SPEIGHT MARSHALL & FRANCIS
A Professional Corporation

Technical Bulletin

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On a regular basis, we plan to distribute these informational leaflets about crucial - but often ambiguous - structural engineering topics. With the knowledge of our featured subjects, our goal is to help our clients improve their profitability while reducing their liability. We suggest distributing a copy of our technical bulletins throughout your office and keeping them on hand for quick reference.

Office Buildings - Floor Framing Options

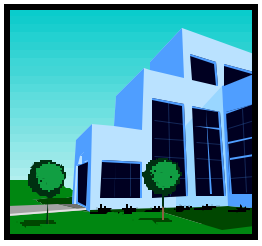
Introduction:

When choosing the framing system for an office environment, the issues of cost and ease-of-construction are not the only factors to consider for the Owner. The typical office floor plan includes areas of high foot traffic adjacent to areas of dead load (e.g. desks, computers, or filing). The floor framing will influence how vibrations from foot traffic are transferred and felt in these adjacent areas. This vibration "feel" is another factor to consider when choosing the framing system for an office environment.

Floor Vibration Consideration:

Unfortunately, personal comfort level is not an easily defined value. Individuals working in the office will have differing reactions and tolerances for the floor vibrations, ranging from slight awareness to near-nausea. The spacing and length of framing members as well as the dead weight of the slab all affect the amount of vibration damping.

Listed below are several typical joist and joist girder options for office floor framing, ordered from most vibration felt to least vibration felt.



Joist and Joist Girder Framing Options:

- **Joists at 2'-6" on-center with 3" concrete slab**
  Most economical, but also least damped.
- **Joists at 4'-0" on-center with 4" concrete slab**
  The thicker concrete slab will provide more damping, but spacing the joists further apart will require increased depth (and cost).
- **Joists at 2'-6" on-center with 4" concrete slab**
  Again, a thicker slab will provide extra damping but require deeper joists.

Composite Beam Framing Options:

- **Beams at 6 to 8 feet on-center with 4 to 5 inch concrete slab**
  This is the typical configuration for composite beams in an office-type building, recommended for spans less than 28 feet. Vibration can be controlled by the spacing and depth/stiffness of beams.
- **Beams at 8 to 9 feet on-center with 6 inch concrete slab**
  A wide beam spacing and extra slab weight will significantly reduce floor vibrations, but increase beam depth and weight.

Fireproofing Consideration:

A separate consideration when choosing between beams and joists for office floor framing is the need for fireproofing. Fireproofing a joist is much more difficult and costly than fireproofing a beam because of the joist's open web configuration. Additionally, the steel deck for the floor or roof may need to be spray-fireproofed. This hampers the ability to hang anything (electrical, mechanical, plumbing) from the deck. Spray-fireproofing is also known for falling/flaking off due to foot traffic above, so maintenance/future cost for the Owner becomes an issue. If the office building will require fireproofing, composite framing with beams is usually a prudent decision.

Additional Information:

Following are resources which contain more information on avoiding floor vibrations in office buildings:

Galambos, Theodore V., "Technical Digest #5 - Vibration", *Steel Joist Institute*, March 1988. www.steeljoist.org

Murray, Thomas M., "Floor Vibration and the Electronic Office", *Modern Steel Construction*, August 1998.

Murray, Thomas M., "Tips for Avoiding Office Building Floor Vibrations", *Modern Steel Construction*, March 2001.

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