 and 1-4). Therefore, these sites have been removed from the list of sites receiving E-designations (see Appendix G, "Noise E-Designations").