Vibration Control of an Office Floor System Using Tuned Mass Dampers

Foot traffic (walking) resulted in vibration of the composite floor system at the 11th floor of an office building. The make-up of the floor system is slab construction consisting of 3.25 inch lightweight concrete fill on 2” deep, 20 gauge composite steel deck with the typical bay sizes of 30 ft x 30 ft and composite steel beam and girder framing. The first resonant frequency and damping ratio of the bay with the most severe vibration were around 6 Hz and 3.5%, respectively.

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

The floor vibration response is presented by the power spectral density of the measured acceleration.

As shown in Figure 3, the 8-fold reduction in the vibration power at the target frequency indicates that the tuned mass dampers have dampened the first structural mode they were designed for and tuned to, effectively.

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.