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# International Standard



# 2103

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INTERNATIONAL ORGANIZATION FOR STANDARDIZATION • МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ • ORGANISATION INTERNATIONALE DE NORMALISATION

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## Loads due to use and occupancy in residential and public buildings

*Charges dues à l'exploitation dans les bâtiments d'habitation et publics*

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## Foreword

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Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

International Standard ISO 2103 was prepared by Technical Committee ISO/TC 98, *Bases for design of structures*.

Users should note that all International Standards undergo revision from time to time and that any reference made herein to any other International Standard implies its latest edition, unless otherwise stated.

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# Loads due to use and occupancy in residential and public buildings

## 0 Introduction

Characteristic values of loads are defined by ISO 2394 as values that will not be exceeded with a certain probability; evaluation should be based on the available statistical data. For the time being, however, the amount of collected information on loads due to use and occupancy is still insufficient for statistical evaluation.

Since it was considered advisable to publish the values based on these reasons, an attempt has been made to collect the appropriate data on loads due to use and occupancy in residential and public buildings from national codes. It was found that, although some were characteristic, the majority of current imposed values were nominal. A comparison of these values shows that there is general accord between the different national standards and codes in some areas.

Nevertheless, there are inevitable differences for some kinds of loads and, for these reasons, the only acceptable solution seems to be an indication of their lowest values; this has been adopted in this International Standard.

In applying this International Standard to national codes, it is important to recognize that national structural safety is represented by a package comprising action, design rules, safety coefficients, workmanship and national customs, all of which are mutually dependent.

## 1 Scope and field of application

This International Standard indicates the lowest nominal values of loads due to use and occupancy in residential and public buildings.

The term "equipment" covers furniture, bookshelves, pianos, televisions and radios, refrigerators, washing machines, exhibition displays, special technical installations on laboratory floors, scenery in theatres, gymnastic apparatus, etc.

## 2 Reference

ISO 2394, *General principles for verification of structural safety*.

## 3 Load values

**3.1** The lowest nominal values of loads due to use and occupancy are defined as the most unfavourable values for certain (or expected) conditions of normal use of a building.

**3.2** When designing floors for uniformly distributed loads, the lowest characteristic value shall not be prescribed less than the values given in the table.

**3.3** For several floor zones which are used in conditions similar to those in production and storage buildings, loads due to use and occupancy shall be defined according to the rules for those buildings and facilities.

**3.4** Besides uniformly distributed load, floors shall also be designed for a concentrated load applied to the element of the floor to produce the most unfavourable effects.

If detailed data for concentrated loads are not available, the load shall be considered as applied to a square area  $0,1 \text{ m} \times 0,1 \text{ m}$  and its value taken equal to:

- a) floors and staircases: 1,5 kN;
- b) loft space floors, roofs, terraces and balconies: 1,0 kN;
- c) roofs allowing movement of people only by foot-bridges: 0,5 kN.

**3.5** The effect of significant dynamic loads shall be taken into account by dynamic factors or by special dynamic analysis.

**3.6** The table does not contain floor loads due to partitions; these should be considered separately. If it is necessary to take into account the effect of the partitions not planned for in the design (or movable partitions), these can be considered as a uniformly distributed load with a lowest nominal value 0,5 kPa if their weight does not exceed 2,5 kN/m.<sup>1)</sup> In all other cases, the effect of partitions shall be determined as a function of their position, their weight and their jointing to other elements of the building.

1) This applies only to floors where, due to the structural system, the partition loads are sufficiently distributed in a direction transverse to the partition.

Table — Lowest nominal values of uniformly distributed loads

No.	Buildings and premises	Lowest nominal values of loads kPa
1	Residential flats, bedrooms in kindergartens and schools, dwellings, hotel rooms, hospital and sanatorium wards, etc.	1,5
2	Offices for administration, technical and scientific staff, classrooms in schools and colleges, cloak-rooms, shower-baths, lavatories in industrial and public buildings	2,0
3	Studyrooms and laboratories in health, education or scientific establishments, rooms with data processing equipment, kitchens in public buildings, technical floors, basements, etc.	2,0
4	Halls: a) reading-rooms (without bookshelves) b) dining-rooms (in cafés, restaurants, etc.) c) conference-halls, waiting-rooms, theatre and concert halls, gymnasia, ball-rooms, etc. d) department stores e) exhibition halls (in addition to equipment and materials)	2,0 2,0 4,0 4,0 2,5
5	Shelving in libraries, offices with filing storage, stages in theatres, etc.	5,0
6	Stands: a) with fixed seats b) without fixed seats	4,0 5,0
7	Loft space (in addition to the weight of equipment and materials)	0,7
8	Terraces and roofs: a) zones for rest b) zones crowded by people leaving halls, offices, production buildings, etc.	1,5 4,0
9	Balconies and loggias: a) strip uniformly loaded in an area 0,8 m wide along the barrier b) uniformly loaded over the whole balcony area, if its effect is more unfavourable than that in a)	4,0 2,0
10	Lobbies, foyers, corridors, staircases (with adjacent passages), adjoining premises specified in a) No. 1 b) Nos. 2 and 3 c) Nos. 4 and 5 d) No. 6	2,5 3,0 4,0 5,0
11	Platforms of railway and subway stations	4,0
12	Garages and car parks for passenger cars and light vehicles (not for trucks)	2,5

## NOTES

- 1 Loads specified in No. 8 shall be taken instead of snow loads if they give more unfavourable results.
- 2 Loads specified in No. 9 shall be taken into account when analysing the load-bearing elements directly supporting balconies (loggias). When analysing lower wall zones, bases and foundations, the load on balconies and loggias is taken equal to the load due to adjoining main premises of the building and may be reduced in accordance with clause 4.
- 3 Loads specified in the table include some allowance for impact arising from the usual movement of people and furniture.
- 4 If necessary, national standards may apply further subdivision to any floor zone for which a single load value is specified in this table. For example, some areas may be unloaded if this produces a more unfavourable effect.

#### 4 Reduction of uniformly distributed loads

It is recommended that uniformly distributed loads (except the loads due to stationary equipment and stocked materials) are reduced for analysis of:

- a) floor beams— as a function of floor zone dimensions supported by the beams (tributary area),
- b) columns, walls, bases and foundations, as in the previous case or as a function of the number of floors supported above the floor under consideration.

When analysing beams with load tributary area  $A$  (in square metres), the load specified in the table may be reduced:

- a) for premises specified in Nos. 1 and 2 of the table, by multiplying by the factor

$$\alpha_1 = 0,3 + \frac{3}{\sqrt{A}} \text{ (if } A > 18 \text{ m}^2\text{)} \quad \dots (1)$$

- b) for premises specified in No. 4 of the table, by multiplying by the factor

$$\alpha_2 = 0,5 + \frac{3}{\sqrt{A}} \text{ (if } A > 36 \text{ m}^2\text{)} \quad \dots (2)$$

When analysing columns, walls, bases and foundations, the loads given in the table may be reduced:

- a) for premises specified in Nos. 1 and 2 of the table, by multiplying by the factor

$$\eta_1 = 0,3 + \frac{0,6}{\sqrt{n}} \text{ (for } n \geq 2\text{)} \quad \dots (3)$$

- b) for premises specified in No. 4 of the table, by multiplying by the factor

$$\eta_2 = 0,5 + \frac{0,6}{\sqrt{n}} \text{ (for } n \geq 2\text{)} \quad \dots (4)$$

where  $n$  is the number of completely loaded floors considered in the analysis (over the cross-section considered): for  $n = 1$ ,  $\eta_1 = 1$ , and  $\eta_2 = 1$ .

NOTE — National standards may admit other methods of reducing the uniformly distributed loads as functions of area dimensions and number of storeys, provided the resulting load is not smaller than the reduced load derived in accordance with this International Standard.

#### 5 Horizontal loads

Minimal characteristic values of horizontal loads per unit length on the hand-rails and balcony barriers shall be taken as follows:

- a) for residential buildings, kindergartens, hospitals and other health establishments: 0,3 kN/m;
- b) for stands and gymnasias: 1,5 kN/m;
- c) for other buildings and premises: 0,8 kN/m.

For service platforms, foot-bridges, roof barriers visited only by individuals, the minimum characteristic value of horizontal concentrated load on hand-rails and barriers shall be taken equal to 0,3 kN (at any point along the barrier). The same value of horizontal concentrated load should be taken for lightweight partitions.

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