Construction & Development

NEWYORK CITY TRANSIT NOISE REDUCTION REPORT

Prepared Pursuant to the Rapid Transit Noise Code and Public Authorities Law 1204-a

Abstract

This report shall include, but not be limited to an itemized summary of all monies spent, bids requested and received, contracts let, and actual work done on noise abatement programs during the previous period. Any and all subway noise measurements made during the previous period shall be included, with, whenever possible, analyses of such measurements. Such annual reports shall include a detailed analysis of all future noise abatement activities planned for the upcoming twelve months. Following the first twelve-month interval these reports shall also include comprehensive statements of progress made on all planned noise abatement activities included in the previous annual report.

Introduction

MTA New York City Transit (NYCT) has investigated noise issues that may affect the health, safety, or quality of life of our customers and employees and the communities we serve, and has expedited any necessary mitigation actions, for many decades. Noise abatement efforts have been undertaken by technical experts from the Departments of Subways, Stations, Buses, Office of System Safety and MTA Construction & Development (C&D). Beginning in 2015, annual noise reduction reports have been posted on the MTA website and this effort has been continued by MTA C&D since then.

This annual report, prepared pursuant to the requirements of Public Authorities Law 1204-a, provides an update for the previous year on capital investments and improved maintenance that contribute most to reducing subway system noise. All subway noise measurements made during the previous period shall be included, with, whenever possible, analyses of such measurements. The annual report shall also include a detailed analysis of all future noise abatement activities planned for the next twelve months.

Noise Abatement Program

MTA NYCT's ongoing noise abatement program was begun in 1974. It calls for noise related improvements where appropriate as part of other important capital and operating programs. This has included such major programs as track reconstruction (welded rail and resilient rail fastener installation), station reconstruction (station acoustic treatments), car overhauls (traction motor retrofit, air conditioning retrofit/overhaul) and Scheduled Maintenance System work (ring damped wheels and wheel truing machines). This policy was adopted, and continues to be favorably implemented, because it is most efficient to undertake treatments which contribute to noise reduction in concert with other activities. By including noise abatement activities as integral parts of other vital NYCT programs, such as track replacement, they will not take a back seat to other high priority projects which may otherwise fail to contribute to noise abatement efforts.

There have been several MTA NYCT programs which were designed to exclusively address noise abatement. Many projects have also provided noise abatement benefits indirectly. Examples of the abatement treatments have included traction motor noise reduction (5-7 dBA noise reduction), resilient rail fastener installation on steel elevated structures (3-5 dBA noise reduction), ring damped wheel installation (15-20dBA screech noise reduction). Programs which provide benefits in addition to noise abatement have included new car purchases, rail welding (9-10 dBA noise reduction, while at the same time decreasing the wear on wheels and rails, and providing a smoother ride), car air conditioning and rail lubrication (reduces wheel and rail wear on curved track).

MTA NYCT's noise abatement programs are summarized below. These initiatives are organized by the four specific categories in which noise occurs. They are: 1) in-car, 2) elevated structures, 3) curve and brake screech and 4) stations. These represent the areas which are most significantly affected by a particular treatment, although many treatments provide benefits which overlap environments.

In-Car Environment

By purchasing new subway cars and overhauling older cars, MTA NYCT has provided significant reductions to in-car noise, while reducing the amount of noise which emanates from cars. MTA NYCT's existing fleet consists of two Divisions, namely Division A and Division B. The lines that are represented in Division A include all the numbered lines as well as the Times Square Shuttle; Division B consists of all the lettered lines as well as the Rockaway and Franklin Avenue Shuttles.

For each of these Divisions, new cars are being introduced into the fleet for each line. For Division A, older R62 and R62A models were replaced by R142 and R142A. With this changeover, one could see a measurable reduction in noise. A 2010 systemwide noise study indicated that the R62 model, manufactured in 1983-85, had an average sound level of 73.2 dBA. This is in comparison to the newer model R142A that had an average sound level of 69.7 dBA. This satisfies the suggested goal of 80 decibels for new cars cited in the Rapid Transit Noise Code. The results of Division B were even clearer that MTA NYCT is continually improving its fleet when it comes to noise reduction in passenger cars. For instance, the average sound level was found to be 80 dBA for a R32A versus 63.9 dBA for a newer R160B; this is a 16.1 dBA reduction in interior noise level.

Many older cars also meet the 80dBA noise level goal, including over 1,000 cars purchased in the 1970's. Currently, the newer R211 subway car models are being phased in and will replace all R44 cars on the Staten Island Railway and all R46 subway cars.

Other improvements have been made which reduce in-car noise. The use of controllers that more closely synchronize acceleration and deceleration of individual cars in a train reduces the incidence of locked wheels, thereby reducing a major cause of flat wheels. The use of improved door and window components provides better seals to insulate the car interior from outside noise. Some cars also have noise abating material installed under the floor.

The installation of welded rail and resilient rail fasteners has had a significant impact on in-car noise levels. Resilient rail fasteners are installed on reconstructed tangent (straight) track and unguarded (gentle) curves on subway concrete track (Type II) and elevated track (Type III). Welded rail is installed only on tangent track and unguarded curves in the subway, open-cut and at-grade sections of the track system.

Elevated Structure Environment

There are several treatments which can contribute to noise abatement on elevated structures. These treatments include the installation of resilient rail fasteners, wheel dampeners, wheel truing and the use of rail lubricants to reduce curve screech. Resilient rail fasteners with improved noise reducing characteristics now replace steel tie plates placed between the rail and the ties during elevated structure track replacement. Prefabricated track panels are constructed with resilient rail fasteners in place. NYCT installs resilient rail fasteners in Type III track installations at all tangent track and unguarded curve locations.

The occurrence of flat wheels can significantly contribute to an increase in the noise level of a train. In some cases, the increase can be as great as 10 dBA. Flat wheels generally occur because of poor

controller operation, which causes unsynchronized acceleration and deceleration from car to car within the train. This in turn results in wheels dragging rather than rolling evenly on the rails. There are two related strategies for reducing flat wheels. One is to prevent them before they occur. Car controllers replaced as part of the completed car overhaul program have significantly reduced the incidence of flat wheels. The improvements made in controller maintenance and increased track testing of cars are also factors in assuring that controllers do not contribute to wheels flattening. The second strategy is to true wheels after they become flat. Wheel truing, a procedure in which the surface of the wheel is ground to correct flats, is an important part of MTA NYCT operations. Wheel truing also eliminates other imperfections created by irregular wheel wear which may cause them to generate excessive noise.

Curve and Brake Screech

Screech noise is generated by friction between wheels and rails, usually on tight curves. It can also be caused by friction from braking. The primary ways to reduce screech noise are through ring damped wheels, rail lubrication and composition brake shoes. Resilient rail fasteners may also reduce rail screech to some extent, but their effectiveness on reducing noise is better addressed in the sections covering elevated structures, stations, and in-car environments.

Ring damped wheels have shown to be an effective means to reduce wheel screech on curves. Rail lubrication of curves is used by MTA NYCT to reduce curve screech. All guarded curves with a radius of less than 1500 feet are equipped with lubricators with Maintenance of Way (MOW) personnel working year-round to keep the lubricators operational and in a good state of repair.

Old cast iron brake shoes have been replaced by new composition brake shoes that lower the screech associated with braking. Composition brake shoes provide a more constant level of friction and, to some extent, sound damping.

Station Environment

The station environment benefits from almost all noise treatments. This includes station acoustical treatments such as noise absorbing barriers installed between tracks and acoustic material installed over and under subway platforms and on ceilings over tracks. The other noise abatement treatments which lower noise in stations are the installation of welded rail with resilient rail fasteners, running trains with quieter traction motors and equipping cars with composition brake shoes and ring damped wheels. In addition, if the station is adjacent to a curve, rail lubrication of that curve will decrease screech noise as trains enter or leave the station.

The Station Reconstruction and Rehabilitation Programs such as the Enhanced Station Initiative are designed to reconstruct or refurbish all elements of a station. Noise reduction is one of the many types of improvements these programs produce. MTA NYCT has instituted a policy to include station acoustical treatments where appropriate as part of these programs.

2022 Noise Abatement Program Progress

Resilient Rail Fasteners. Resilient rail fasteners reduce noise by absorbing vibration from wheel-rail interaction and is the best method to reduce vibration and vibration-generated noise in supporting structures. Resilient fasteners can reduce noise by 3 to 5 dBA underground and 6 to 8 dBA on elevated tracks. NYCT installed more than 19,779 regular resilient rail fasteners in 2021, plus over 15,050 super resilient rail fasteners in 2021.

New Low Vibration Track (LVT). A new type of LVT is being installed throughout the NYCT System to determine its cost effectiveness. Several locations have been completed and preliminary results show a marked improvement in vibration-generated noise. The Culver Viaduct LVT installation, which ended in 2013, was for 18,000 track-feet. The #7 Line Extension LVT track installation, completed in 2014, was for 13,600 track-feet. In 2016, 23,006 track-feet LVT was added when the 2nd Avenue Subway Line opened for business. In 2017, 13,629 track-feet LVT was added, in 2018, 656 track-feet LVT was added throughout the System, 2019, 2020 and 2021 did not include any LVT. A total of 41,649 track-feet of regular track was replaced in 2019, none was replaced in 2020 but a total of 33,739 track-feet was replaced in 2021. In 2022, zero track-feet of low vibration track was added, and none is projected for 2023.

Continuous Welded Rail (CWR). A proven noise reduction technique, welded rail continues to be installed with approximately 28,319 track-feet added throughout the system in 2020 which is approximately 56,638 feet of CWR. This includes continuous welded rail where rails are welded together to form one uninterrupted rail that may be several miles long. Because there are few joints, this form of track is very strong, gives a smooth ride, and needs less maintenance; trains can travel on it at higher speeds and with less friction. This technique can result in up to 8 to 10 dBA of noise reduction when used with resilient fasteners. CWR is installed on tracks underground and at-grade, but not on elevated track due to thermal expansion issues and need to modify structure and rail fixation.

Top of Rail Friction Modifiers: This is a technique that lubricates contact surfaces of the rail to reduce squeal, which can be very effective under certain circumstances: Eight units were added to our system in 2020.

Ring-Damped Wheels: All NYCT revenue subway car wheels continue to be outfitted with ring-damped wheels, which reduces bell-like ringing of wheels. Ring-Damped Wheels are economical and achieve between 15 to 20dBA screech noise reduction (both level and duration).

Wheel Truing. Flat wheels sometimes develop over time and can cause extreme noise conditions, in addition to potentially causing damage to rail and or the subway car itself. When it is ascertained through inspection that flat wheels exist the wheels are removed from the truck of the subway car and sent for wheel truing. Wheel truing machines are located in 8 of our 15 Maintenance shops (239th Street, Corona, 207th Street, Jamaica, Concourse, East NY, Coney Island Overhaul Shop, 207'th Street Overhaul Shop) and 1850 cars wheels were trued in 2022MOW.

Fan Plants and Electric Substations: In addition to incorporating noise reduction techniques for new fan plants and substations, MTA NYCT has added silencers and vibration isolators to a number of existing above-ground fan plants to reduce emergency ventilation fan noise and ground-borne vibration to adjacent structures. In addition, in September 2022 a noise study was conducted at Maspeth Substation in

Brooklyn to better ascertain noise levels in underground stations and what mitigation measures can be taken to minimize noise impacts for future installations.

Buses: All recent, current, and future bus purchases require sustainable design incorporating the latest noise reduction methods available, such as through the use of state-of-the-art mufflers, to reduce the noise level exposure of passengers and bus operators as well as adjacent pedestrians, vehicles, housing, and businesses. Future studies may be performed to ascertain the effectiveness of current operations in regard to noise mitigation.

Annual and Projected Noise Abatement Financials

Noise Abatement Financials 2022			
Regular Resilient Rail Fasteners (feet)	19,527 Each/Total	2022 Construction Cost	$1,650,812.58
Super Resilient Rail Fasteners (feet)	14,123 Each/Total	2022 Construction Cost	$4,231,250.80
Track-feet of LVT installed (feet)	0 Feet/Total	2022 Construction Cost	$0.00
Track Feet replaced (feet)	36,268 Feet/Total	2022 Construction Cost	$16,326,884.55
Feet of Welded rail installed	20,983 Feet/Total	2022 Construction Cost	$21,607,663.91
Number top-of-rail friction modifiers	2 Each/Total	2022 Lubrication Cost	$30,000.00
2022 Material Cost			**$43,846,611.84**
2022 Labor Cost			**$112,748,430.45**
Noise Abatement Projected Financials 2023			
Regular Resilient Rail Fasteners (feet)	23,432 Each/Total	2023 Construction Cost	$1,981,014.15
Super Resilient Rail Fasteners (feet)	16,948 Each/Total	2023 Construction Cost	$5,077,500.96
Track-feet of LVT installed (feet)	0 Feet/Total	2023 Construction Cost	$0.00
Track Feet replaced	45,229 Feet/Total	2023 Construction Cost	$19,592,261.46
Feet of Welded rail installed	25,180 Feet/Total	2023 Construction Cost	$21,934,071.41
Number top-of-rail friction modifiers	2 Each/Total	2023 Lubrication Cost	$36,000.00

2023 Projected Material Cost		**$48,620,847.98**
2023 Projected Labor Cost		**$125,025,037.67**

Response to Noise Complaints

MTA C&D measures and quantifies noise on transit equipment/structures for maintenance and troubleshooting purposes, but also in residences impacted by the operation of the subway system, critical infrastructure, and construction activity from NYCT capital projects. In 2022, Environmental Services responded to 16 noise and vibration complaints from residents located throughout Brooklyn, Manhattan, Queens, and the Bronx. Many of these projects continued into 2023 and involved significant follow up measurements and testing. Memorandums sent to various NYCT departments are included in the appendix of this report.

Conclusion

MTA NYCT has continued to make substantial progress in abating noise in the system. Transit's fleet is now entirely composed of new and overhauled cars, and new subway cars that are in the process of being phased in, such as the new R211 trains on the A line. Based on noise studies conducted by the MTA, it has been established that the noise exposure of the riding public is substantially less than the maximum acceptable dose established by OSHA for 8 hours continuous exposure (85 dBA, 8-hour time weighted average).

In the area of track MTA NYCT continues its capital program to improve its inventory of mainline track. Through the installation of welded rail, resilient rail fasteners and rail lubricators, substantial progress has been made in reducing noise. Rail welding and the installation of resilient rail fasteners is continuing in the next program as part of the normal replacement track program. Car equipment maintenance is also being undertaken to ensure that noise emissions are minimal by means of ring damped wheels and wheel truing. A total cost of $43,846,611.84 was spent on materials and $112,748,430.45 was spent on labor for noise mitigation efforts; a projected material cost of $48,620.847.98 and a projected labor cost of $125,025,037.67 is expected for 2023.

APPENDIX

2 Broadway, 8th Fl.
New York, NY 10004-2207

Memorandum

Construction & Development

Date: **September 21, 2022**

To: **Jimmy Antony, Construction Manager, Infrastructure Business Unit**

From: **Stavroula Konstantellis, Project Administrator, Environmental Services**

Re: **Noise Measurements, Maspeth Substation**

Environmental Services conducted noise measurements at Maspeth Substation during daytime and evening hours on September 15 and September 20, 2022 respectively. The purpose of these measurements is to provide reference noise levels for a similarly designed substation being proposed for West 28th Street below street level nearby sensitive receptors.

The measurements collected were divided into three sections: background noise levels, noise levels with the transformers running without the exhaust fans and the AC that cools the electronics in the HMI/control panel for the substation, and noise levels with the transformers and exhaust fans running. The table below summarizes the data collected; measurement intervals for each mode were for three and a half to four minutes each, using the L_{EQ} parameter to report the average noise level.

Operating Mode	Substation Noise Level Day	Substation Noise Level Night	Above Grade Noise Level Day	Above Grade Noise Level Night
Background	51.8 dB(A)	48.8 dB(A)	66.5 dB(A)	61.6 dB(A)
Only Transformers Running	64.5 dB(A)	68.4 dB(A)	67.8 dB(A)	63.1 dB(A)
Transformers & Exhaust Fans Running	76.9 dB(A)	75.7 dB(A)	68.8 dB(A)	63.3 dB(A)

In the substation, an increase in noise level by 5.8 dB(A) can be observed when the transformers draw more current due to trains entering and leaving the station. The noise source above grade is dominated by vehicular traffic noise and commercial activity (loading/unloading trucks).

Looking at the frequency spectrum from the meter in the substation shows peaks on the first and second harmonic of the 60 Hz utility frequency that is not replicated on the meter above grade.

There is no correlation between the noise levels in the underground substation and the noise levels above grade, measured a few feet away from the exhaust grating, in front of a sensitive receptor; when the noise level in the substation goes from its minimum level to its maximum level there is no corresponding increase in noise level above grade.

If any further information is needed, please contact Gideon Dunkley of my staff at 646-316-9224.

cc: G. Dunkley
P. Kohutis
S. Singh

2 Broadway, 8th Fl.
New York, NY 10004-2207

Memorandum

Construction & Development

Date: August 12, 2022

To: Andrew Inglesby, Assistant Director, Government & Community Relations

From: Stacy Konstantellis, Project Administrator, Environmental Services, C & D SKonstantellis

Re: Noise & Vibration Measurements, 25 Joralemon Street

Environmental Services conducted vibration measurements in the basement of the subject address from August 8-11, 2022. The highest vibration level measured that was attributable to passing subway trains was 0.0152 in/sec Peak Particle Velocity (PPV) in the basement.

According to published criteria, these levels are perceptible and are in the range of what is normally found in buildings located over or near subway tracks. This level of vibration has no risk of architectural damage to normal buildings.

Noise measurements were also made in the residence but are not reported due to the predominance of interior noise during the measurement.

If any further information is needed, please contact Gideon Dunkley of my staff at 646-252-3543.

cc: G. Dunkley
A. Lawrence
M. Dawson

2 Broadway, 8th Fl.
New York, NY 10004-2207

Memorandum

MTA Construction & Development

Date: **June 10, 2022**

To: **Michael Dawson, Superintendent, MOW Engineering, DOS**

From: **Stavroula Konstantellis, Project Administrator, Environmental Services, C & D**

Re: **Noise Measurements, Front St & Pine St, Manhattan Bridge Anchorage, Brooklyn**

Environmental Services conducted noise measurements underneath the Brooklyn side of the Manhattan Bridge at the intersection of Front Street & Pine Street on June 10, 2022. Measurements were collected for a 30-minute period at street level with the sound level meter set to fast response for impulsive sound measurements, due to indications that the noise impact is caused by sudden impact with a track element. The highest sound level produced by passing trains on the Manhattan bridge was 94.4 dB(A) against a background sound level of 68.2 dB(A).

If any further information is needed, please contact Gideon Dunkley of my staff at 646-316-9224.

cc: G. Dunkley

2 Broadway, 8th Fl.
New York, NY 10004-2207

Memorandum

Construction & Development

Date: **May 31, 2022**

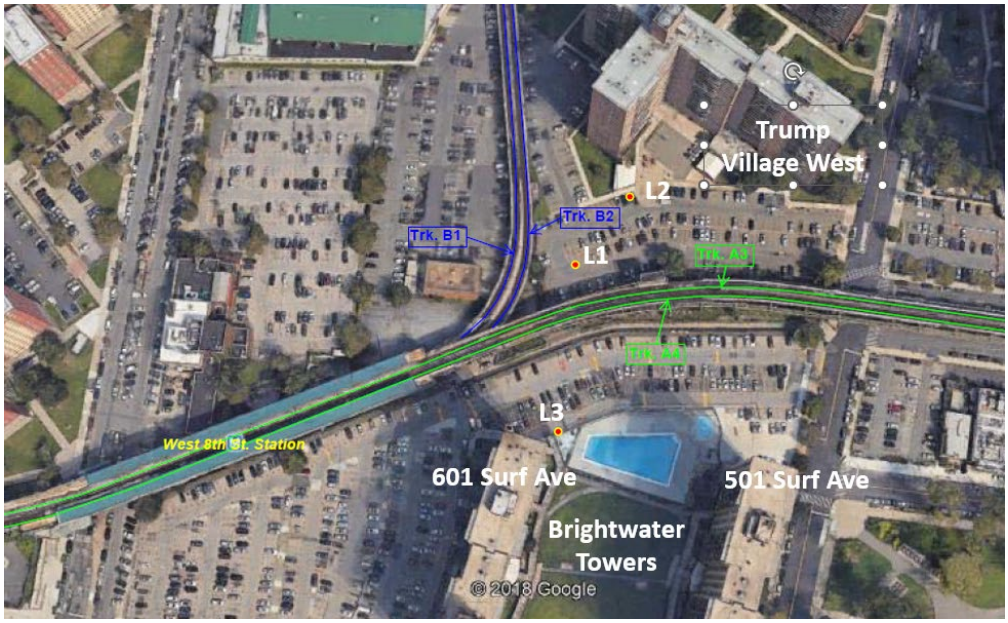
To: **Melissa Farley, Assistant Director, Government & Community Relations**

From: **Stacy Konstantellis, Project Administrator, Environmental Services, C & D**

Re: **Noise Measurements Trump Village & Brightwater Towers Condominiums**

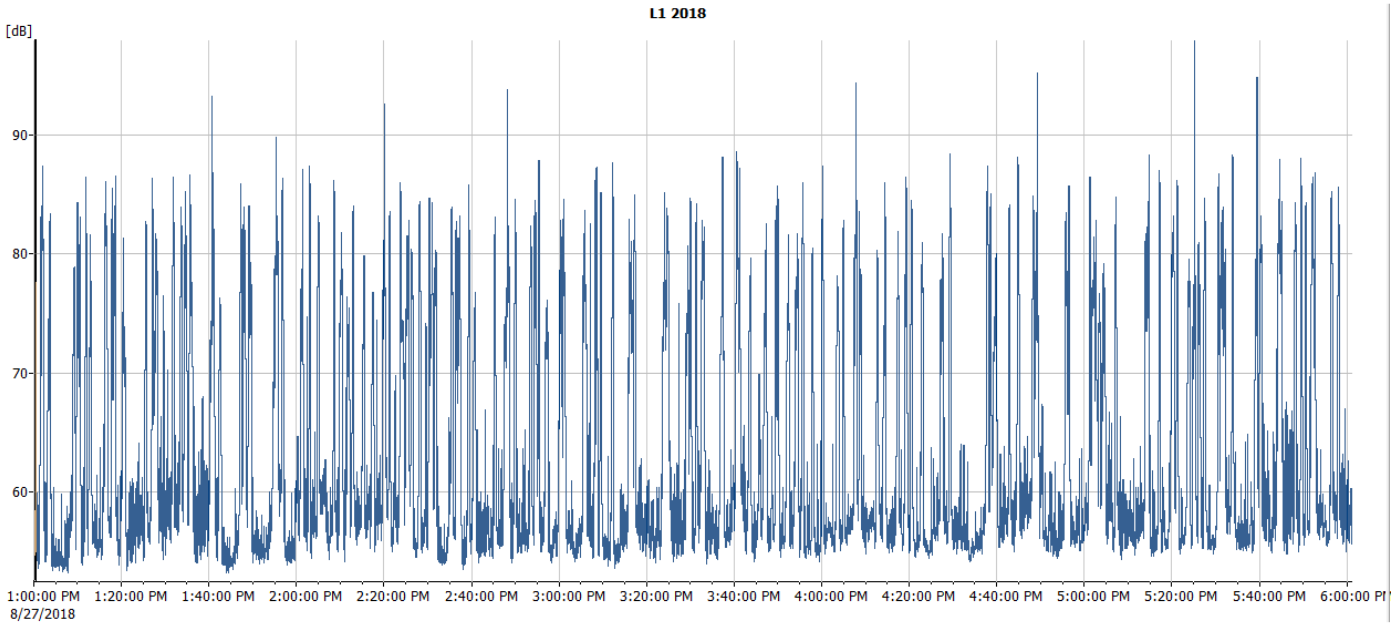
Environmental Services conducted twelve-hour noise measurements on May 26, 2022 at several locations serviced by West 8th Street Station on the F & Q lines in Coney Island. These measurements serve as a follow-up to a noise study conducted over an extended period of time in August 2018; the purpose of the 2018 study was to determine the level of noise impact and identify particular sources (impact vs screech) so targeted noise remediation methods may be evaluated. The follow up measurements conducted were done to determine the efficacy of the noise mitigation efforts implemented.

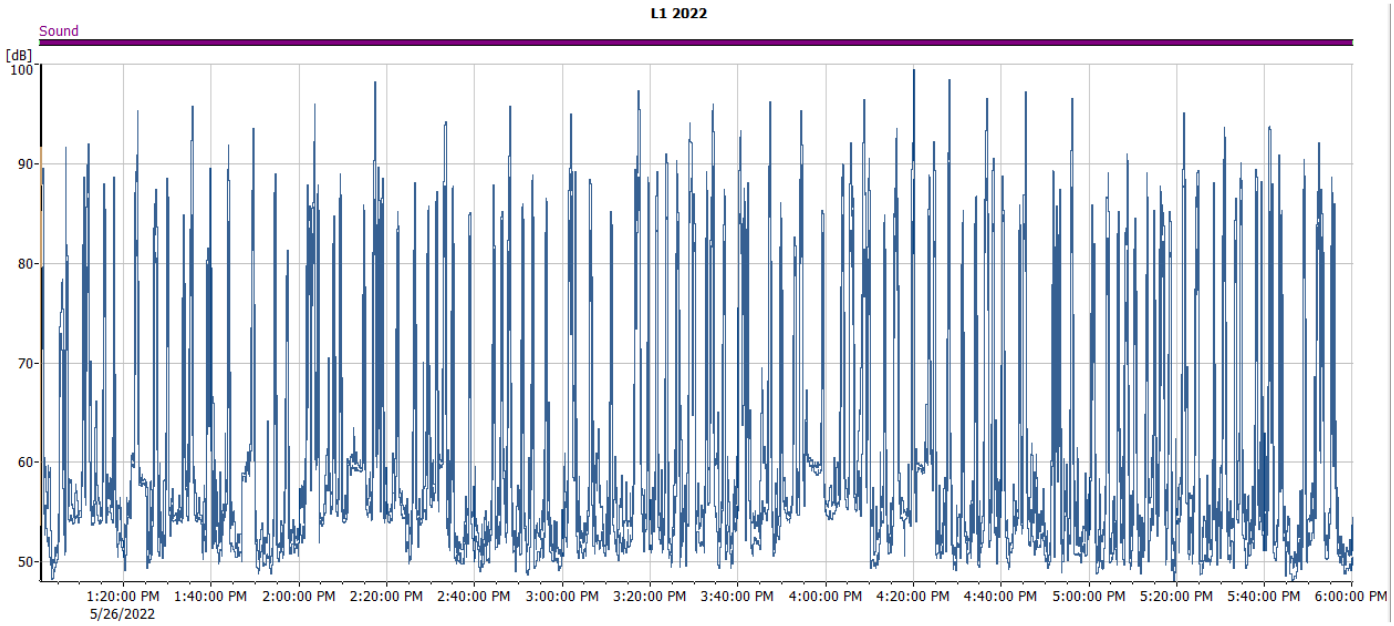
The noise impact area comprises Trump Village West located at 2942-44 W. 5th Street, building 7A, and Bright Water Towers, located at both 501 and 601 Surf Avenue. In March 2016, Environmental Services conducted noise level measurements in the Trump Village West parking lot at street level, at the wye, where the F and Q lines diverge past the W. 8th Street station and revisited the locality in October 2017 to take measurements on the balcony of a 4th floor residence located at 601 Surf Avenue (Bright Water Towers). The following map (not to scale) shows the noise study area.



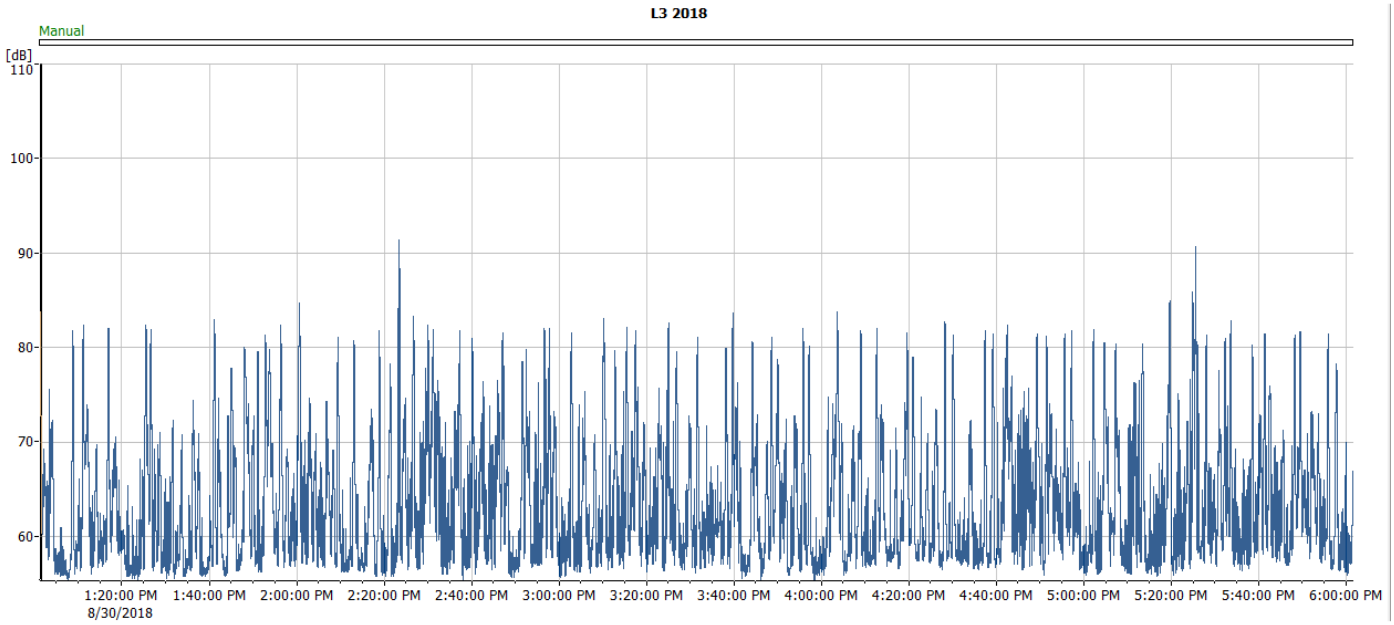
Measurements collected at Location 1 (L1) were measured closer to the wye to avoid passing vehicular traffic in both 2018 and 2022. Furthermore, instead of conducting follow up measurements at L2, a measurement point on the balcony of apartment 2J at 601 Surf Avenue was chosen in order to assess noise levels inside of a sensitive receptor. Track workers were observed on the F-line track for a brief period of time, which caused trains to move slower around the curve, but this does not appear to have affected the result.

The following charts show the noise levels collected at L1 and L3 in 2018 and 2022 during similar periods of the day to show there has been no attenuation of noise levels:

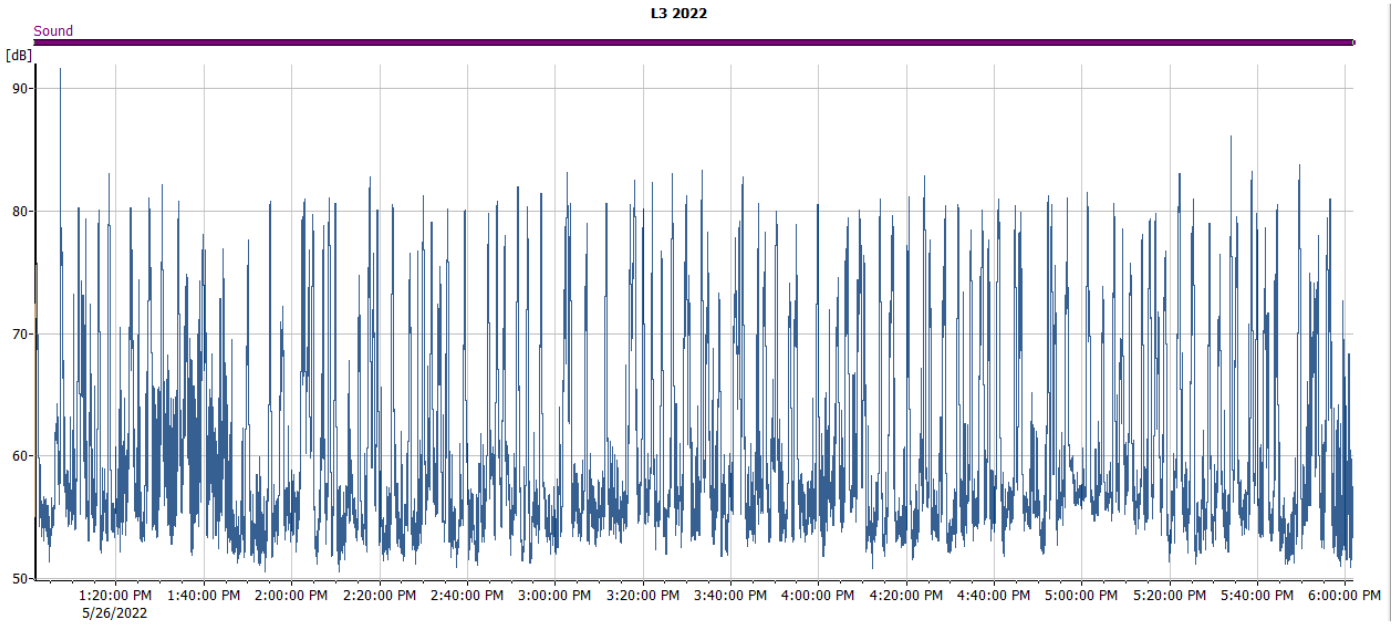




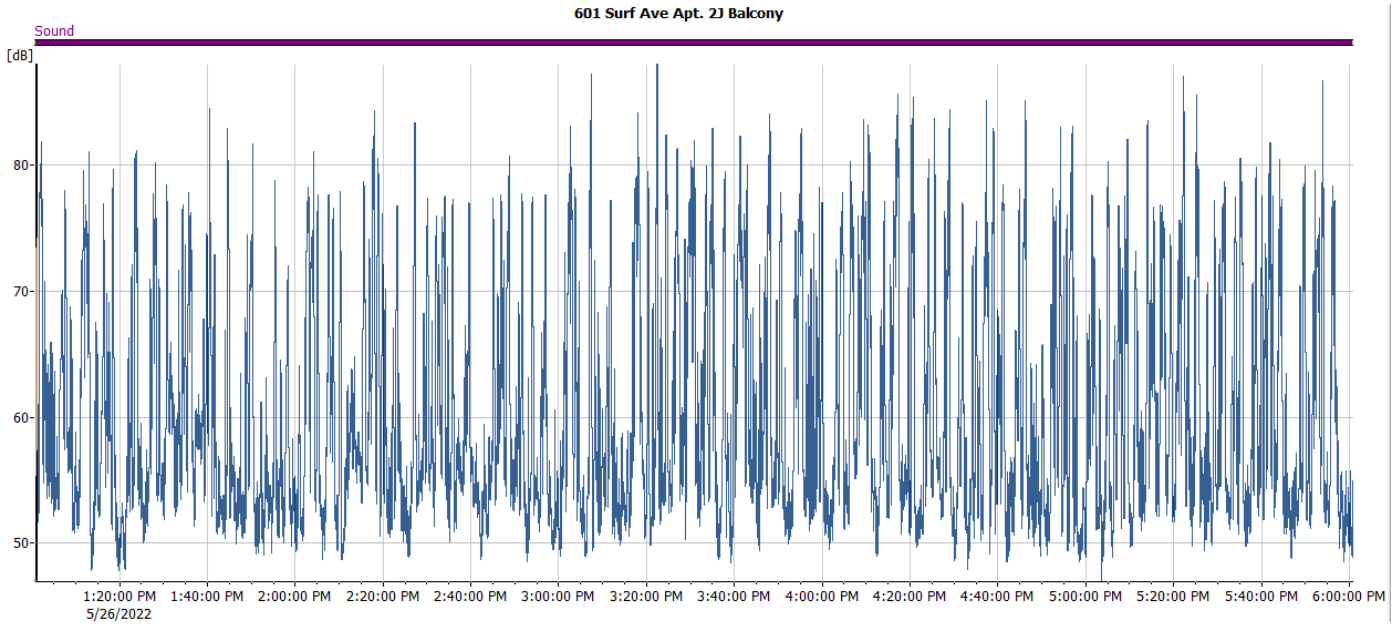
L3 2018



L3 2022



The following chart shows noise levels measured in apartment 2J of 601 Surf Avenue:



The following table summarizes the above information:

Location	2016	2017	2018	2022
601 Surf Ave Apt 4S (L_{Max})		79.1 dB(A)		
601 Surf Ave Apt 2J (L_{Max})				81.9 dB(A)
Location 1 (L_{Max})	102.9 dB(A)		97.6 dB(A)	98.6 dB(A)
Location 3 (L_{Max})			90.5 dB(A)	90.8 dB(A)
Background (L_{EQ})	49.6 dB(A)	58.1 dB(A)	58.1 dB(A)	56.2 dB(A)

The above data shows there has been no noise attenuation over the six-year period that noise monitoring has been conducted in this neighborhood. Environmental Services strongly recommends consideration be given to noise mitigation measures.

cc: G. Dunkley
M. Dawson
T. Abdallah

2 Broadway, 8th Fl.
New York, NY 10004-2207

Memorandum

MTA Construction & Development

Date: **February 25, 2022**

To: **Mike Dawson, Superintendent, Track Engineering, RS & MOW**

From: **Stacy Konstantellis, Project Administrator, Environmental Services, C &D**

Re: **Vibration and Noise Measurements, 181 18th Street Apt. 206, Brooklyn**

Environmental Services conducted vibration measurements in a second-floor apartment and basement of the subject address from February 22-23, 2022. The highest vibration level measured that was attributable to passing subway trains was 0.0248 in/sec Peak Particle Velocity (PPV) in the apartment and 0.0660 in/sec PPV in the basement.

According to published criteria, the vibration levels in the basement are perceptible and are above the upper range of what is normally found in buildings located over or near subways. This level of vibration has no risk of architectural damage to normal buildings.

Noise measurements were conducted in the apartment, however train noise was not detected.

If any further information is needed, please contact Gideon Dunkley of my staff at 646-252-3543.

cc: G. Dunkley
P. Kohutis

2 Broadway, 8th Fl.
New York, NY 10004-2207

Memorandum

Construction & Development

Date: **February 16, 2022**

To: **Jessica Spanton, Assistant Director, Government & Community Relations**

From: **Stacy Konstantellis, Project Administrator, Environmental Services, C & D**

Re: **Noise & Vibration Measurements, 655 6th Avenue, Manhattan Apt. 2E**

Environmental Services conducted vibration measurements in a second-floor residence and basement of the O'Neill Condominium at the subject address from February 9-10, 2022. The subject address is a neo-Grec style department store with both commercial and residential spaces located in the Ladies' Mile Historic District. The highest vibration level measured that was attributable to passing subway trains was 0.0358 in/sec Peak Particle Velocity (PPV) in the apartment and 0.0274 in/sec PPV in the basement.

According to published criteria, the vibration levels are perceptible and are in the range of what is normally found in buildings located over or near subway tracks. This level of vibration has no risk of architectural damage to normal buildings.

Noise measurements were also made in the basement in a soon-to-be-occupied commercial space due to less measurement interference in that area. Noise produced by passing trains elevates interior noise levels by more than 20 dB(A). A typical train produces a max sound level of 57.7 dB(A) against an interior noise level of 34.5 dB(A) (5-minute L_{90}).

If any further information is needed, please contact Gideon Dunkley of my staff at 646-316-9224.

cc: G. Dunkley
P. Kohutis