

# Vibration Control of an Office Building Floor System Using Tuned Mass Dampers

Walking induced vibration of composite floor system of an office building was controlled at 4 bays, using 8 x 1500 lb tuned mass dampers (TMDs). The measured natural frequencies of the floor system were used in tuning the TMDs targeting the first vibration mode of two bays and first two vibration modes of the other two bays.



With the floor vibration measurement results identifying the first natural frequencies of various bays on hand, two tuned mass dampers (TMDs) per bay were designed, manufactured and installed at locations where they could most effectively couple with the first mode of the floor system (the vibration mode for which they were designed to dampen). Figure 1 shows two tuned mass dampers bolted to a pair of C-channels bridging two existing beams, underneath one of the bays. The tuned mass dampers were tuned to 5.5 Hz, i.e., the natural frequency of the mode targeted for damping.

The floor vibration associated with occupant activities, mainly walking, was exacerbated by resonant amplification of the lower modes (mainly first mode) of the underdamped floor system.

The tuned mass dampers effectively dissipated the vibration energy of four bays of the floor system, lowering the annoying walking-induced vibration motion of the floor to an imperceptible level.

The blue trace in Figure 2 presents the vibration response of the floor to a heel drop perturbation

The floor vibration is presented by the power spectral density (PSD) of the measured acceleration.

Tuned mass dampers (TMDs) are tuned damping devices commonly used for dampening the vibration of a structure at a particular resonant frequency. TMDs come in various configurations. The commonality between all of them is their make-up which includes an inertia element (mass) suspended by an energy dissipating (damping) device and a restoring (resilient) element.



Figure 1 Two TMDs appended underneath one of bays of the floor system

without the TMDs operational (TMDs locked). The red traces in Figure 2 depicts the same measurements when the TMDs are brought online (TMDs unlocked and fine-tuned).

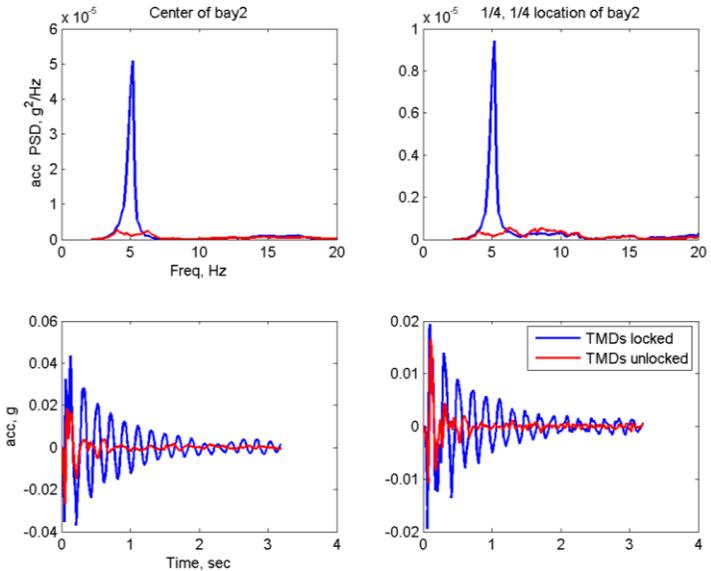


Figure 2 Power spectral density traces of the floor acceleration measured at two locations on one the bays without and with the TMDs operational

As shown in Figure 2, the 8-fold reduction in the vibration power at the target frequency indicates that the tuned mass dampers have dampened the structural mode they were designed for and tuned to, effectively.

