INTERNATIONAL STANDARD

ISO 10137

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Bases for design of structures — Serviceability of buildings and walkways against vibrations

Bases du calcul des constructions — Aptitude au service des bâtiments et des passerelles sous vibrations

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 10137 was prepared by Technical Committee ISO/TC 98, *Bases for design of structures*, Subcommittee SC 2, *Reliability of structures*.

This second edition cancels and replaces the first edition (ISO 10137:1992) and differs from the previous edition as follows:

— information on relevant International Standards have been updated;

— treatment of vibrations from rock bursts has been added;

— actions due to human activities have been updated (Annex A);

— serviceability criteria for occupants of buildings subjected to wind-induced vibrations have been added (Annex D);

— the bibliography has been revised and updated;

— editorial changes and clarifications of text have been made.

Introduction

Economic use of high-strength and lightweight materials has resulted in a trend towards more dynamically responsive structures. This trend is exacerbated by the emergence of new sources of vibration acting on buildings and walkways, and is compounded by an increasing demand for “vibration free” environments for proper functioning of industrial and laboratory processes and instruments, and for work efficiency and personal comfort. In the past, vibrations in buildings have largely been controlled by specified loads or limitation of static deflections, or they have simply not occurred because of the massive nature of buildings. A number of unsatisfactory vibration levels in buildings have been observed, however, and this seems to indicate that the indirect criteria are no longer adequate. Hence, this International Standard was developed with the objective of presenting the principles for predicting vibrations at the design stage, in addition to assessing the acceptability of vibrations in existing structures.

The recommendations presented here are for serviceability and not for safety. It is, however, possible that some vibrations (usually associated with resonance) can become a safety hazard. Therefore, for severe dynamic loading, a check on the possible occurrence of resonance and associated limit stresses, deflections and fatigue effects shall be carried out. The vibration effects discussed here represent a serviceability limit state in accordance with ISO 2394.

The serviceability limit state for vibrations is described by constraints, generally consisting of vibration values (displacement, velocity or acceleration), usually in combination with frequency or a frequency range and possibly with other parameters. The constraints can also be connected to stress, strain, cracking occurrence and duration. The constraints can be determined statistically, but are generally prescribed in codes deterministically.

The design or evaluation criteria employed for achieving satisfactory vibration behaviour of buildings and walkways in the serviceability limit state should consider, among others, the following aspects:

a) variability of tolerance of human occupants due to cultural, regional or economic factors;

b) sensitivity of building contents to vibrations and changing use and occupancy;

c) emergence of new dynamic loadings which are not explicitly addressed by this International Standard;

d) use of materials whose dynamic characteristics may change with time;

e) impracticality of analysis due to the complexity of the structure or complexity of the loading;

f) social or economic consequences of unsatisfactory performance.

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