

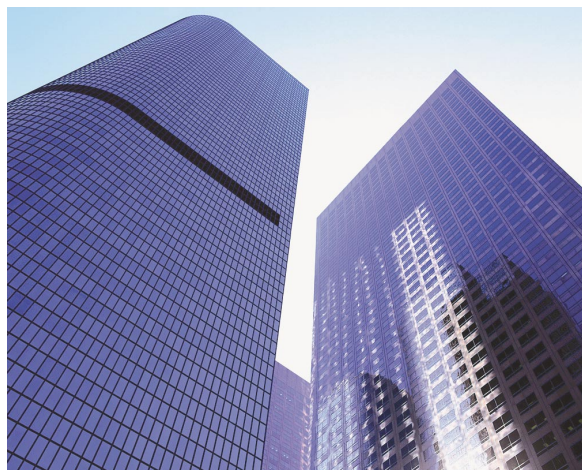


# T E C H N O T E S

ISSUE NO. 2c

## MOTION CRITERIA IN HIGH RISE BUILDINGS

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Oscillation of a structure in wind can rapidly lead to structural failure if the oscillations grow to a large amplitude. However, certain types of oscillation, while they are not large enough to cause structural problems, may cause problems of human discomfort in tall buildings.

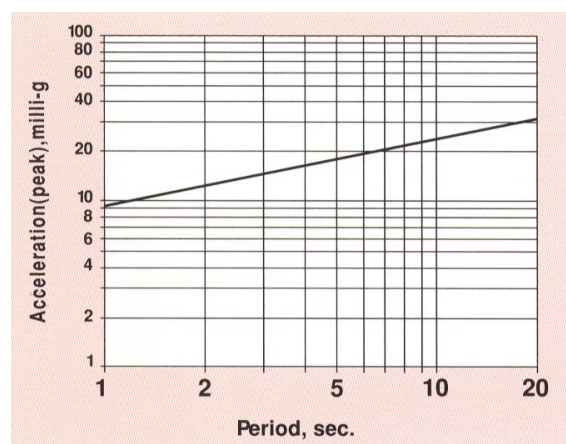
Building motions under the action of commonly occurring winds need to be kept within comfortable limits for the building occupants. For lightweight modern structures, keeping the building motions within acceptable limits can be more of a challenge than ensuring that they have sufficient structural strength. Acceleration has emerged as the most common index of motion effects. The horizontal force felt on the human body is directly proportional to the horizontal acceleration. An acceleration of one thousandth of gravity is called a milli-g. People are sensitive to accelerations as small as a few milli-g.

It is unrealistic to demand that no perceptible motions ever occur. Therefore, how much horizontal acceleration is acceptable and how often can it take place? The International Standards Organization (ISO) has published guidelines in terms of the value of the acceleration on the top floor that should not be exceeded more than once in five years on average. The adjacent graph illustrates the criteria

that can be derived from the ISO information. For example, for a building with a five second period, the five year acceleration should not exceed 18 milli-g. For a building with an eight second period, a higher five year acceleration not exceeding 22 milli-g is acceptable. These accelerations will be perceived, but if they only occur once every five to ten years, the functioning and commercial viability of the building will not be adversely affected.

More recently there has been a trend towards setting the criteria at a shorter return period of one year with values of acceptable acceleration set about 30% lower. This has been prompted by the increasing number of buildings being constructed in hurricane and typhoon areas. Typically, in these areas, there is ample warning of the five or ten year winds caused by these storms. Buildings are usually evacuated before the storm hits, and occupants who stay are not expecting normal comfortable conditions. Therefore, in such areas, it is more meaningful to consider the one year wind event.

The criteria discussed above apply primarily to office buildings since the most data are available for that situation. Target accelerations for residential buildings are often set 20% to 30% lower.



Guideline for 5 Year Acceleration in Buildings

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