The experiment setup consisted of a laser tracker (Leica AT4030) measuring the position of a single, stable point 9.5 m away. The most critical parameter was chosen to be the averaging time of a measurement. Main aim was to observe how much this time can be reduced (in the measurement profile) without observing the negative influence of vibrations. The tracker was placed atop a tripod and traxial accelerometer (PCB 356A15) was placed under the mounting disc. The vibration of floor under the stand was measured triaxially by seismic accelerometers (PCB 393B31). The tests were carried out for two particular states: vibrations generated by excavation works outside of the building and background vibrations without the influence of construction works. In each case, three profiles of the tracker measurement were used, varying only by averaging time. The values chosen were 2 s, 1 s and 0.001 s. The last, extremely short time was chosen specifically to see how big the influence of the vibrations can be.

To better understand the results, modal analysis of the stand was performed. The FEA results were compared to data obtained from impulse response of the test setup.

RESULTS

Standard deviation of elevation measurement series was considerably larger when heavy construction equipment was working and 1 s or 0.001 s averaging times were chosen. No effects on elevation can be seen with 2 s averaging time. In case of azimuth measurement, vibrations influenced the results equally throughout the assessed averaging time range.

CONCLUSION

Ground vibrations generated by construction equipment affect laser tracker measurements. Averaging times of a single measurement is a crucial parameter in such conditions. It is usually set long enough for high-precision measurements to neglect the influence of vibrations. Shortening this time can have a negative impact on results, especially with the elevation angle (averaging time of 1 s resulted in ±2 asec of dispersion). No significant impact has been seen on the azimuth or distance measurements. The frequency of vibrations generated by construction equipment coincides with modal frequency of the stand (approx. 60 Hz). This can lead to induction of resonance, which will negatively affect measurement results.