Chapter 11: Noise and Vibration

11.1 INTRODUCTION

This chapter considers the potential for construction or operation of the Modified Design to result in impacts related to airborne noise, ground-borne noise, and vibration. *Airborne noise* is noise that travels through the air—such as the sound of traffic on a nearby roadway, or children playing in a playground. *Ground-borne noise* is the rumbling sound caused by *vibration* (or oscillatory motion). With ground-borne noise, buildings and other structures act like speakers for low-amplitude noise. As an example, ground-borne noise is the low rumbling sound that occurs within a building as a subway passes beneath.

The 2004 FEIS concluded that airborne noise, ground-borne noise, and vibration associated with construction activities for the new subway would result in significant adverse impacts in nearby areas. An extensive construction noise mitigation plan is included as part of the Project's Construction Environmental Protection Plan to reduce and alleviate impacts to the extent practicable. The 2004 FEIS found that once the Project is complete and operational, the new subway would not result in significant adverse impacts related to airborne noise or ground-borne vibration. Significant adverse impacts related to ground-borne noise were identified in the 2004 FEIS if no mitigation were employed due to a new a subway being introduced in areas where no subway currently exists. MTA committed to addressing potential issues by including design features that reduce noise and vibration as part of the Project. These include designing all above-ground mechanical equipment with noise attenuation and using resilient track fasteners or track support structures or other similar measures at locations with the potential for ground-borne noise or vibration impacts. With these measures, ground-borne noise levels were to be reduced below the Federal Transit Administration's (FTA's) impact thresholds. The Modified Design would not change the conclusions of the 2004 FEIS.

11.2 FEIS FINDINGS

11.2.1 CONSTRUCTION IMPACTS

The 2004 FEIS evaluated the noise and vibration impacts of construction of the new subway following the procedures in FTA's guidance manual, *Transit Noise and Vibration Impact Assessment*, DOT-T-95-16, April 1995. The analysis identified the potential for construction of the Second Avenue Subway to result in significant adverse impacts from airborne and ground-borne noise and vibration. These impacts would occur in the vicinity where construction work is occurring.

Significant adverse airborne noise impacts were predicted to occur at all stations and at all shaft sites/spoils removal locations during certain construction periods because of the proximity of construction to sensitive uses. The types and extent of the impacts were found to be comparable in all construction phases. Some activities creating such impacts would not have occurred during late night and early morning hours (e.g., 10 PM to 7 AM). Noise levels from construction of the

project up to 101 dBA were predicted during daytime hours and levels up to 92 dBA were predicted during nighttime hours.[1] These airborne noise impacts were identified for locations up to approximately 750 feet from where construction operations would be taking place. Airborne noise travels both vertically and horizontally; whenever a line-of-sight is available between the noise source and a receptor location within approximately 750 feet, the impacts could occur.

The values described above did not include noise from pile-driving operations, because these operations would have typically taken place only for a relatively short time period (about three months) at any location. Noise produced by pile driving varies depending on the soil conditions and the specific construction equipment and techniques utilized. For example, typical noise levels for an impact pile driver are 109 dBA at 20 feet and 101 dBA at 50 feet. Vibratory or sonic pile drivers are about 5 dBA quieter. To mitigate noise impacts, MTA committed to avoiding use of impact pile driving methods where possible, using bored or augured piles instead. In all cases, however, pile-driving operations would have produced intrusive and annoying noise levels that would exceed the FTA's construction impact criteria. Pile-driving operations typically do not occur at night, although it is possible that certain activities needed to support pile-driving (such as drilling) could have occurred during nighttime hours under certain circumstances.

The 2004 FEIS stated that MTA was committed to implementing an extensive mitigation program to reduce and alleviate construction noise impacts. This program was therefore included in the Project's CEPP.

Table 12-9 in the 2004 FEIS provided a list of proposed mitigation measures on a site-by-site basis. Contractors will be required to implement measures to achieve the levels specified in the performance standards identified in Table 12-6 of the 2004 FEIS. This information is presented below in **Table 11-1**.

Mitigation measures for the construction airborne noise identified in the 2004 FEIS included: enclosing areas where spoils from tunnel operations would be loaded into trucks, or at station locations where spoils removal would take place for long durations during the daytime or at night; placing some equipment or operations below grade in shielded locations; changing construction sequencing to reduce noise impacts by combining noisy operations to occur in the same time period or by spreading them out; avoiding nighttime activities; prohibiting blasting after 8 PM or on holidays; and using alternative construction methods, such as avoiding impact pile installation in sensitive areas, using special low noise emission level equipment, and selecting and specifying quieter demolition methods. Despite these measures, it was disclosed in the 2004 FEIS that it would not be possible to fully mitigate all airborne noise impacts because of the proximity of residences and other sensitive uses to construction.

According to the 2004 FEIS, construction would result in varying degrees of ground vibration, depending on the stage of construction, equipment and construction methods employed, and distance from the construction to buildings and vibration-sensitive structures. Due to the proximity of sensitive receptors, vibration levels during a large portion of the period of the construction were predicted to be perceptible. Airblast from blasting was also predicted to be perceptible.

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[1] Sound pressure levels are measured in units called "decibels" (dB). This 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.

Table 11-1
Cumulative Construction Noise Lot-Line Limits at 50 Feet
Based on 2004 FEIS[1]

Noise Monitoring Location Land Use	Average Noise Not to Exceed (L_{eq}) [2]	Maximum Noise Level Criteria (L_{max}) [3]
DAYTIME (7 AM TO 6 PM)		
Noise Sensitive Locations	75 or Background + 5 [4]	85 [4] (or 90 for impact equipment)
Commercial Areas	80 or Background + 5 [4]	None [5]
Industrial Areas	85 or Background + 5 [4]	None [5]
EVENING (6 PM TO 10 PM)		
Noise-Sensitive Locations	Background + 5	85
Commercial Areas	Background + 5 [4]	None [5]
Industrial Areas	None [5]	None [5]
NIGHT-TIME (10 PM TO 7 AM)		
Noise-Sensitive Locations	Background + 5	80
Commercial Areas	None [5]	None [5]
Industrial Areas	None [5]	None [5]

Notes:
[1] All measurements will be taken at the affected lot line. In situations where the work site is within 50 feet of a lot-line, the measurement will be taken at the lot line, and projected to a distance of 50 feet.
[2] L_{eq} noise readings are averaged over 20-minute intervals and compared against the higher of the two criteria. L_{eq} Level (dB(A), slow) re 2x10-5 Pa
[3] L_{max} noise readings occur instantaneously. L_{max} Level (dB(A), slow) re 2x10-5 Pa
[4] Noise from impact equipment is exempt from the L_{eq} requirement, but is subject to a lot-line Lmax limit of 95 dBA.
[5] In no case will the public be exposed to construction noise levels exceeding 90 dB(A) on "slow" response or to impulsive noise levels exceeding 125 dB(A) maximum transient level fast response as measured on a general purpose sound level meter.

Source: 2004 FEIS Table 12-9.

The construction vibration analysis included in the 2004 FEIS determined that with the exception of pile installation machines and clam shovel drops (needed for the slurry walls), at distances greater than 20 feet, all of the vibration values for the types of equipment likely to be used during subway construction would be below the New York City Department of Buildings (NYCDOB) vibration damage threshold criterion for fragile buildings and the FTA vibration damage threshold for extremely fragile historic buildings. Similarly, at distances greater than 20 feet, vibration levels for the Tunnel Boring Machine (TBM) would be below both thresholds. Ground-borne noise from the TBM would be perceptible, but would only occur for a limited time at any particular location, since the equipment is continuously moving. Sensitive buildings, including all historic structures, typically receive careful consideration to determine appropriate vibration thresholds. In addition, special measures are typically taken at all phases of construction to avoid damaging fragile and extremely fragile (including historic) structures.

At the time of the 2004 FEIS, MTA had committed to mitigation measures for construction ground-borne noise and vibration including development of a Project-wide vibration monitoring program to minimize vibration levels and respond to community complaints and concerns as they arise. Multi-delay blasting techniques, careful installation of tracks for spoils removal trains, and other site-specific vibration control measures were to be employed as necessary.

11.2.2 PERMANENT IMPACTS

The noise analysis included in the 2004 FEIS found no potential for operation of the Second Avenue Subway to result in significant adverse airborne noise impacts at any nearby receptors along the alignment or at potential storage yards. Once operational, the Second Avenue Subway's trains themselves do not have the potential to create airborne noise impacts outside of the tunnel and stations because they are generally below ground and do not have an unobstructed pathway for airborne sound to travel to receptors. The various ancillary facilities such as fans, cooling towers, chillers, and pumps required to operate the Second Avenue Subway Project are located at every station and in certain other areas along the entire alignment, but these facilities include in-duct splitter attenuators (which can achieve between 20 to 30 dBA reductions in noise), sound absorptive plenums (large rooms enclosed by acoustic materials which can achieve between 10 and 15 dBA reductions), and/or acoustic louvers for fans. The 2004 FEIS indicated that noise from the ancillary facilities' cooling towers located on buildings' roofs would be controlled by building noise barriers around one or both sides of the towers. MTA committed to designing all above-ground mechanical equipment (as well as any below-ground equipment requiring above-ground vents or similar structures) so that the noise level produced when the equipment is in use would not exceed 60 dBA as measured from the façade of the nearest residential property.

The vibration and ground-borne noise analysis included in the 2004 FEIS found no potential for operation of the Second Avenue Subway to result in significant adverse vibration impacts at any nearby receptors along the alignment or at potential storage yards, but concluded that operation of the Second Avenue Subway would have the potential to result in significant adverse ground-borne impacts in the absence of mitigation measures. MTA committed to mitigating ground-borne noise impacts from train operations using resilient track fasteners or track support structures or other similar measures at all locations where operational ground-borne noise impacts were predicted. With these measures, ground-borne noise levels were predicted to be reduced at all locations to below FTA's impact thresholds.

11.3 UPDATE OF BACKGROUND CONDITIONS

Subsequent to the 2004 FEIS, new development has occurred in East Harlem, but the overall urban character and traffic patterns of the area have not changed ambient noise levels drastically. In May 2006, the Federal Transit Administration (FTA) issued updated noise and vibration guidance, *Transit Noise and Vibration Impact Assessment* (FTA-VA-90-1003-06).

11.4 PHASE 2 MODIFIED DESIGN—CHANGES IN IMPACTS

11.4.1 CONSTRUCTION IMPACTS

As part of the Modified Design, there have been changes to the configuration of the stations and ancillary facilities for Phase 2. None of these configuration changes would substantially alter the location of the construction work or material staging areas compared to the 2004 FEIS. Consequently, these changes would not result in any change to the area of predicted adverse noise or vibration impacts identified in the 2004 FEIS.

As described in Chapter 2, "Description of Phase 2 Modified Design," Section 2.3.4, the Modified Design includes changes to construction means and methods. The Modified Design would substantially reduce the amount of surface activity along and near 125th Street, where tunnel and

station excavation would occur below ground rather than using cut-and-cover techniques. The refinement in construction means and methods along 125th Street for the Modified Design would reduce the intensity and duration of noise from construction, because it would reduce cut-and-cover work in proximity to receptors. The Modified Design would also redirect some construction traffic along 124th Street rather than 125th Street, to limit disruption on this heavily traveled and commercial corridor. The land uses along 124th Street between Park Avenue and Second Avenue include several Category 2 noise-sensitive uses according to FTA noise impact criteria (i.e., residential, nursing home), as well as industrial, commercial, and playground uses that would not be considered noise-sensitive. The impacts identified in the 2004 FEIS for receptors along construction truck routes would occur along the newly determined construction truck routes with the same intensity and duration as identified in the 2004 FEIS. However, the same mitigation measures identified in the 2004 FEIS would also apply to the areas along any newly determined construction truck routes, and the expected noise and/or vibration impacts would be the same as those identified in the 2004 FEIS.

On Second Avenue, construction techniques would be similar to those described in the 2004 FEIS for the 2004 FEIS Design. The 2004 FEIS Design anticipated removal of TBMs used to excavate the curved tunnel between Second Avenue and 125th Street at a shaft excavated in Second Avenue near 122nd Street. With the Modified Design, this excavation would be farther south, near 120th Street, which would reduce the excavated area on Second Avenue. The 120th Street shaft would be used to launch the TBM headed northward and also for staging associated with tunneling and construction of the 116th Street Station. Similar to the 2004 FEIS Design, intensive construction activities would occur in this area of Second Avenue.

For the Modified Design, as for the 2004 FEIS Design and for Phase 1, the construction contract will be required to comply with the noise mitigation requirements outlined in the 2004 FEIS and Record of Decision. As stated in the 2004 FEIS, this may include enclosing areas where spoils from tunnel operations would be loaded into trucks, or at station locations where spoils removal would take place for long durations during the daytime or at night; placing some equipment or operations below grade in shielded locations; changing construction sequencing to reduce noise impacts by combining noisy operations to occur in the same time period or by spreading them out; avoiding nighttime activities; prohibiting blasting after 8 PM or on holidays; and using alternative construction methods, such as avoiding impact pile installation in sensitive areas, using special low noise emission level equipment, and selecting and specifying quieter demolition methods.

11.4.2 PERMANENT IMPACTS

The changes in location of ancillary facilities may potentially result in noise at different receptors than those identified under the design analyzed in the 2004 FEIS; however, since the noise levels would be less than 60 dBA at all receptors, which is generally less than the existing condition noise levels at all receptors in the Project study area, these changes would be imperceptible to barely perceptible and would not constitute adverse impacts. Moreover, the Modified Design includes use of a dry cooler system, which would eliminate the need for rooftop cooling towers and therefore remove a source of noise. The other changes in the Modified Design would not affect any of the conclusions of the noise, vibration, or ground-borne noise analyses included in the 2004 FEIS.

11.5 CONCLUSIONS

The Modified Design would reduce the amount of cut-and-cover construction at some locations, which would reduce the amount of construction noise and vibration adjacent to these locations, and the 2004 FEIS conclusions regarding construction noise and vibration remain unchanged at other locations. Once construction is complete, the changes to the locations of ancillary facilities would not have the potential to result in adverse noise impacts because of MTA's commitment to design the facilities such that they do not produce noise more than 60 dBA at the nearest residential property, regardless of the location of the facility. Therefore, the Phase 2 Modified Design would not result in any new or different significant adverse impacts related to noise and vibration not previously identified in the 2004 FEIS and ROD. ✷