

## Footfall-induced Vibrations in Healthcare Facilities

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The recently released 2010 Guidelines for Design and Construction of Health Care Facilities provides guidance for acceptable levels of floor vibration in hospitals and healthcare facilities. For sensitive areas like patient rooms and operating/treatment rooms, the guide recommends that floor vibrations be limited to 4,000 micro-inches per second. For public and administrative areas, an 8,000 micro-inch per second limit is recommended.

Human activity (walking) is often the greatest source of floor vibration on above-grade floors in buildings. A building floor vibrates at its natural frequency in response to a footstep impulse, much the same way a guitar string responds to being plucked. Footfall-induced vibrations are generally most severe at the middle of structural bays and least severe near columns where the floor is naturally stiffer. Similarly, walkers in the middle of a structural bay produce more vibration than do walkers closer to column lines. The vibrations due to footfalls generally increase with increased walker speed.

Some sound design practices that can be employed to limit footfall-induced vibrations are:

- 1) Locate corridors near column lines;
- 2) Do not locate corridors within sensitive bays; and
- 3) Locate vibration sensitive equipment near columns, away from the middle of structural bays.

Structural solutions also can be employed to reduce footfall-induced vibrations. To a good approximation, the floor vibration scales as floor stiffness to the  $-3/2$  power. The response of a structure to footfalls is not generally affected by the construction method (concrete vs. steel).

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