INFORMATION PAPER IP 21/12

# AN INTRODUCTION TO STRUCTURAL DYNAMIC COMFORT CRITERIA

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Modern buildings are becoming lighter and have less structural damping than older, heavier structures. Vibrations in such buildings can become annoying and even alarming, and different serviceability criteria have been developed over the years to ensure that buildings are suitable for their intended purpose.

This Information Paper gives an overview of current UK dynamic comfort criteria used to assess the acceptability of buildings, structures and components. It introduces a subject that is widely regarded as being confusing and difficult, and the subject is explained so that it is accessible to the non-expert reader. This Information Paper also presents four case studies that show the practical application of the techniques and methods described.

*Figure 1:* A tall modern building

## BACKGROUND

The effects of vibration are becoming increasingly important in the design of buildings and building elements. Modern construction methods mean that buildings are becoming lighter, and have less structural damping. The response of such buildings to imposed vibration is therefore increased, so people using the buildings are more likely to experience vibrations. If the vibration is large enough it can cause annoyance, motion sickness and ultimately panic. Over a number of years, different serviceability criteria have been developed to ensure that buildings and building elements are suitable for their intended activity. BRE has been involved in research and testing in this field for over 60 years.

When a structure is subjected to vibration, people tend to become uncomfortable well before the limiting state of the design is reached, ie before the structure is damaged. Hence the serviceability requirements tend to be the critical factor in structures with human occupants. Within the population there is a wide range of sensitivity to vibration. Generally children are the most sensitive to vibration, and adult males the least sensitive. Both the activity and posture of a person affect their perception of acceleration. A person's expectation and exterior cues (such as sound) are also important factors. This wide number of complicating factors means that serviceability criteria can never be precise; what one person judges to be a tolerable level of vibration may be perceived to be annoying by another. Therefore judgements often need to be made about the percentage of the population that would perceive building motion as being unacceptable. These judgements have significant financial implications. For this reason, many codes of practice recommend that agreement is reached with the client about limiting vibration threshold levels.