INTERNATIONAL STANDARD

ISO 9836

Third edition
2017-09

Performance standards in building — Definition and calculation of area and space indicators

Normes de performance dans le bâtiment — Définition et calcul des indicateurs de surface et de volume

Reference number
ISO 9836:2017(E)

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Contents

Page

Foreword ... **iv**
Introduction ... **v**
1 Scope ... **1**
2 Normative references ... **1**
3 Terms and definitions ... **1**
4 Units ... **3**
5 Intra-muros calculation methods and list of indicators for geometric performance ... **3**
5.1 Surface areas ... 3
5.1.1 Calculation principles ... 3
5.1.2 Covered area ... 3
5.1.3 Total floor area ... 3
5.1.4 Intra-muros area ... 5
5.1.5 Net floor area ... 5
5.1.6 Area of structural elements ... 6
5.1.7 Usable area ... 6
5.1.8 Services area ... 7
5.1.9 Circulation area ... 8
5.1.10 Building envelope area ... 8
5.1.11 Effective and actual building loss area ... 8
5.2 Volumes ... 15
5.2.1 Calculation principles ... 15
5.2.2 Gross volume of buildings or parts of buildings which are enclosed and covered on all sides ... 17
5.2.3 Gross volume of buildings or parts of buildings which are not enclosed on all sides up to their full height, but which are covered ... 17
5.2.4 Gross volume of buildings or parts of buildings which are enclosed by components, but which are not covered ... 18
5.2.5 Net volume ... 18
5.2.6 Net volume above intra-muros area ... 18
5.2.7 Net volume above usable area ... 18
5.2.8 Net volume above services area ... 19
5.2.9 Net volume above circulation area ... 19
5.3 Examples of indicators ... 19
5.3.1 Surface area indicators ... 19
5.3.2 Space indicators ... 20
5.3.3 Area/volume indicators ... 21
5.4 Commentary ... 21
Annex A (informative) **Examples of using building loss factors for a new construction** ... **22**
Bibliography ... **23**

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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 59, *Buildings and civil engineering works*, Subcommittee SC 15, *Framework for the description of housing performance*.

This third edition cancels and replaces the second edition (ISO 9836:2011), of which it constitutes a minor revision with the following changes plus other minor editorial modifications:

— in Figure 1, the intra-muros area has been changed;

— in 5.1.7.3, ISO 6241:1984, Tables 1 and 2 has been changed to ISO 19208:2016, Table B.1;

— in 5.4, ISO 6241:1984, Table 2 has been changed to ISO 19208:2016;

— in Bibliography, references have been added;

— in 5.1.11 g) and A.2, the decimal point expression has been corrected.

Introduction

The surface area and volume indicators derived from measuring spaces in buildings can be used to compare aspects of value, such as the proportion of space or volume which can be utilized functionally. As approximate values for planning, they can be a basis for further developments.

Reference to surface area and volume indicators when assessing buildings, which either already exist or which are in the planning stage, indirectly indicates certain economic characteristics of the buildings. Thus, the relationship between the area taken up by the building and the usable area indicates whether the building costs and materials have been used to their best advantage.

In the same way, the relationship between the area of the building envelope and the usable area shows the extent to which basic savings have been made on the envelope and the running costs of the heating and air conditioning systems.

As far as the determination of the economic performance of whole buildings is concerned, surface area and volume indicators contain basic data for calculation and comparison of capital costs and for running costs and maintenance. They give a basis for the minimization of running costs by limiting the amount of space and the cost of individual materials. For example, if the area of the external walls is small compared to the usable area, this would indicate not only relatively low energy costs but also relatively low cleaning and maintenance costs for facades.

NOTE Examples of using building loss factors for a new construction are given in Annex A.

Performance standards in building — Definition and calculation of area and space indicators

1 Scope

This document specifies the definition and calculation of surface area and volume indicators.

In defining area measurement, this document uses three measurement concepts:

a) the intra-muros and extra-muros concept used in many parts of the world;

b) the wall centre method of measurement used in many parts of the world;

c) variations on these methods to comply with certain national laws or for particular types of buildings.

The surface area and volume indicators defined in this document are intended for practical use, as a basis for measuring various aspects of the performance of buildings or as a planning aid. In other words, they should enable judgement to be made on functional, technical and economic aspects of buildings.

This document is intended to be used when establishing

— specifications for the geometric performance of a building and its spaces (e.g. in design, purchasing procedures, etc., or in building regulations where appropriate),

— technical documentation relating to the performance of whole buildings prepared by designers, contractors and manufacturers,

— the amount of floor area that will not be effectively available for the placement of an individual's workplace, furniture, equipment, or for circulation, and

— evaluation, comparison or control of the properties of a building which are connected to its geometric performance.

NOTE Although there are a variety of methods of area measurement around the world depending on the country and/or types of buildings, all measuring methods are not necessarily of practical use because of inability to identify real area (e.g. the wall centre method of measurement). Thus, this document specializes in the measurement solely for practical use.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 6707-1, *Building and civil engineering — Vocabulary — Part 1: General terms*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 6707-1 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at http://www.iso.org/obp

3.1
surface area indicator
amount of certain types of area (e.g. usable area) and the relationship between different types of area (e.g. area occupied by structure/usable area)

3.2
volume indicator
amount of certain types of volume (e.g. net volume) and the relationship between different types of volume (e.g. gross volume/net volume)

Note 1 to entry: An example of a relationship indicator of volume is gross volume/net volume.

3.3
mixed surface area and volume indicator
indicator relating a type of volume to a type of area (e.g. gross volume/usable area) and a type of area to a type of volume

Note 1 to entry: Clause 5 gives further definitions of the different surface area and volume indicators, together with the appropriate calculation methods.

Note 2 to entry: An example of a mixed relationship indicator is area of building envelope/net volume.

3.4
building loss feature
feature or element of a building in which a portion of the floor area is not available for an individual's activities, or for furniture, equipment or circulation

Note 1 to entry: Examples of places in which a portion might not be available because of a building loss feature are workplaces, corridors, etc.

Note 2 to entry: A building loss feature may be a physical element such as a column, or the configuration of an element such as the curve of a wall, or the configuration of a fire escape route which is mandated by regulation but not needed for normal circulation.

3.5
effective building loss area
portion of the floor area that is not physically occupied by building material yet is not fully available for an individual's activities, or for furniture, equipment or for circulation, because of a building loss feature

Note 1 to entry: Examples of places in which a portion might not be available because of a building loss feature are workplaces, corridors, etc.

3.6
actual building loss area
portion of the floor area that is not available for an individual's activities, or for furniture, equipment or for circulation, because it is physically occupied by a building loss feature, or is required to be vacant by law or regulation or by a lease

Note 1 to entry: Examples of places in which a portion might not be available because of a building loss feature are workplaces, corridors, etc.

3.7
perimeter encroachment
form of building loss feature which prevents effective use of floor area near a wall or other geometrically regular building form

Note 1 to entry: Examples of a perimeter encroachment include pilaster, convector, baseboard heating unit and radiator.

4 Units

Surface area and volume indicators are obtained by measuring the plan and elevation of the building. Their units of measurement differ according to the type of calculation (m^2: m^3: m^2/m^2: m^3/m^3: m^2/m^3: m^3/m^2).

5 Intra-muros calculation methods and list of indicators for geometric performance

5.1 Surface areas

NOTE See Figure 1.

5.1.1 Calculation principles

5.1.1.1 Surfaces which are horizontal or vertical are measured by their actual dimensions. For calculations of area and space, inclined planes are measured by their vertical projection onto an (imaginary) horizontal plane or vertical plane as appropriate. For calculations of heat gain or loss, the actual exposed surface area shall be used instead of the projected area.

5.1.1.2 The surface areas are expressed in square metres, to two decimal places.

5.1.2 Covered area

5.1.2.1 The covered area is the area of ground covered by buildings in their finished state.

5.1.2.2 The covered area is determined by the vertical projection of the external dimensions of the building onto the ground.

The following are not included in covered area:

— construction or parts of construction not projecting above the surface of the ground;

— secondary components, e.g. external staircases, external ramps, canopies, horizontal sun-shields, roof overhangs, street lighting;

— the areas of outdoor facilities, e.g. greenhouses and outhouses.

5.1.3 Total floor area

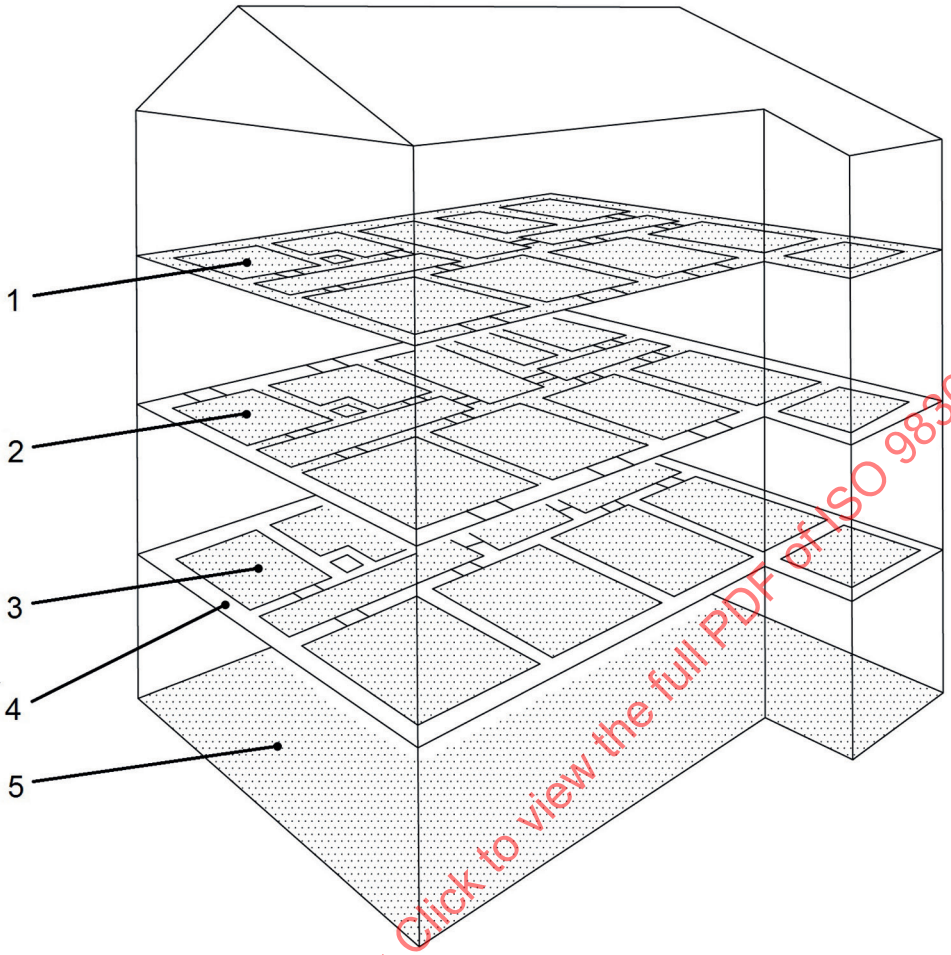
5.1.3.1 The total floor area of a building is the total area of all floor levels. Floor levels may be storeys which are either completely or partially under the ground, storeys above ground, attics, terraces, roof terraces, service floors or storage floors (see Figure 1).

It is necessary to distinguish between

a) floor areas which are enclosed and covered on all sides,

b) floor areas which are not enclosed on all sides up to their full height, but which are covered, such as recessed balconies, and

c) floor areas which are contained within components (e.g. parapets, fascias, handrails), but which are not covered, such as open balconies.



Key

1 total floor area (see 5.1.3)
2 intra-muros area (see 5.1.4)
3 usable area (see 5.1.7)
4 area of structural elements (see 5.1.6)
5 covered area (see 5.1.2)

Figure 1 — Presentation of principal areas

5.1.3.2 The total floor area of each level is obtained from the external dimensions of the enclosing elements, at floor height, above and below ground. These elements include finishes, claddings and parapets.

Recesses and projections for structural or aesthetic purposes and profiling are not included if they do not alter the net floor area (see 5.1.5). Covered floor areas which are not enclosed or are partially enclosed and have no enclosing elements [e.g. areas in accordance with 5.1.3.1 b)] are calculated according to the vertical projection of the outer limit of the covering components.

Net floor area is not determined for the following spaces (see 5.1.5.4):

— voids between the ground and the underside of the building, e.g. crawlways;

— space inside ventilated roofs;

— roofs not subjected to foot traffic other than for maintenance purposes.

5.1.3.3 The total floor area is calculated separately for each floor level. Areas with varying storey height within one floor level (e.g. large halls, auditoria) are also calculated separately.

5.1.3.4 If the floor areas are added together, the proportions of the different areas (according to 5.1.3) shall be distinguishable in order to enable the evaluation, comparison and separate calculation of the volumes.

5.1.3.5 The total floor area is made up of the net floor area (see 5.1.5) and the area taken up by the structure (see 5.1.6). This is diagrammed in Figure 2.

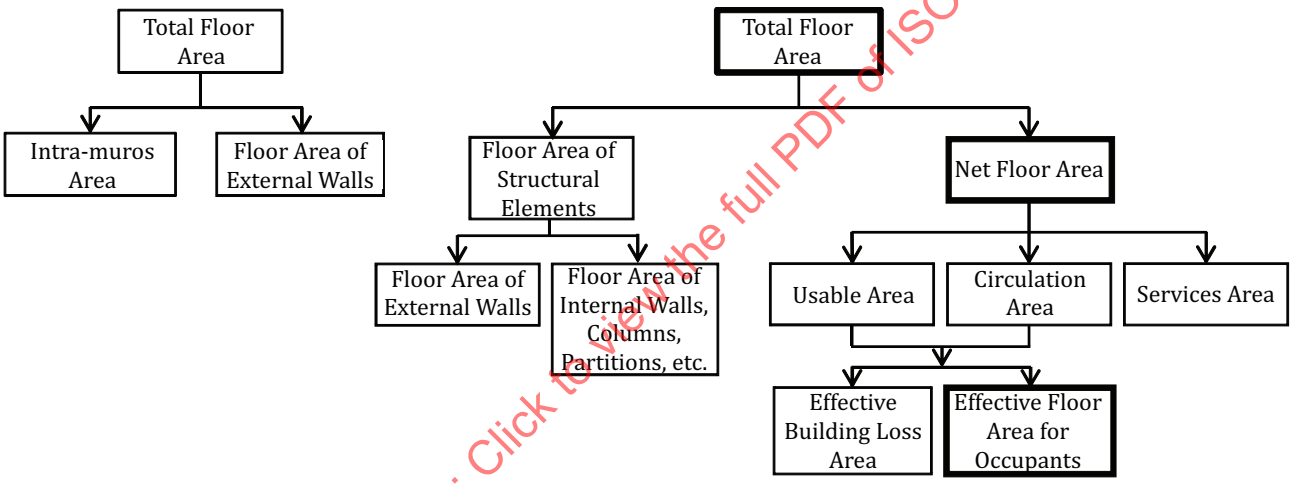


Figure 2 — Components of total floor area

5.1.4 Intra-muros area

5.1.4.1 The intra-muros area is the total floor area (see 5.1.3) less the floor area taken up by the external walls (floor area of the building envelope).

5.1.4.2 The intra-muros area is determined separately for each floor level. The calculation principles established for the total floor area (see 5.1.3) and for the area taken up by the external walls (see 5.1.6) apply equally. The intra-muros area is obtained by subtracting the area taken up by the external walls from the total floor area.

5.1.4.3 The intra-muros area includes the net floor area (see 5.1.5) and the area taken up by the internal walls.

5.1.5 Net floor area

5.1.5.1 The net floor area is the area between (within) the enclosing elements (see also 5.1.3.2).

5.1.5.2 The net floor area is determined separately for each floor level and is subdivided according to 5.1.3.1. It is calculated from the clear dimensions of the finished building at floor height, excluding skirtings, thresholds, etc.

Covered floor areas that are not enclosed or only partially enclosed and have no enclosing elements [areas mentioned in 5.1.3.1 b)] are determined by the vertical projection of the outer limit of the covering components. Areas with varying storey height within one floor level (e.g. large halls and auditoria) are calculated separately.

5.1.5.3 Also included in the net floor area are demountable components such as partitions, pipes and ducts.

5.1.5.4 The floor areas of structural elements, door and window recesses, and niches to recesses in the elements enclosing the area are not included in the net floor area.

5.1.5.5 The net floor area is divided into

— usable area (see 5.1.7),

— services area (see 5.1.8), and

— circulation area (see 5.1.9).

5.1.6 Area of structural elements

5.1.6.1 The area of structural elements is the area within the total floor area (on a horizontal section at floor level) of the enclosing elements (e.g. external and internal load-bearing walls) and the area of columns, pillars, piers, chimneys, partitions, etc., which cannot be entered (see Figure 1).

5.1.6.2 The area of structural elements is determined separately for each floor level and, where necessary, is subdivided according to 5.1.3.1. It is calculated from the dimensions of the finished building at floor height excluding skirtings, thresholds, plinths, etc.

5.1.6.3 Also included in the area of structural elements are the floor areas of door recesses, and recesses and niches in the enclosing elements (see 5.1.5.4). This is in accordance with 5.1.3.2.

5.1.6.4 The area of structural elements may also be calculated as the difference between the total floor area (see 5.1.3) and the net floor area (see 5.1.5).

5.1.7 Usable area

5.1.7.1 The usable area is that part of the net floor which corresponds to the purpose and use of the building (see Figure 1).

5.1.7.2 The usable area is determined separately for floor level and is subdivided according to 5.1.3.1.

5.1.7.3 Usable areas are classified according to the purpose of the building and the use to which they are put; they are usually divided into main usable areas and subsidiary usable areas.

The classification into main usable area and subsidiary usable area is dependent on whether the purpose of the space is an integral component of the primary purpose(s) of the building, or in support of the primary purpose(s) of the building.

Below is a sample list of such purposes. For more detail, see also ISO 19208:2016, Table B.1.

a) Transport (of people, goods, fluids, electricity, etc.).

b) Industry (manual work, production, manufacture, agriculture, experimentation, etc.).

c) Office, commerce (study, writing, drawing, retail or wholesale selling, book-keeping, etc.).

d) Medical care (examination, treatment, operations, etc.).

e) Recreation (gymnastics, swimming, play, dance, etc.).

f) Culture (worship, education, meeting, etc.).

g) Housing (sleeping, dwelling, etc.).

h) Circulation (walkway, corridor, stairway, etc.).

i) Catering (cooking, consumption, etc.).

j) Hygiene (bathing, toilet functions, etc.).

k) Cleaning, maintenance (laundry, janitorial, repair, etc.).

l) Storage (of goods, clothing, foods, etc.).

m) Service (power plant, building operations, guard post, etc.).

n) Other.

5.1.8 Services area

5.1.8.1 The services area is that portion of the net floor area with technical installations which service the building or parts of it, such as:

a) installations and pipes for the disposal of waste water;

b) water supply;

c) heating and hot water systems;

d) gas installations (other than for heating purposes) and installations for liquids;

e) electricity supply generators;

f) ventilation, air-conditioning and cooling systems;

g) telephone switchboard apparatus;

h) lifts, escalators and conveyors (see 5.1.9.3);

i) any other central building service installation.

5.1.8.2 The services area is determined separately for each floor level and, where necessary, is subdivided according to 5.1.3.1.

5.1.8.3 Floor areas of spaces for principal service installations, man-sized supply shafts and ducts, and service floors are also included in the services area.

5.1.8.4 Floor areas of spaces in which technical installations directly support occupant operations, such as a room for computer servers, are part of the usable area and not part of the services area.

5.1.9 Circulation area

5.1.9.1 The circulation area is that portion of the net area used for circulation within the building (e.g. the area of stairwells, corridors, internal ramps, waiting areas, escape balconies, etc.).

5.1.9.2 The circulation area is determined separately for each floor level and is subdivided according to 5.1.3.1. Areas with varying storey height within one floor level are calculated separately.

5.1.9.3 The net floor areas of lift shafts and the floor areas of built-in conveying installations for general circulation, e.g. escalators, on each floor level (see 5.1.8.1) are also included in the category of circulation area.

5.1.10 Building envelope area

5.1.10.1 The building envelope area is obtained from buildings or parts of buildings which are enclosed on all sides and covered, including those parts of the structure which are above the top level of the ground and those below it.

Distinction is to be made between the following, in the order shown:

a) area of the foundations;

b) external wall area below ground level;

c) external wall area above ground level;

d) roof area.

Glazed areas are specified separately as parts of external wall or roof surfaces.

The following are not included in the area considered:

— components of the building which are below the lowest floor level (e.g. parts of the foundation);

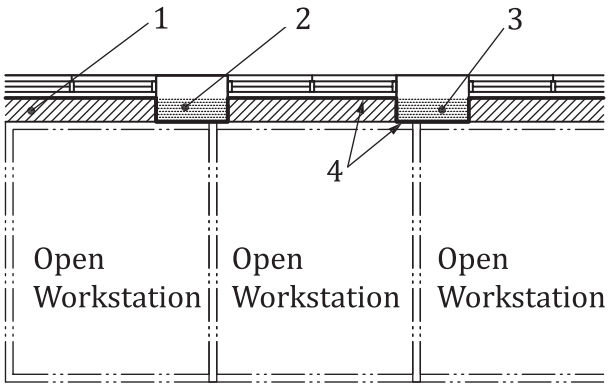
— recesses and projections for aesthetic purposes, pavement lights, external staircases, external ramps, canopies, horizontal sun-shields, roof overhangs, skylights, chimney stacks, etc.

5.1.10.2 The foundation area of a building is obtained from buildings or parts of buildings which are enclosed on all sides and covered, including only those parts of the structure which are below the top level of the ground in each part of the lowest floor level.

5.1.11 Effective and actual building loss area

The effective building loss area is the total of those portions of usable area and circulation area which are not continuously or fully available for an individual's activities (e.g. workplaces, resting areas, etc.), or for furniture, equipment or for circulation, as would be appropriate at that location, in a way as identified below.

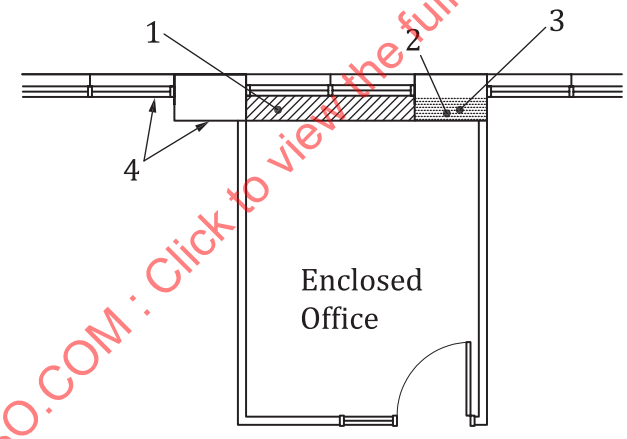
a) When columns, pilasters or other elements of a building encroach into usable area and the floor area between such encroachments or between such encroachments and a wall, is of size or configuration such that it cannot be used effectively to place furniture or carry out user functions, such in-between floor area is effective building loss area (see Figures 3, 4, 5 and 6).



Key

1 effective loss
2 perimeter encroachment
3 actual loss
4 dominant portion

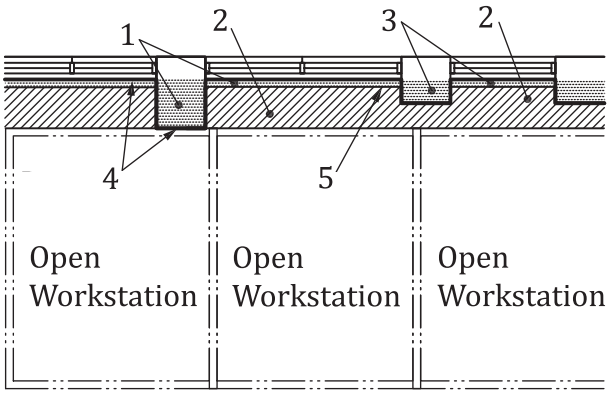
Figure 3 — Encroachments of pilasters force workstations to be placed away from the wall



Key

1 effective loss
2 perimeter encroachment
3 actual loss
4 dominant portion

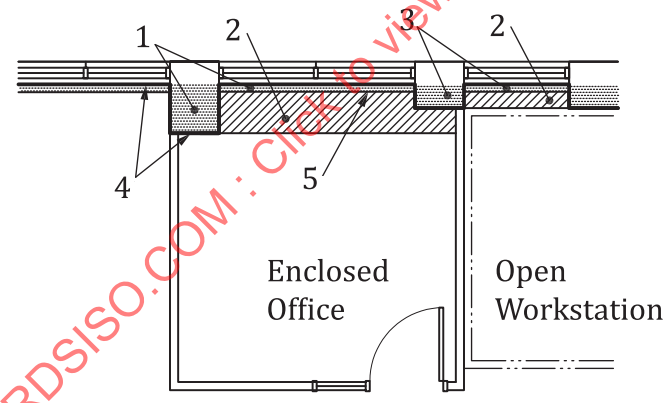
Figure 4 — Encroachments of pilasters force reduced usability of a portion of enclosed office



Key

1 perimeter encroachment/actual loss
2 effective loss
3 actual loss
4 dominant portion
5 convector

Figure 5 — Uneven encroachments force workstations to be placed further from wall



Key

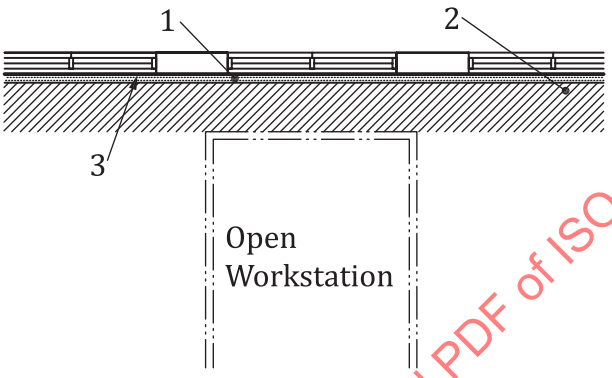
1 perimeter encroachment/actual loss
2 effective loss
3 actual loss
4 dominant portion
5 convector

Figure 6 — Uneven encroachments within an enclosed office

b) When a portion of floor area must be kept clear to access or service columns, pilasters or other encroachments into usable area, or a thermostat or other device affixed on the surface or wall, or the technology inside, or to access a service panel in a wall, or to open or service a window, then the floor area which must be kept clear is effective building loss area (see Figures 7, 8 and 9).

c) When a portion of floor area greater than 30 cm^2 in usable area must be kept clear for an air duct or to access or service technology under raised access floor then the floor area which must be kept clear is effective building loss area (see Figures 8 and 10).

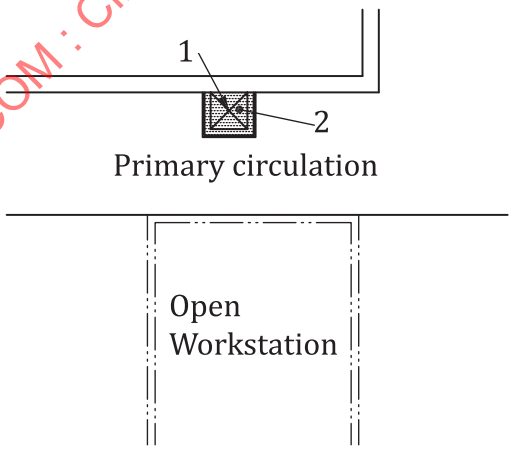
d) When a portion of floor area greater than 30 cm^2 in circulation area must be kept clear for an air duct, to access or service technology under raised access floor then the floor area which must be used to avoid the duct or other opening (for instance, by diverting the path of circulation) is effective building loss area (see Figure 8).



Key

1 perimeter encroachment (ex. convector) actual loss
2 effective loss to service perimeter encroachment
3 dominant portion

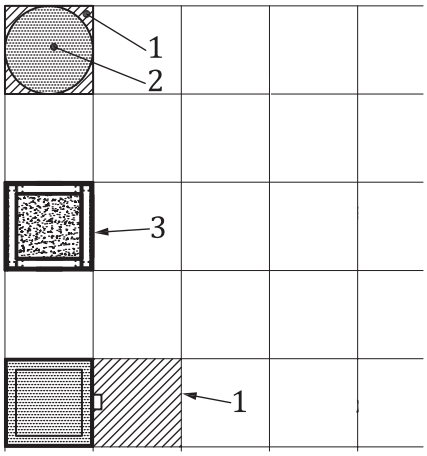
Figure 7 — Encroachment due to need to keep clear a defined zone to service or wash windows



Key

1 duct or opening
2 actual loss

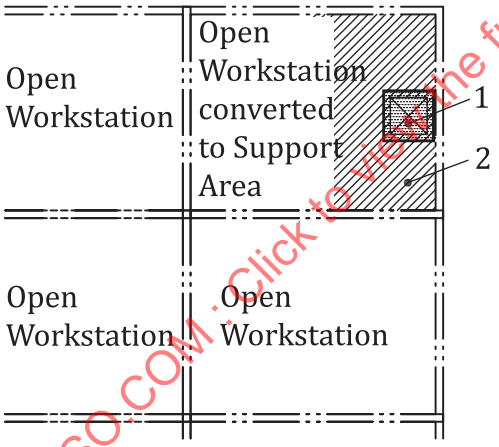
Figure 8 — Encroachment by a required accessible duct or panel opening in floor surface, as in 5.1.11 b), c) and d)



Key

1 effective loss
2 actual loss
3 actual loss including finishes

Figure 9 — Encroachments due to columns, their shape or attachments



Key

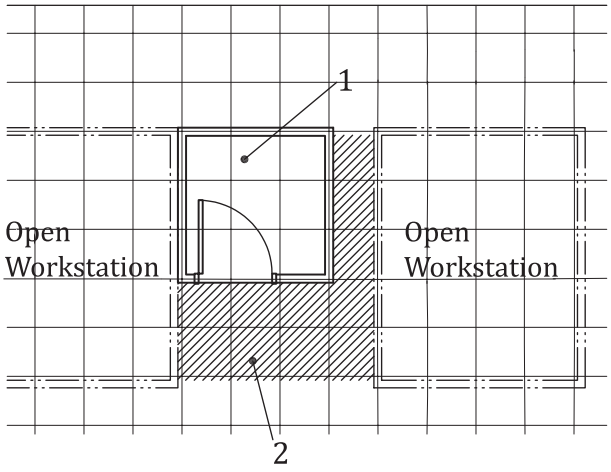
1 actual loss
2 effective loss

Figure 10 — Effective loss because of required access to a floor opening

e) When a portion of floor area must be kept clear for access to a service room, a utility, a room for mechanical or electrical or telecommunications or electronic equipment, or for access to a roof or a penthouse or a ceiling void and such portion of floor area is not circulation area, then such portion of floor area is effective building loss area (see Figures 11, 12, and 13).

f) When a portion of the usable or circulation floor area is restricted from use by building occupants or is not available because of regulation, building code, or terms of contract or lease, then such portion of floor area is effective building loss area.

g) When a portion of the usable or circulation floor area is restricted from use or unavailable up to a height of 2,4 m because of an interior encroachment such as exposed elements of earthquake bracing or a sloping wall, then that portion is effective building loss area (see Figure 14).

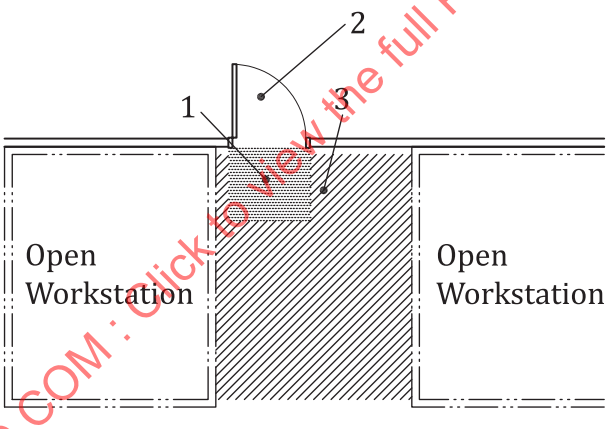


Key

1 telecommunications room

2 effective loss

Figure 11 — Service room set back from circulation or grid line



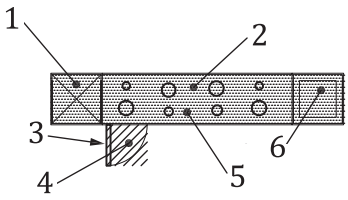
Key

1 actual loss

2 door provides roof access

3 effective loss

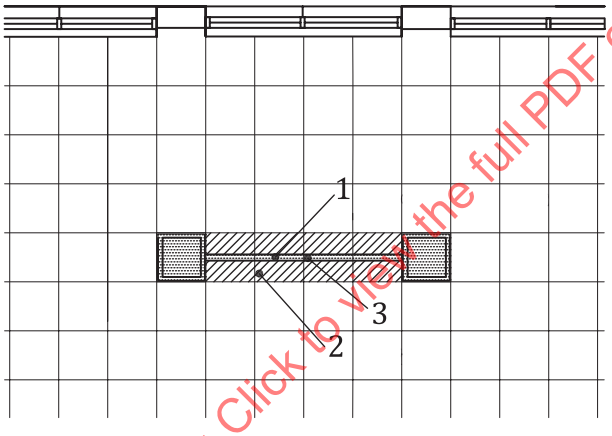
Figure 12 — Effective loss due to access to opening to roof



Key

1 duct
2 pipes or conduit
3 access door
4 effective loss
5 actual loss
6 column

Figure 13 — Effective loss because of access to utilities

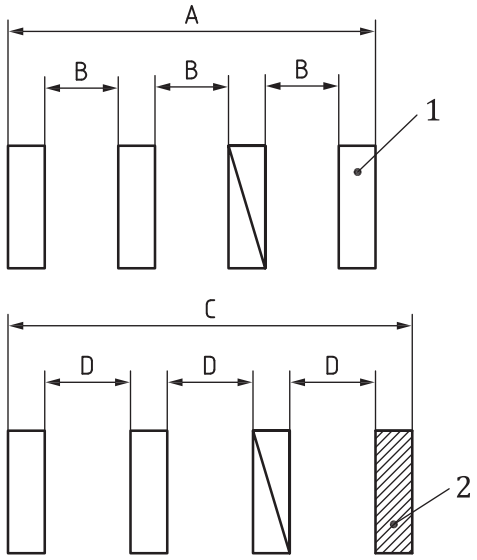


Key

1 earthquake bracing
2 effective loss
3 actual loss

Figure 14 — Loss due to earthquake bracing between columns

h) When a portion of the usable floor area is partially restricted from use because its floor load capacity is less than required for safety by applicable regulations or building codes, causing furnishings or supplies to be spread out over a larger area than would normally be needed, then the required additional floor area is effective building loss area (see Figure 15).



Key

1 shelving bay

2 effective loss

Figure 15 — Effective loss due to inadequate floor loading capacity

i) When a portion of the usable or circulation floor area is occupied by a projecting window sill, or a radiator, convector, piping or other fixed part of the building, and therefore cannot be used effectively to place furniture or carry out user functions, then that portion is effective building loss area (see Figures 5, 6 and 7).

j) When a portion of the usable or circulation floor area is occupied by a demountable component such as a partition, pipe or duct which is required for the normal functionality of the facility, then that portion is effective building loss area.

5.2 Volumes

NOTE See Figure 16.

5.2.1 Calculation principles

5.2.1.1 The gross volume of a building is obtained from the outer limiting faces. Distinction is to be made between the following, in the order shown:

a) gross volume of buildings or parts of buildings which are enclosed and covered on all sides in accordance with 5.1.3.1 a) (see 5.2.2);

b) gross volume of parts of buildings which are not enclosed up to their full height on all sides, but which are covered in accordance with 5.1.3.1 b) (see 5.2.3);

c) gross volume of buildings and parts of buildings which are enclosed by components (e.g. parapets, fascias, hand-rails), but which are not covered in accordance with 5.1.3.1 c) (see 5.2.4).

5.2.1.2 The net volume of a building is obtained from the inner limiting faces. Distinction is to be made between the following, in the order shown:

a) net volume above the net floor area (see 5.1.5):

   1) net volume of full storeys;

2) net volume of storeys below ground level;

3) net volume of other incomplete storeys.

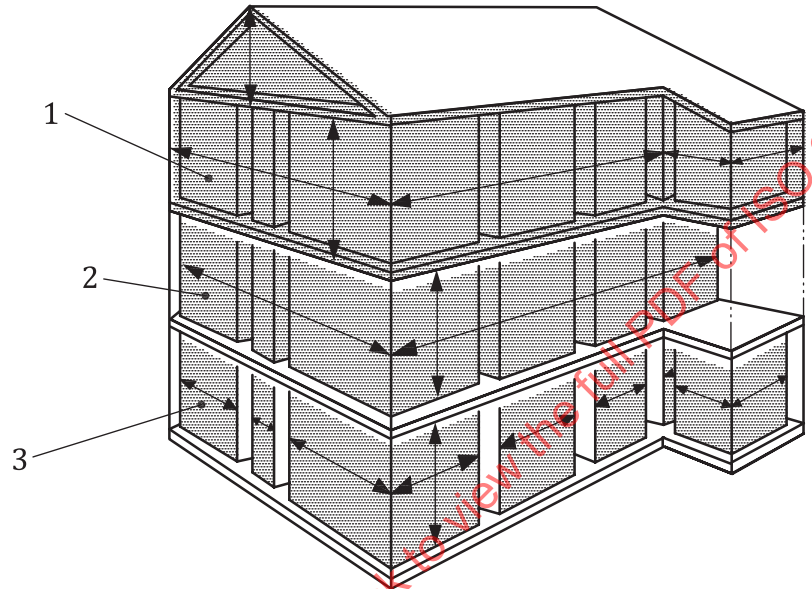
b) net volume above the intra-muros area (see 5.1.4);

c) net volume above the usable area (see 5.1.7);

d) net volume above the services area (see 5.1.8);

e) net volume above the circulation area (see 5.1.9).

These types of net volume may be further subdivided by analogy with 5.2.1.1 a), b) and c).



Key

1 gross volume (see 5.2.2)

2 net volume above intra-muros area (see 5.2.6)

3 net volume (see 5.2.5)

Figure 16 — Presentation of principal volumes

5.2.1.3 Volumes are expressed in cubic metres, to two decimal places.

5.2.1.4 The bases for calculation of volumes are the surface areas determined in accordance with 5.1 and the heights above the surface areas (i.e. height of building, storey height, room height, height of enclosing elements).

Where the buildings or parts of buildings are limited by faces which are neither horizontal nor vertical, the volumes are calculated according to appropriate formulae.

5.2.1.5 Recesses and projections for structural and aesthetic purposes, profiling and other secondary components (e.g. external staircases, external ramps, canopies, horizontal sun-shields, roof overhangs, chimney stacks, street furniture, etc.) are not included.

5.2.2 Gross volume of buildings or parts of buildings which are enclosed and covered on all sides

5.2.2.1 The gross volume of buildings or parts of buildings which are enclosed and covered on all sides is the product of the total floor area in accordance with 5.1.3.1 a) and the appropriate height if it is not calculated in accordance with 5.2.1.4.

5.2.2.2 The height applied is as follows.

a) For areas below ground level:

the distance between the underneath of the construction bearing the floor and the surface of the floor of the above storey.

NOTE Foundations, layers of hardcore, etc. are not included.

b) For areas in normal storeys above ground:

the distance between the surface of the floor and the ceiling (surface of the floor of the storey above).

c) For areas in storeys where the ceiling is also the exterior face or roof plane (e.g. storey below a cavity floor, attic):

the distance between the surface of the floor and the surface of the roof or the terrace.

d) For areas in storeys where the underside is also the outer face (e.g. storey above a cavity storey):

the distance between this underside and the surface of the floor of the storey above.

5.2.3 Gross volume of buildings or parts of buildings which are not enclosed on all sides up to their full height, but which are covered

5.2.3.1 The gross volume of buildings or parts of buildings which are not enclosed on all sides up to their full height, but which are covered, is the product of the total floor area in accordance with 5.1.3.1 b) and the appropriate height.

5.2.3.2 The height is applied as follows.

a) For areas below ground level which are covered by a storey which is enclosed on all sides (e.g. open entrance hall of a building without a basement):

the distance between the underside of the construction bearing the floor and the underside of the storey above.

NOTE 1 Foundations, layers of hardcore, etc. are not included.

b) For areas between storeys enclosed and covered on all sides (e.g. open entrance hall of a building having a basement cavity storey):

the clear distance between the surface of the floor and the underside of the storey above.

c) For areas under a storey which is also not enclosed on all sides or for areas of storeys whose ceiling is also the external surface area or roof surface area (e.g. loggia, outside corridor, open storey in a multi-storey car park, covered roof terrace):

the distance between the surface of the floor and the surface of the roof or the ceiling.

d) For areas under a storey which is not enclosed on all sides and whose underside is also the external surface (e.g. lowest outside corridor):

the distance between the above-mentioned underside and the surface of the covering component.

e) For single-storey buildings or parts of buildings (e.g. petrol stations, covered connecting corridors, open recreation halls):

the distance between the underside of the construction bearing the floor and the surface of the roof.

NOTE 2 Foundations, layers of hardcore, etc. are not included.

5.2.4 Gross volume of buildings or parts of buildings which are enclosed by components, but which are not covered

5.2.4.1 The gross volume of buildings or parts of buildings which are enclosed by components (e.g. parapets, fascias, handrails), but which are not covered, is the product of the total floor area according to 5.1.3.1 c) and the appropriate height.

5.2.4.2 The height is applied as follows.

a) For areas above a storey (e.g. roof terrace):

the distance between the surface of this storey and the upper edge of enclosing components.

b) For areas of projecting components:

the distance between the underside of this component and the upper edge of the enclosing components.

5.2.5 Net volume

NOTE See Figure 2.

5.2.5.1 The net volume is the product of the net floor area (see 5.1.5) and the height between the surface of the floor and the underside of the ceiling.

5.2.5.2 Distinction is to be made between the following, in the order shown:

a) net volume of full storeys above ground level;

b) net volume of storeys below ground level;

c) net volume of incomplete storeys.

5.2.5.3 The net volume may be further subdivided by analogy with 5.2.1.1 a), b) and c).

5.2.6 Net volume above intra-muros area

5.2.6.1 The net volume above the intra-muros area is the product of the intra-muros area (see 5.1.4) and the height between the surface of the floor and the underside of the ceiling.

5.2.6.2 The net volume above the intra-muros area is determined separately for each floor level.

5.2.7 Net volume above usable area

5.2.7.1 The net volume above the usable area is the product of the usable area (see 5.1.7) and the height between the surface of the floor and the underside of the ceiling.

5.2.7.2 The net volume above the usable area is determined separately for each floor level.

