



NYCDOT Residential Vibration Summaries

In 2017, 5 properties along the BQE Triple Cantilever were monitored for vibrations. Residents of the area noted that after NYCDOT repaved the roadway the vibrations lessened. In 2019 more concerns regarding building vibrations came to the department. Following public input, 17 properties were monitored, including the 5 previous buildings. Along with the buildings, the BQE structure was monitored during the same period and charted against the building vibration data.

Individual Property Summaries

The 17 properties monitored were:

73 Columbia Heights *		
122 Columbia Heights	1 Grace Court *	
146 Columbia Heights *	34 Hicks Street	8 Remsen Street *
184 Columbia Heights	25 Middagh Street	7 Willow Street
19 Cranberry Street	27 Middagh Street	9 Willow Street
7 Everit Street	30 Middagh Street	20 Willow Street*
	55 Poplar Street	28 Willow Street

*Monitored both in 2017 and 2019.

Residents in each property were asked to keep a log of vibrations they experienced, which were also plotted against the data where available.

Vibration Monitoring Summaries were distributed to the buildings in January 2020. The data in the reports was summarized from a larger data set, which was made available through the NYCDOT Brooklyn Borough Commissioner’s office.

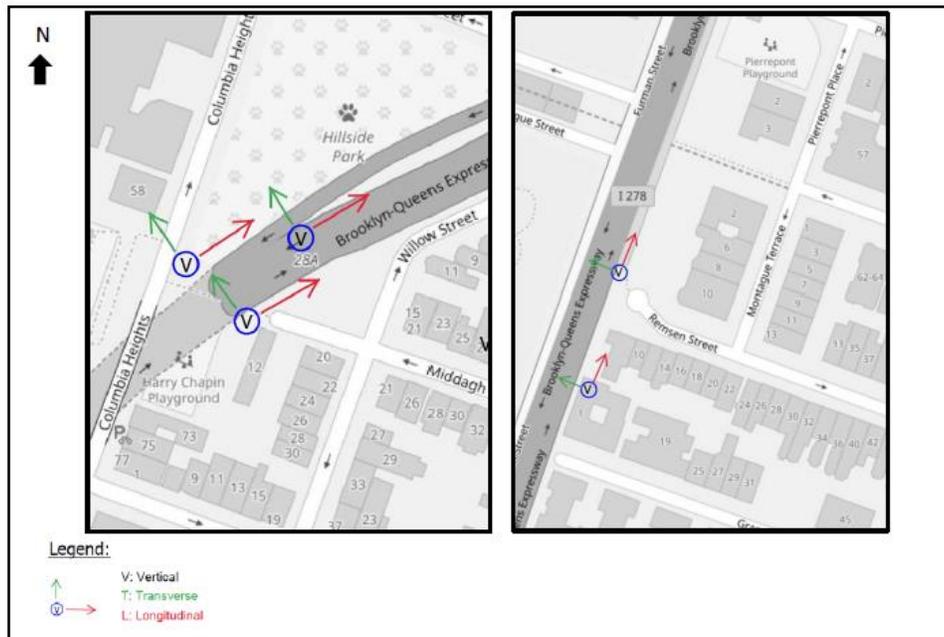
Overall Vibration Summary Methods

To measure the vibrations, monitoring stations were placed at the ground level, and at a higher level within the building and on the Brooklyn Queens Expressway. Additionally, occupants were provided a log to document any vibrations felt during the monitoring period. Vibrations were monitored for a minimum of one week to ensure that a sufficient variety of traffic conditions on the Brooklyn Queens Expressway (BQE) were captured. Data was continuously collected and monitored through a website in real-time. The data collected by the sensors in the vibration monitoring stations shows the velocity of the vibration in the Vertical, Longitudinal, and Transverse directions which are abbreviated as V, L, and T. Figure 1 provides an illustration of the vibration direction with respect to the BQE. These measuring directions are described as:

- V stands for vertical vibrations and points upward.

- L stands for lateral vibrations and is parallel to the BQE, and to the direction of traffic.
- T stands for transverse vibrations and is perpendicular to the BQE, and to the direction of traffic.

Figure 1 – Vibration Directions



Vibrations can be classified into two types: “ground-borne vibrations” and “non-ground borne vibrations”. Sources of ground-borne vibrations can include heavy construction activities such as pile driving, soil compacting, or the passage of trains or traffic on rough roads. Sources of non-ground-borne vibrations can include wind or construction activities within the building itself.

The Peak Particle Velocity (PPV) was recorded for each of the three directions. In general, a PPV value of 0.02 in/sec is a conservative threshold for a vibration to be perceptible. As shown in Figure 2, a PPV value of 0.15 can be felt and is often perceived as annoying. Sources that generate this level of vibration include transit and subways. A PPV of 0.8 represents the approximate threshold for vibrations that could cause potential structural damage. Sources can include heavy construction activities and the magnitude of the vibration will depend on variables such as the source frequencies, the vibration duration, the number of times it is repeated, structure foundation and building characteristics¹.

¹ Federal Transit Administration

Figure 2 – Vibration Scale



Results

In eight of the monitored properties, the data showed no correlation between the BQE structure and vibrations measured within the buildings. In the remaining nine monitored properties, the data showed some correlation at certain times between the BQE structure and the vibrations measured within the building, but the correlation was not consistent or clear.

In order to better understand the vibrations, NYCDOT has continued the monitoring process to target the source of the vibrations. As sources of the vibrations are identified, NYCDOT will continue to target repair work to try to reduce the vibrations. Unfortunately, this is an aging roadway that is experiencing significant deterioration, underscoring the need for a large-scale BQE project. DOT has increasingly limited short-term repair options, and is finding that such repairs are not lasting as long as they traditionally would have.