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.

2021 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.

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 and 1633 cars wheels were trued in 2021.

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.

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 2021			
Regular Resilient Rail Fasteners	19,779 Each/Total	2021 Construction Cost	$1,483,425.00
Super Resilient Rail Fasteners	15,050 Each/Total	2021 Construction Cost	$2,500,147.58
Track-feet of LVT installed	0 Feet/Total	2021 Construction Cost	$0.00
Track Feet replaced	33,379 Feet/Total	2021 Construction Cost	$10,588,595.85
Feet of Welded rail installed	28,319 Feet/Total	2021 Construction Cost	$29,480,079.00
Number top-of-rail friction modifiers	1 Each/Total	2021 Lubrication Cost	$15,000.00
2021 Material Cost			**$44,067,247.43**
2021 Labor Cost			**$113,315,779.12**
Noise Abatement Projected Financials 2022			
Regular Resilient Rail Fasteners	18,404 Each/Total	2022 Construction Cost	$1,380,300.00
Super Resilient Rail Fasteners	47,278 Each/Total	2022 Construction Cost	$3,698,498.85
Track-feet of LVT installed	0 Feet/Total	2022 Construction Cost	$0.00
Track Feet replaced	32,438 Feet/Total	2022 Construction Cost	$10,177,153.63
Feet of Welded rail installed	10,758 Feet/Total	2022 Construction Cost	$11,199,078.00
Number top-of-rail friction modifiers	2 Each/Total	2021 Lubrication Cost	$30,000.00
2022 Projected Material Cost			**$26,455,030.48**
2022 Labor Cost			**$68,104,364.09**

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 2021, Environmental Services responded to 18 noise and vibration complaints from residents located throughout Brooklyn, Manhattan, Queens, and the Bronx. Many of these projects continued into 2022 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. 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 $44,067,247.43 was spent on materials and $113,315,779.12 was spent on labor for noise mitigation efforts; a projected material cost of $26,455,030.48 is expected for 2022.

APPENDIX

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

Memorandum

Construction & Development

Date: November 18, 2021

To: Mohammed Z, Rahman, P.E., Construction Manager, Infrastructure Business Unit

From: Thomas Abdallah, P.E., Chief Environmental Engineer, Environmental Services

Thomas Abdallah

Re: Noise Measurements
Rail Control Center
354 West 54th Street
Manhattan

On November 9th and November 10th, 2021, Environmental Services collected daytime and nighttime noise measurements from a temporary chiller unit consisting of 8 fans, 2 compressors, and 2 pumps in the alleyway of the referenced location with mitigation barriers in place. The unit cycled between 75% and 85% capacity under full load at ambient temperatures. Noise level measurements were collected on the sidewalk at four locations on West 54th Street:

- In front of the RCC alleyway next to 354, approximately 20 feet from the pumps
- Directly across from the alleyway in front of 317
- In front of 315
- At the building corner of 317 & 321. The following measurements were collected.

	Day		Night	
Location	L_{10}	L_{EQ}	L_{10}	L_{EQ}
RCC	76.3 dB(A)	75.0 dB(A)	74.6 dB(A)	72.9 dB(A)
315 W 54	74.0 dB(A)	70.6 dB(A)	66.1 dB(A)	65.0 dB(A)
317 W 54	67.0 dB(A)	65.7 dB(A)	67.9 dB(A)	66.1 dB(A)
321 W 54	65.8 dB(A)	64.0 dB(A)	63.5 dB(A)	62.6 dB(A)
Background	--	61.4 dB(A)	--	58.2 dB(A)

L_{10} is the sound level exceeded for 10% of the recording interval and represents the upper range of noise levels sampled; L_{EQ} is the equivalent sound of the fluctuating noise level for the recording period.

As you are aware MTA NYCT is not subject to the New York City Noise Code. However, general prohibitions during daytime (7AM-10PM) for non-impulsive sound is 10 dB(A) above ambient and 7 dB(A) above ambient during nighttime hours (10PM-7AM) (§24-218 b.1-2). For impulsive sounds, a max sound level of 15 dB(A) above ambient is permitted (§24-218 b.3). While the noise mitigation measures implemented have reduced noise level (for example without mitigation an L_{10} of 82.4 dB(A) was measured on Oct 27 at the RCC location, resulting in a reduction in sound level by 6.1 dB(A)), we recommend further mitigation measures be considered.

If you have any questions regarding this matter, feel free to contact Paul Kohutis of my staff at x-4793 or MS Teams

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

Memorandum

Construction & Development

Date: October 27, 2021

To: Mohammed Z, Rahman, P.E., Construction Manager, Infrastructure Business Unit

From: Stavroula Konstantellis, Project Administrator, Environmental Services

Re: Noise Measurements
Rail Control Center, 354 West 54th Street, Manhattan

On October 27, 2021, Environmental Services collected noise measurements from a temporary chiller unit in the alleyway of the referenced location. The unit cycled between 75% and 85% capacity and peaked at a capacity of 95% under full load at ambient temperatures. Noise level measurements were collected on the sidewalk at four locations on West 54th Street:

- Location 1 in front of the alleyway next to 354, approximately 20 feet from the pumps
- Location 2 directly across from the alleyway in front of 317
- Location 3 in front of 315
- Location 4 at the building corner of 317 & 321.

The following measurements were collected:

	Location 1	Location 2	Location 3	Location 4
L_{MAX}	88.1 dB(A)	80.1 dB(A)	80.8 dB(A)	76.4 dB(A)
L_{10}	82.4 dB(A)	69.3 dB(A)	69.3 dB(A)	68.6 dB(A)

L_{10} is the sound level exceeded for 10% of the recording interval and represents the upper range of noise levels sampled; L_{MAX} is the max sound level reached during the measurement period.

Due to the intermittent nature of one of the water pumps' operation, transient spikes in the noise level due to the motor starting were recorded and contributed to the max sound level.

The New York City Noise Code General prohibitions during day time (7AM-10PM) for non-impulsive sound is 10 dB(A) above ambient and 7 dB(A) above ambient during nighttime hours (10PM-7AM) (§24-218 b.1-2). For impulsive sounds, a max sound level of 15 dB(A) above ambient is permitted (§24-218 b.3). An ambient sound level of 63.2 dB(A) (5-minute L_{EQ}) was measured before the chiller began operating.

Environmental Services recommends noise mitigation be implemented for the operation of the temporary chiller due to the decrease in ambient sound levels overnight.

If you have any questions regarding this matter, feel free to contact Paul Kohutis of my staff at 646 879-8893 or MS Teams.

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

Memorandum

Construction & Development

Date: September 14, 2021

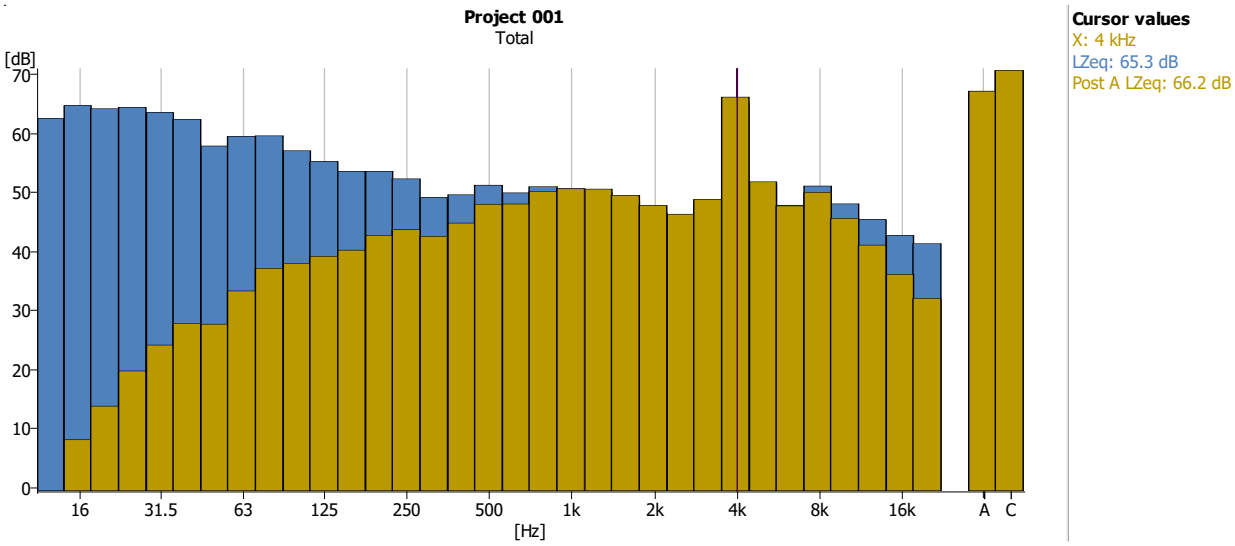
To: Anthony Casella, Chief Officer, MOW Engineering, RS & MOW

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

Re: Noise Measurements, 158th Street and River Avenue Bronx

On September 14, 2021 Environmental Services conducted noise measurements at the referenced intersection in response to a citizen complaint. A high frequency whistling noise was observed being emitted from an air leak in a pressure line on the elevated structure midway between vents 10 and 11. A track worker from MoW was able to verify he felt air leaking from the line. The line produces a maximum broadband sound level of 69.4 dB(A) against a background sound of 64.9 dB(A).

Because of the non-linearity of human hearing, the higher frequencies are perceived as louder, even though the difference above the broadband ambient noise is relatively small. Per the NYC Noise Code §24-232(a), noise levels above 33 dB(A) on a 4kHz band for residential/mixed use buildings are prohibited, and noise levels above 38 dB(A) on this band are prohibited for commercial properties; a level of 66.2 dB(A) was measured on this band at street level. See the following chart.



If any further information is needed, please contact Paul Kohutis of my staff at 646-252-4793.

cc: G. Dunkley
P. Kohutis

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

Memorandum

Construction & Development

Date: **August 19, 2021**

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

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

Re: **Noise & Vibration Measurements, 415 74th Street, Bay Ridge Brooklyn**

Environmental Services conducted vibration measurements in a second-floor residence and basement of the subject address from August 16-18, 2021. The highest vibration level measured that was attributable to passing subway trains was 0.0276 in/sec Peak Particle Velocity (PPV) in the apartment and 0.0196 in/sec 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 at the reference residence. The highest noise level produced by a passing subway train measured an L_{MAX} of 63.6 dB(A) against a background sound level of 32.9 dB(A) (6-hour L_{EQ}).

Previous vibration measurements were collected at this address in February 2021 measured 0.0496 in/sec PPV in the apartment and 0.0354 in/sec PPV in the basement. Measurements were also previously collected in June 2014 and measured 0.0289 in/sec Peak Vector Sum (PVS) in the basement.

Previous noise measurements were collected at this address in February 2021 and measured an L_{MAX} of 53.5 dB(A) against a background sound level of 45.8 dB(A) (one-hour L_{EQ}).

If any further information is needed, please contact Gideon Dunkley of my staff at 646-252-3570.

cc: G. Dunkley
P. Kohutis
A. Lawrence
M. Dawson

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

Memorandum

Construction & Development

Date: May 18, 2021

To: Algernon Lawrence, Superintendent, MOW Engineering, RS & MOW

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

Re: Noise & Vibration Measurements, 195 Smith Street Apartment 2F, Brooklyn

Environmental Services conducted vibration measurements in a second-floor apartment and basement of the subject address from May 11-13, 2021. The highest vibration level measured that was attributable to passing subway trains was 0.0568 in/sec Peak Particle Velocity (PPV) in the second-floor apartment and 0.0390 in/sec PPV in the basement.

The vibration levels are perceptible and are in the upper range of what is normally found in buildings located over or near subways. According to published criteria, these levels of vibration have no risk of architectural damage to normal buildings.

Noise measurements were also conducted in the complainant's apartment with the windows closed. The highest noise level produced by a passing subway train measured an L_{MAX} of 72.0 dB(A) against a background sound level of 36.0 dB(A) (3-minute L_{EQ}).

An analysis of the noise event waveforms show a sharp increase in the interior noise as a subway train approaches, and a significant drop off as the train passes by. This seems to be due to a subway grating along the front property of the residence.

If any further information is needed, please contact Paul Kohutis of my staff at 646-252-4793.

cc: G. Dunkley
P. Kohutis

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

Memorandum

Construction & Development

Date: May 10, 2021

To: A. Cassella, P.E., Assistant Chief Engineering Officer, MOW Engineering, DOS

From: S. Konstantellis, Project Administrator, Environmental Services, DSO, C&D

Re: Noise Measurements, 512 Beach 32nd Street, Far Rockaway, A/S Line

Environmental Services conducted noise measurements in a second-floor room at the referenced address on April 29-May 2, 2021. The room is facing the elevated structure for the A train and Rockaway Park Shuttle Line. Measurements were collected for a 36-hour period, three feet from a closed window that was opened temporarily to get a worst-case measurement. The prolonged measurements were taken due to the complainant's indication that the noise levels were worse over the weekend. The following table summarizes the noise measurements collected.

Weekday Max Sound Level (L_{MAX}) (window closed)	**64.6 dB(A)**
Weekday Max Sound Level (L_{MAX}) (window open)	**71.3 dB(A)**
Weekend Max Sound Level (L_{MAX}) (window closed)	**64.9 dB(A)**
Ambient Sound Level (window open) (2-minute L_{EQ})	**46.9 dB(A)**
Ambient Sound Level (window closed) (2-minute L_{EQ})	**27.1 dB(A)**

If any further information is needed, please contact Paul Kohutis of my staff at 646-879-8839.

cc: G. Dunkley
P. Kohutis

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

Memorandum

Construction & Development

Date: February 25, 2021

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

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

Re: Noise & Vibration Measurements, 7825 4th Avenue Apt. F6 (Sixth Floor), Brooklyn

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Environmental Services conducted noise and vibration measurements, in the sixth-floor residence and basement of the referenced address, from February 23-24, 2021. The highest vibration level measured that was attributable to passing subway trains was 0.0357 in/sec Peak Particle Velocity (PPV) in the apartment and 0.149 in/sec PPV in the basement. An additional vibration meter was placed in the superintendent's apartment located in the basement and measured a maximum vibration level of 0.0828 in/sec PPV.

The vibration levels in the basement are highly perceptible. According to published criteria, such vibration levels are approximately equivalent to vibration sources such as bulldozers and other heavy tracked construction equipment and are above the upper range for commuter rails. Environmental Services strongly recommends a track inspection be completed immediately.

Noise measurements were also made in the complainant's apartment; the highest noise level produced by a passing subway train measured an L_{MAX} of 54.3 dB(A) compared to a background sound level of 43.1 dB(A).

Previous measurements collected at this address in December 2013 and measured 0.068 in/sec Peak Vector Sum (PVS).

If any further information is needed, please contact Paul Kohutis of my staff at 646-252-4793.

cc: M. Dawson
G. Dunkley
P. Kohutis
A. Lawrence

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

Memorandum

Construction & Development

Date: January 27, 2021
To: Micahel Dawson, Superintendent, Track Engineering, RS & MOW
From: Stacy Konstantellis, Project Administrator, Environmental Services, C & D
Re: 473 Broadway Manhattan
Noise and Vibration Measurements

Environmental Services conducted vibration measurements in an unoccupied second-floor apartment and basement of the subject address from January 26, 2021 to January 27, 2021. The highest vibration level measured that was attributable to passing subway trains was 0.0897 in/sec Peak Particle Velocity (PPV) in the apartment and 0.115 in/sec PPV in the basement. Noise measurements were also made in the second-floor apartment. The highest noise level produced by a passing subway train measured an L_{MAX} of 63.2 dB(A) against a background sound level of 42.0 dB(A) (two-minute L_{EQ}).

The vibration levels are highly perceptible. According to published criteria, such vibration levels are approximately equivalent to vibration sources such as bulldozers and other heavy tracked construction equipment, and are well beyond the upper range for commuter rails. Environmental Services strongly recommends a track inspection immediately.

If any further information is needed, please contact Paul Kohutis of my staff at 646-252-4793.

cc: A. Cabrera
G. Dunkley
L. Flax
P. Kohutis

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

Memorandum

Construction & Development

Date: **February 12, 2021**

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

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

Re: **Noise & Vibration Measurements**
427 9th Street Apartment #1
Brooklyn

Environmental Services conducted noise and vibration measurements in a ground level apartment at the referenced address from February 10-11, 2021. Two vibration meters were placed in the ground floor apartment; one in the rear bedroom and one in the living room, which faces 9th Street. The highest vibration level measured that was attributable to passing subway trains was 0.068 in/sec Peak Particle Velocity (PPV) in the living room and 0.0276 in/sec PPV in the bedroom.

A noise meter was placed in the bedroom. The highest noise level produced by a passing subway train measured an L_{MAX} of 50.9 dB(A) against a background sound level of 43.0 dB(A) (forty-five minute L_{90}).

The vibration levels are perceptible and are in the range of what is normally found in buildings located over or near subways. According to published criteria, these levels of vibration have no risk of architectural damage to normal buildings.

If any further information is needed, please contact Paul Kohutis of my staff at 646-252-4793.

cc: M. Dawson
G. Dunkley
P. Kohutis

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

Memorandum

Construction & Development

Date: **February 16, 2021**

To: **Anthony Casella, Chief Officer, MOW Engineering, RS & MOW**

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

Re: **Noise & Vibration Measurements 2125 West 8th Street Brooklyn**

Environmental Services conducted noise and vibration measurements in the first-floor residence and basement of the referenced address from February 11-15, 2021. Measurements were conducted over a longer time frame, due to the complainant's suggestion that highest vibration was experienced on the weekends. The highest vibration level measured that was attributable to passing subway trains was 0.1058 in/sec Peak Particle Velocity (PPV) in the first-floor and 0.0645 in/sec PPV in the basement.

Noise measurements were also collected in the basement due to less measurement interference in that area. The highest noise level produced by a passing subway train measured an L_{MAX} of 55.6 dB(A) against a background sound level of 42.0 dB(A) (12 hour L_{EQ}).

The vibration levels are highly perceptible. According to published criteria, such vibration levels are approximately equivalent to vibration sources such as bulldozers and other heavy tracked construction equipment and are well beyond the upper range for commuter rails. Environmental Services strongly recommends a track inspection immediately.

Previous measurements collected at this address in April 2015 measured 0.0818 in/sec Peak Vector Sum (PVS) and 90.3 dB(A) as measured on the patio near the retaining wall of the property

If any further information is needed, please contact Paul Kohutis of my staff at 646-252-4793.

cc: G. Dunkley
P. Kohutis

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

Memorandum

Construction & Development

Date: **February 25, 2021**

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

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

Re: **Noise & Vibration Measurements, 415 74th Street, Bay Ridge Brooklyn**

Environmental Services conducted vibration measurements in a second-floor residence and basement of the subject address from February 22-23, 2021. The highest vibration level measured that was attributable to passing subway trains was 0.0496 in/sec Peak Particle Velocity (PPV) in the apartment and 0.0354 in/sec 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 at the reference residence. The highest noise level produced by a passing subway train measured an L_{MAX} of 53.5 dB(A) against a background sound level of 45.8 dB(A) (one-hour L_{EQ}).

Previous vibration measurements were collected at this address in June 2014 and measured 0.0289 in/sec Peak Vector Sum (PVS) in the basement.

If any further information is needed, please contact Paul Kohutis of my staff at 646-252-4793.

cc: G. Dunkley
P. Kohutis
A. Lawrence
M. Dawson

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

Memorandum

Construction & Development

Date: February 25, 2021

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

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

Re: Noise and Vibration Measurements, 532 Pacific Street, Brooklyn

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Environmental Engineering conducted noise and vibration measurements, in the third-floor bedroom and basement of the referenced address, from February 22-23, 2021. No vibrations that are attributable to subways trains were detected, with the meters set at the lowest reasonable setpoint, for each seismometer at this location.

The complainant stated that there were construction activities close by on Pacific Street. These activities may be the source of this complaint.

If any further information is needed, please contact Paul Kohutis of my staff at 646-252-4793.

cc: G. Dunkley
P. Kohutis

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

Memorandum

Construction & Development

Date: February 25, 2021

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

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

Re: Noise & Vibration Measurements, 7825 4th Avenue Apt. F6 (Sixth Floor), Brooklyn

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Environmental Services conducted noise and vibration measurements, in the sixth-floor residence and basement of the referenced address, from February 23-24, 2021. The highest vibration level measured that was attributable to passing subway trains was 0.0357 in/sec Peak Particle Velocity (PPV) in the apartment and 0.149 in/sec PPV in the basement. An additional vibration meter was placed in the superintendent's apartment located in the basement and measured a maximum vibration level of 0.0828 in/sec PPV.

The vibration levels in the basement are highly perceptible. According to published criteria, such vibration levels are approximately equivalent to vibration sources such as bulldozers and other heavy tracked construction equipment and are above the upper range for commuter rails. Environmental Services strongly recommends a track inspection be completed immediately.

Noise measurements were also made in the complainant's apartment; the highest noise level produced by a passing subway train measured an L_{MAX} of 54.3 dB(A) compared to a background sound level of 43.1 dB(A).

Previous measurements collected at this address in December 2013 and measured 0.068 in/sec Peak Vector Sum (PVS).

If any further information is needed, please contact Paul Kohutis of my staff at 646-252-4793.

cc: M. Dawson
G. Dunkley
P. Kohutis
A. Lawrence

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

Memorandum

Construction & Development

Date: **February 25, 2021**

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

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

Re: **Noise & Vibration Measurements, 415 74th Street, Bay Ridge Brooklyn**

Environmental Services conducted vibration measurements in a second-floor residence and basement of the subject address from February 22-23, 2021. The highest vibration level measured that was attributable to passing subway trains was 0.0496 in/sec Peak Particle Velocity (PPV) in the apartment and 0.0354 in/sec 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 at the reference residence. The highest noise level produced by a passing subway train measured an L_{MAX} of 53.5 dB(A) against a background sound level of 45.8 dB(A) (one-hour L_{EQ}).

Previous vibration measurements were collected at this address in June 2014 and measured 0.0289 in/sec Peak Vector Sum (PVS) in the basement.

If any further information is needed, please contact Paul Kohutis of my staff at 646-252-4793.

cc: G. Dunkley
P. Kohutis
A. Lawrence
M. Dawson

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

Memorandum

Construction & Development

Date: **February 16, 2021**

To: **Anthony Casella, Chief Officer, MOW Engineering, RS & MOW**

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

Re: **Noise & Vibration Measurements 2125 West 8th Street Brooklyn**

Environmental Services conducted noise and vibration measurements in the first-floor residence and basement of the referenced address from February 11-15, 2021. Measurements were conducted over a longer time frame, due to the complainant's suggestion that highest vibration was experienced on the weekends. The highest vibration level measured that was attributable to passing subway trains was 0.1058 in/sec Peak Particle Velocity (PPV) in the first-floor and 0.0645 in/sec PPV in the basement.

Noise measurements were also collected in the basement due to less measurement interference in that area. The highest noise level produced by a passing subway train measured an L_{MAX} of 55.6 dB(A) against a background sound level of 42.0 dB(A) (12 hour L_{EQ}).

The vibration levels are highly perceptible. According to published criteria, such vibration levels are approximately equivalent to vibration sources such as bulldozers and other heavy tracked construction equipment and are well beyond the upper range for commuter rails. Environmental Services strongly recommends a track inspection immediately.

Previous measurements collected at this address in April 2015 measured 0.0818 in/sec Peak Vector Sum (PVS) and 90.3 dB(A) as measured on the patio near the retaining wall of the property

If any further information is needed, please contact Paul Kohutis of my staff at 646-252-4793.

cc: G. Dunkley
P. Kohutis

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

Memorandum

Construction & Development

Date: **February 12, 2021**

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

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

Re: **Noise & Vibration Measurements**
427 9th Street Apartment #1
Brooklyn

Environmental Services conducted noise and vibration measurements in a ground level apartment at the referenced address from February 10-11, 2021. Two vibration meters were placed in the ground floor apartment; one in the rear bedroom and one in the living room, which faces 9th Street. The highest vibration level measured that was attributable to passing subway trains was 0.068 in/sec Peak Particle Velocity (PPV) in the living room and 0.0276 in/sec PPV in the bedroom.

A noise meter was placed in the bedroom. The highest noise level produced by a passing subway train measured an L_{MAX} of 50.9 dB(A) against a background sound level of 43.0 dB(A) (forty-five minute L_{90}).

The vibration levels are perceptible and are in the range of what is normally found in buildings located over or near subways. According to published criteria, these levels of vibration have no risk of architectural damage to normal buildings.

If any further information is needed, please contact Paul Kohutis of my staff at 646-252-4793.

cc: M. Dawson
G. Dunkley
P. Kohutis

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

Memorandum

Construction & Development

Date: January 27, 2021
To: Micahel Dawson, Superintendent, Track Engineering, RS & MOW
From: Stacy Konstantellis, Project Administrator, Environmental Services, C & D
Re: 473 Broadway Manhattan
Noise and Vibration Measurements

Environmental Services conducted vibration measurements in an unoccupied second-floor apartment and basement of the subject address from January 26, 2021 to January 27, 2021. The highest vibration level measured that was attributable to passing subway trains was 0.0897 in/sec Peak Particle Velocity (PPV) in the apartment and 0.115 in/sec PPV in the basement. Noise measurements were also made in the second-floor apartment. The highest noise level produced by a passing subway train measured an L_{MAX} of 63.2 dB(A) against a background sound level of 42.0 dB(A) (two-minute L_{EQ}).

The vibration levels are highly perceptible. According to published criteria, such vibration levels are approximately equivalent to vibration sources such as bulldozers and other heavy tracked construction equipment, and are well beyond the upper range for commuter rails. Environmental Services strongly recommends a track inspection immediately.

If any further information is needed, please contact Paul Kohutis of my staff at 646-252-4793.

cc: A. Cabrera
G. Dunkley
L. Flax
P. Kohutis

From:	Konstantellis, Stavroula
To:	Bettelheim, Joseph; Wilson, Vincente
Cc:	Inglesby, Andrew; Kohutis, Paul; Dunkley, Gideon
Subject:	Furman Ventilation Plant Remediation Octave Band Analysis
Date:	Friday, June 4, 2021 1:55:03 PM
Attachments:	Furman Fan Plant Octave Band Data.xlsx

Environmental Services collected daytime noise level measurements at three measurement points in the vicinity of the Furman Street Fan plant on June 2nd 2021. Octave band measurements were recorded with slow time response (S) and zero weighting (Z) with the fans operating in each mode (ventilation-exhaust & ventilation-supply) on the 1/3 octave band scale. Three samples for each location were collected for each operating mode. The attached spreadsheet contains all the amplitudes for each frequency band along with a chart visualizing the data for better clarity. Broadband sound levels were collected with A-weighting applied; the ambient levels for each location are as follows (10 minute sample interval):
Fan Plenum Chamber: 64.0 dB(A)
Fan Plant Exterior: 74.0 dB(A),
130 Furman Street, Pierhouse Properties Exterior Ambient Level: 71.9 dB(A)
Max sound level recorded outside at this location during the operation of the fans was 100.2 dB(A) during ventilation-supply mode.