Chapter 3.10: Noise

A. INTRODUCTION

The principal impacts of the proposed project on ambient noise levels would result from the increased vehicular traffic generated by the proposed residential development and construction-related activities. The following section examines the potential for significant adverse noise impacts from these sources.

B. 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. 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 3.10-1.

Table 3.10-1
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 3.10-2). 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.

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 3.10-3). 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 3.10-2
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.	

Table 3.10-3
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
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_{01} 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} is a noise descriptor that is widely used for project impact evaluation.

C. NOISE STANDARDS AND CRITERIA

There are a variety of noise standards and guidelines that have been promulgated by various federal, state, and local entities. Some of these criteria are discussed below as a guide. However, none of these criteria are directly applicable to the proposed facility.

NOISE CONTROL ACT OF 1972

As a result of the Noise Control Act of 1972, a document entitled Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety was published in 1974 by the Federal Environmental Protection Agency (EPA). Table 3.10-4 shows these values. These levels do not constitute enforceable federal regulations or standards. Nevertheless, the noise levels identified by EPA represent valid criteria for evaluating the effect of project noise on public health and welfare.

Table 3.10-4
Noise Levels Identified as Requisite to Protect Public Health and Welfare With an Adequate Margin of Safety

Effect	Level	Area
Hearing loss	$L_{eq(24)} \leq 70$ dB	All areas
Outdoor activity interference	$L_{dn} \leq 55$ dB	Outdoors in residential areas and annoyance and farms, and other outdoor areas where people spend widely varying amounts of time and other places in which quiet is a basis for use.
	$L_{eq(24)} \leq 55$ dB	Outdoor areas where people spend limited amounts of time, such as school yards, playgrounds, etc.
Indoor activity interference and annoyance	$L_{dn} \leq 45$ dB	Indoor residential areas
	$L_{eq(24)} \leq 45$ dB	Other indoor areas with human activities, such as schools, etc.
Sources: Report No. EPA-550/9-74-004, March 1974.		

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

New York State Department of Environmental Conservation (NYSDEC) published a guidance document titled Assessing and Mitigating Noise Impacts (October 6, 2000). This document states that increases from 0-3 dBA should have no appreciable effect on receptors, increases of 3-6 dBA may have the potential for adverse impact only in cases where the most sensitive of receptors are present, and increases of more than 6 dBA may require a closer analysis of impact potential depending on existing noise levels and the character of surrounding land use and receptors. It goes on to say that in terms of threshold values, the addition of any noise source, in a non-industrial setting, should not raise the ambient noise level above a maximum of 65 dBA, and ambient noise levels in industrial or commercial areas may exceed 65 dBA with a high end of approximately 79 dBA. Projects which exceed these guidance levels should explore the feasibility of implementing mitigation.

NEW YORK STATE DEPARTMENT OF TRANSPORTATION

The New York State Department of Transportation (NYSDOT) has noise criteria that it uses for projects subject to its jurisdiction. NYSDOT has adopted the noise criteria of the Federal Highway Administration (FHWA) (23 CFR 772). These criteria have two components: a “fixed” noise criteria, and a “relative” noise criteria.

The fixed noise criteria consist of the FHWA Noise Abatement Criteria (NAC), which are shown in Table 3.10-5. These NAC depend on task interference due to noise interruption of various activities involving speech, which vary by land use. By NYSDOT policy, substantial fixed noise impacts occur when predicted traffic-noise levels equal or exceed the applicable NAC from this table.

Table 3.10-5
FHWA Fixed Noise Criteria (NAC)

Activity Category	$L_{eq(1)}$	Description of Activity
A	57 Outdoors	Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B	67 Outdoors	Picnic areas, recreation areas, playgrounds, active sports areas, parks, residences, motels, hotels, schools, churches, libraries, and hospitals.
C	72 Outdoors	Developed lands, properties, or activities not included in Categories A or B above.
D	None	Undeveloped lands.
E	52 Indoors	Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals, and auditoriums.

The second type of FHWA criterion is relative to existing noise levels. Substantial relative noise impacts occur when predicted traffic-noise levels increase by more than 5 decibels (i.e., 6 decibels or more) above existing noise levels.

LOCAL NOISE CODE

The Town of Hamptonburgh does not have a local noise ordinance.

IMPACT CRITERIA

For purposes of impact assessment, a significant adverse impact will occur when the project results in an $L_{eq(1)}$ noise level of 65 dBA or more and produces an increase in $L_{eq(1)}$ noise levels of greater than 6.0 dBA (comparing $L_{eq(1)}$ noise levels for future conditions with the proposed project with future conditions without the proposed project). Both of these conditions would have to occur for there to be a significant adverse impact. The criteria is consistent with guidance from the New York State Department of Environmental Conservation and other noise criteria.

D. EXISTING CONDITIONS

SITE DESCRIPTION

The proposed project site is located in the Town of Hamptonburgh, Orange County, New York. The proposed development site is roughly bounded by Eager Road to the north, railroad tracks to the east, and NYS Route 416 to the west. Two additional lots are also included as part of the project, one on the west side of NYS Route 416 and one on the north side of Eager Road. The project site is in an R-4A zoning district.

EXISTING NOISE LEVELS

Existing noise levels near and adjacent to the project site are relatively low (with maximum daytime noise levels estimated to be typically in the 50-60 dBA range, and maximum nighttime noise levels approximately 10 dBA lower). Values in this range are typical of a rural area, and reflect the level of vehicular activity on adjacent roadways. The adjacent roadways, such as Eager Road, are narrow roads that are sparsely traveled. The exception is NYS Route 416 which is a two lane corridor in good condition and is directly adjacent to a park (Thomas Bull Memorial Park), and has low to moderate traffic volumes. Residential and industrial land uses are located to the north and south of the project site. The railroad tracks located along the east boundary of the project site do not appear to be active based upon field observations.

E. THE FUTURE WITHOUT THE PROPOSED PROJECT

Future traffic volumes without the proposed project are not expected to significantly increase when compared with existing volumes. At most locations in the project area, traffic is the dominant noise source. Therefore, future noise levels without the project are expected to be similar to the existing noise levels.

F. NOISE PREDICTION METHODOLOGY

A two step approach was used to examine possible significant adverse noise impacts due to project-generated traffic. First, a screening analysis was performed using a proportional modeling technique to determine whether there were any locations where project-generated traffic had the potential for resulting in an increase in noise levels of 6.0 dBA or more (i.e., when comparing Build with No Build noise levels). Since traffic is the dominant noise source, absent a significant increase in vehicle speed and/or change in vehicle mix, an increase in noise level of 6 dBA or more, would require a quadrupling in traffic volume. At locations and for time periods where traffic volume were estimated to quadruple, a noise analysis using the TNM model was performed to more accurately determine the absolute noise level as well as the change in noise level, and to assess the potential for significant adverse noise impacts.

PROPORTIONAL MODELING

Proportional modeling was used to determine locations (and time periods) where the proposed project had the potential for having significant adverse noise impacts. Using this technique, the change in noise levels can be estimated based upon comparing No Build and Build traffic volumes. Using this methodology, Build and No Build traffic volumes are 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, 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. Future noise levels are calculated using the following equation:

Increase in Future Noise Level = 10 * $\log_{10}$ (FB PCE / FNB PCE)

where:

FB PCE = Future Build PCEs

FNB PCE = Existing PCEs

This methodology assumes that traffic is the dominant noise source at a particular location. Using proportional modeling techniques if the No Build traffic volume on a roadway is 200 PCEs and if project-generated traffic increases the volume by 200 PCEs to a total of 400 PCEs, the noise level would increase by approximately 3.0 dBA; similarly, if project-generated traffic increases the volume by 400 PCEs to a total of 600 PCEs, the noise level would increase by approximately 4.8 dBA, and; if project-generated traffic increases the volume by 600 PCEs to a total of 800 PCEs, the noise level would increase by approximately 6.0 dBA.

The screening analysis utilized the weekday AM and PM peak hour traffic values, as well as the Saturday midday peak hour traffic values. These time periods are the hours when the project has its maximum traffic generation and therefore the hours when Build noise levels are most likely to have a significant adverse impact. As mentioned previously, an increase in $L_{eq(1)}$ noise level greater than 6.0 dBA is one of the conditions necessary for a significant adverse impact. Therefore, where traffic is the dominant source of noise, project-generated traffic must result in at least a quadrupling in order to produce a significant adverse noise impact.

TNM MODEL

The *Traffic Noise Model* version 2.5 (TNM) is a computerized model developed for the Federal Highway Administration (FHWA) that takes into account various factors due to traffic flow, including traffic volumes, vehicle mix (i.e., percentage of autos, light duty trucks, heavy duty trucks, buses, etc.), sources/receptor geometry, and shielding (including barriers and terrain, ground attenuation, etc.) It is the current state-of-the-art model for traffic noise analysis.

At locations where there was the potential for significant increases in noise levels, the TNM model was used to determine the absolute noise level as well as the change in noise levels, and to assess the potential for significant adverse noise impacts.

G. POTENTIAL IMPACTS OF THE PROPOSED PROJECT

As mentioned in Section F above, a two step approach was used to examine possible significant noise impacts due to project-generated traffic. First, a screening analysis was performed using a proportional modeling technique to determine whether there were any locations where project-generated traffic had the potential for resulting in an increase in noise levels of 6.0 dBA or more, and then, at locations and for times periods where there was the potential for increases of 6.0 dBA or more a noise analysis using the TNM model was performed to more accurately determine the absolute noise level as well as the change in noise level, and to assess the potential for significant adverse noise impacts.

Based upon a screening analysis performed using the proportional modeling technique described above, only on Eager Road would the increase in traffic due to the project be sufficiently large to have the potential to increase noise levels by 6.0 dBA or more. At all other locations, the increase in traffic due to the proposed project would result in less than a 6 dBA increase in noise levels and therefore, no significant adverse noise impacts would occur. At Eager Road, during the weekday AM and PM and the Saturday midday peak periods, traffic volumes without the proposed project are very low and, based upon a screening analysis using proportional modeling techniques, project-generated traffic would be sufficient to have the potential for causing an increase of 6.0 dBA or more. Therefore, for Eager Road, a quantified analysis was performed for the three time periods using the TNM model. Table 3.10-6 shows the results of this analysis (Build, No Build, and the increase in noise levels due to the proposed project) at a receptor site approximately 15 feet from the edge of the roadway. While the proposed project would result in increases in noise level at Eager Road ranging from 6.2 to 15.4 dBA, in all cases noise levels for Build conditions would be less than 65 dBA. In addition, significant spatial separations from Eager Road to the proposed and existing homes in the area of Eager Road have been incorporated into the site design. Therefore, at Eager Road, as well as other locations, the proposed project would not result in a significant adverse noise impact.

Table 3.10-6
Calculated $L_{eq(1)}$ Noise Levels At Eager Road

Time Period	No Build	Build	Increase
Weekday AM	53.3	59.5	6.2
Weekday PM	50.2	59.7	9.5
Weekend MD	43.2	58.6	15.4

ATTENUATION REQUIREMENTS

In general, recommended noise attenuation values for buildings are designed to maintain interior noise levels of 45 dBA or lower. The design of the proposed residential, amenity, and associated structures would include central air conditioning (i.e., alternate means of ventilation) and well sealed double-glazed windows, and would therefore provide approximately 35 dBA of window/wall attenuation for all facades of potentially affected buildings. Based upon typical expected noise levels in this area, these design measures and the distance of the buildings from Eager Road should provide sufficient attenuation to achieve acceptable interior noise levels.

Also, the residential buildings' mechanical systems (i.e., heating, ventilation, and air conditioning systems) would be designed to meet all applicable noise regulations and to avoid producing levels that would result in any significant increase in ambient noise levels. Maintaining minimal mechanical system noise emissions within the residential neighborhood areas is an important factor to the project's overall design intent as a high-quality community in which enjoyable out-of-doors life and interactions among residents is a specific objective.

CONSTRUCTION-RELATED NOISE

All construction activities would be conducted in full compliance with existing regulations, including any local day and hour construction limitations. Local, state, and federal requirements mandate that certain classifications of construction equipment and motor vehicles be used to minimize adverse impacts. Thus, construction equipment would meet specific noise emission standards. Usually, noise levels associated with construction and equipment are identified for a reference distance of 50 feet, as shown in Table 3.10-7.

Table 3.10-7
Typical Noise Emission Levels For Construction Equipment

Equipment Item	Noise Level at 50 Feet (dBA)
Air Compressor	81
Asphalt Spreader (paver)	89
Asphalt Truck	88
Backhoe	85
Bulldozer	87
Compactor	80
Concrete Plant	83(1)
Concrete Spreader	89
Concrete Mixer	85
Concrete Vibrator	76
Crane (derrick)	76
Delivery Truck	88
Diamond Saw	90(2)
Dredge	88
Dump Truck	88
Front End Loader	84
Gas-driven Vibro-compactor	76
Hoist	76
Jack Hammer (Paving Breaker)	88
Line Drill	98
Motor Crane	93
Pile Driver/Extractor	101
Pump	76
Roller	80
Shovel	82
Truck	88
Vibratory Pile Driver/Extractor	89(3)

Notes:

[1] Wood, E.W., and A.R. Thompson, Sound Level Survey, Concrete Batch Plant; Limerick Generating Station, Bolt Beranek and Newman Inc., Report 2825, Cambridge, MA, May 1974.

[2] New York State Department of Environmental Conservation, *Construction Noise Survey, Report No. NC-P2*, Albany, NY, April 1974.

[3] F.B. Foster Company, Foster *Vibro Driver/Extractors, Electric Series Brochure*, W-925-10-75-5M.

Sources: Patterson, W.N., R.A. Ely, And S.M. Swanson, *Regulation of Construction Activity Noise*, Bolt Beranek and Newman, Inc., Report 2887, for the Environmental Protection Agency, Washington, D.C., November 1974, except for notated items.

The proposed development would be located more than 750 feet from the closest residence to the east and 200 feet to the south. Increased noise levels due to construction activity can be expected to be most audible during the early construction phases and if blasting is necessary, which would be relatively short in duration, approximately three to four months. Also, construction activity will be limited to weekday and weekend daytime hours. Construction operations, for some limited time periods, will result in increased noise levels that may significantly increase ambient noise levels. However, because of the limited duration, these impacts would not constitute significant adverse noise impacts.