MONITORING OF VIBRATIONS ASSOCIATED WITH CONSTRUCTION ACTIVITIES

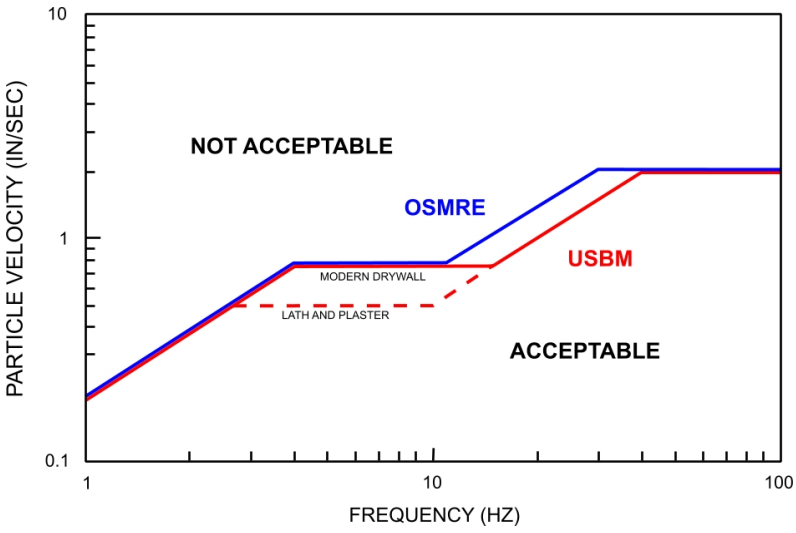
D'Appolonia was retained to perform pre- and post-construction surveys and vibration monitoring during pile driving operations for installation of steel sheeting along a section of the south shore of the Allegheny River at the Cork Factory Apartments in the Strip District of Pittsburgh, PA.

Vibration from construction projects is caused by ground motion from general equipment operations, but is often highest during pile driving activities. Although construction vibrations are sometimes noticeable outdoors, they are mainly observed indoors. While it is conceivable for ground motion from construction projects to cause building damage, construction vibrations rarely cause even minor cosmetic damage to buildings. The primary concern is that the vibration can be intrusive and annoying to building occupants.

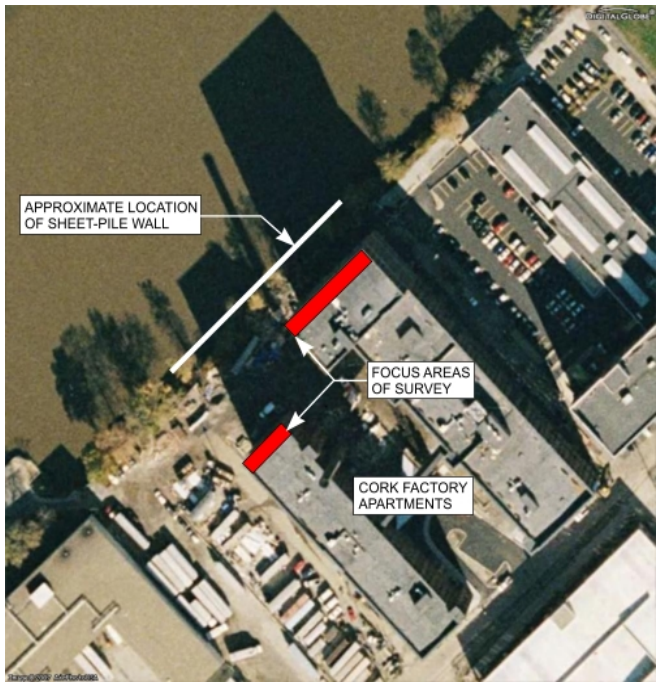
The frequency of vibrations measured in hertz (hz) indicates how rapidly an object oscillates. Human perception of vibration ranges from below one hz to up to about 200 hz, but people are generally most sensitive to the vibrations in the lower part of this range. Ground vibrations from construction are commonly a composite or "spectrum" of many frequencies. Typically, construction vibrations are described in terms of a predominant frequency associated with a peak motion defined as peak particle velocity or peak acceleration. The peak motion is an indicator of its severity in terms of its potential for building damage.

The threshold at which there is a risk of architectural damage to sensitive building components such as plastered ceilings and walls is commonly taken to be about 0.5 in/sec peak particle velocity. This velocity is well below the threshold above which there is the likelihood of minor damage (commonly taken to be 2 in/sec). In reality, the threshold for damage is also a function of frequency. The reason that normal construction vibration does not result in structural damage has to do with several issues, including the vibration frequency and magnitude of construction related vibration. Unlike earthquakes, which produce vibration at very low frequencies and have a high potential for structural damage, most construction vibrations is are in the mid-to-upper frequency range and have a lower potential for structural damage.

In the U.S., commonly applied standards for allowable vibrations at various frequency levels are those published for the U.S. Bureau of Mines (USBM) and the Office of Surface Mines Reclamation and Enforcement (OSMRE). These charts are shown to the left.



OSMRE and USBM acceptable particle velocity vs. frequency standards.



Aerial view of site showing building and sheet-pile wall.

A pre-construction survey was conducted by D'Appolonia field personnel The purpose of the survey was to establish and document the condition of cracking in masonry, concrete, drywall and other brittle building materials before initiation of pile driving. For this survey, primary focus was placed on the foundations and walls nearest to the pile driving as shown on the aerial photograph.

Monitoring of the vibrations produced by the pile driving was performed using a Vibra-Tech Multi-Seis Plus recording unit with a triaxial transducer having a 2-hz to 300-hz calibrated frequency response. The equipment was used in the auto-record mode, where any event greater than a triggering threshold of 0.125 in/sec was recorded. The data were downloaded on an approximately weekly basis to a personal computer for interpretation of the measurements.

A post-construction inspection was conducted by D'Appolonia personnel and showed that cracks and defects identified prior to construction were not enlarged or altered due to the construction activities.