TCVN

VIETNAM NATIONAL STANDARD

# TCVN 9255: 2012
# ISO 9836: 2011

**First edition**

# PERFORMANCE STANDARDS IN BUILDING- DEFINITION AND CALCULATION OF AREA AND SPACE INDICATORS

(This English version is for reference only)

**HA NOI - 2012**

Contents

## Foreword

TCVN 9385:2012 was identical to ISO 9836:2011.

TCVN 9385:2012 was converted from TCXDVN 339:2005 (ISO 9836:1992) into Vietnam National Standard under the regulation specified in Clause 1, Article 69 of the Law on Standards and Technical Regulations and Clause 1, Article 6 of Decree No. 127/2007/ND-CP dated 1/8/2007 of the Government detailing the implementation of a number of articles of the Law on Standards and Technical Regulations.

TCVN 9385:2012 was prepared by Vietnam Institute of Architecture, Urban and Rural Planning-Ministry of Construction, proposed by Ministry of Construction, appraised by Directorate for Standards, Metrology and Quality and announced by Ministry of Science and Technology.

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

## 1 Scope

This standard deals with the definition and calculation of surface area and volume indicators. In defining area measurement, this standard 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 Standard 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 standard 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;

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

Although, as stated above, 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 standard specializes in the measurement solely for practical use.

## 2 Normative references

The following referenced documents are indispensable for the application 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.

TCVN 9254-1:2012 (ISO 6707-1:2004), *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 TCVN 9254-1:2012 and the following apply.

**3.1**

**surface area indicators**

amounts 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 indicators**

amounts of certain types of volume (e.g. net volume) and the relationship between different types of volume (e.g. 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) Clause 5 gives further definitions of the different surface area and volume indicators, together with the appropriate calculation methods.

2) 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) Examples of places in which a portion might not be available because of a building loss feature are workplaces, corridors, etc.

2) 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.

NOTE 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 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 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

#### 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.

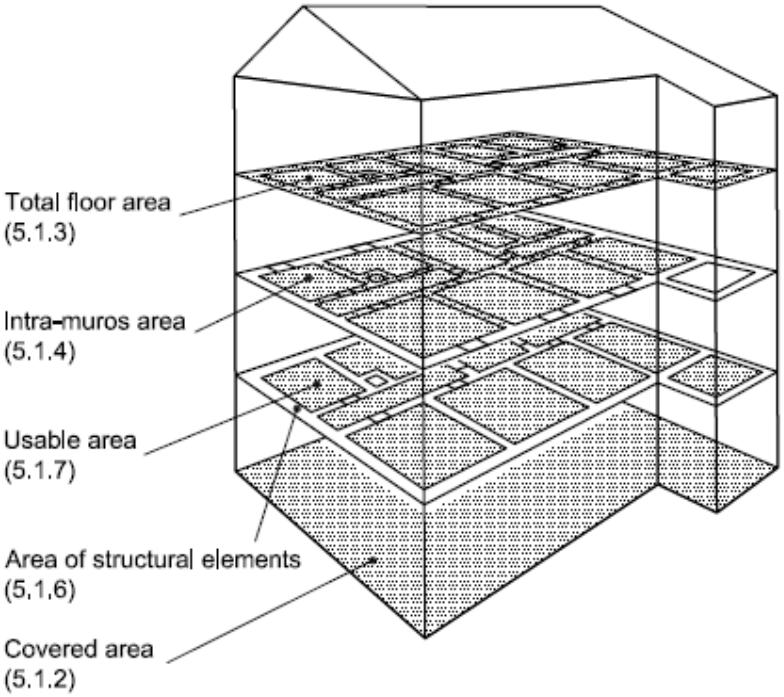


Figure 1 — Presentation of principal areas

#### 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;

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

**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 (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 (5.1.5) and the area taken up by the structure

(see 5.1.6).

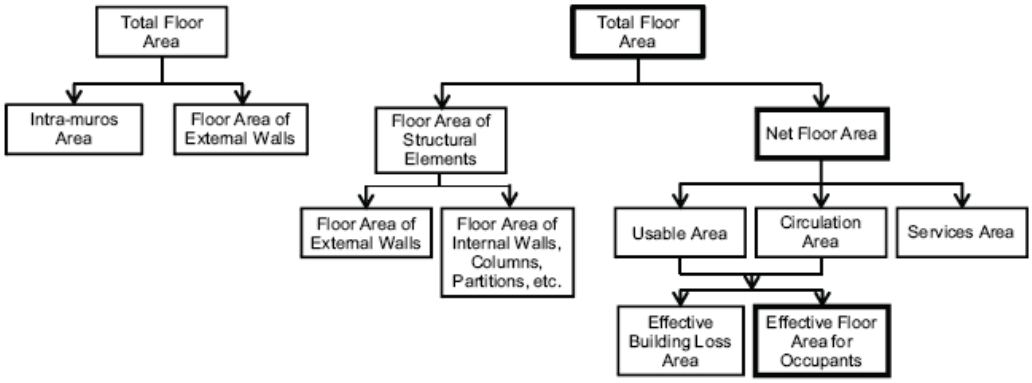


**Figure 2 — Components of total floor area**

### 5.1.4 Intra-muros area

**5.1.4.1** The intra-muros area is the total floor area (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 (5.1.3) and for the area taken up by the external walls (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 (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 sub-divided 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 (5.1.7);
- services area (5.1.8); and
- circulation area (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 sub-divided 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 5.1.3) and the net floor area (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 sub-divided 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 Tables 1 and 2 of ISO 6241:1984.

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.

**5.1.9 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 sub-divided 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**

**5.1.11.1** 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, 6).

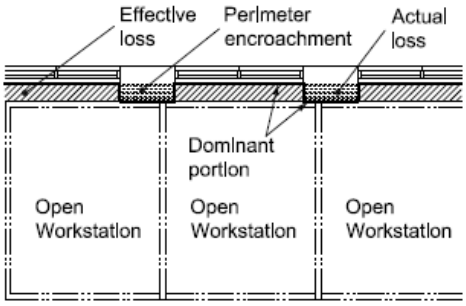


Figure 3 — Encroachments of pilasters force workstations to be placed away from the wall

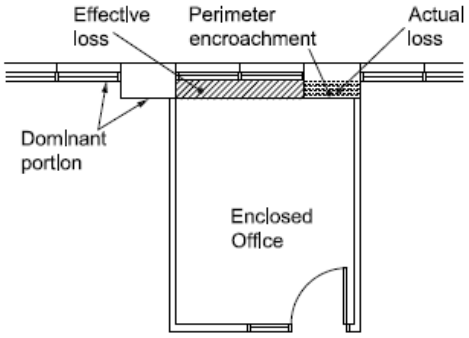


Figure 4 — Encroachments of pilasters force reduced usability of a portion of enclosed office

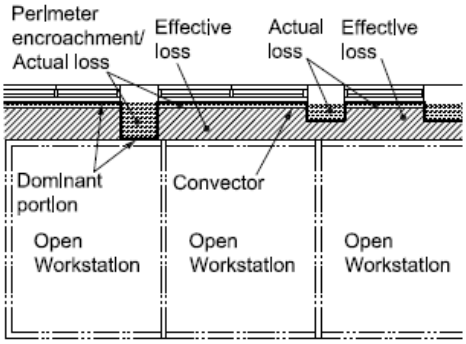


Figure 5 — Uneven encroachments force workstations to be placed further from wall

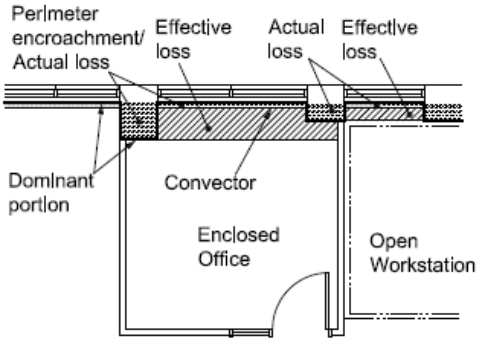


Figure 6 — Uneven encroachments within an enclosed office

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, 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, 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).

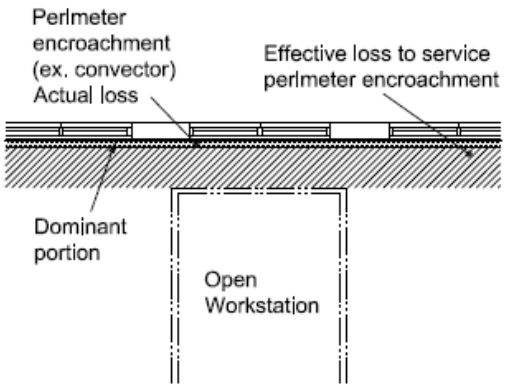


Figure 7 — Encroachment due to need to keep clear a defined zone to service or wash windows

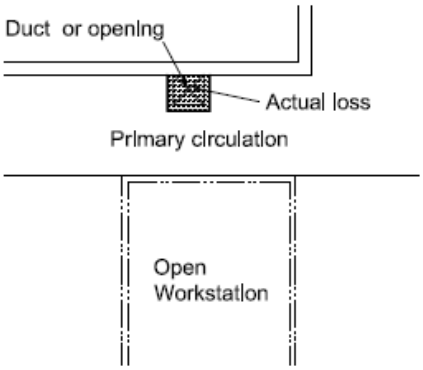


Figure 8 — Encroachment by a required accessible duct or panel opening in floor surface, as in 5.1.11.1 b), c) and d)

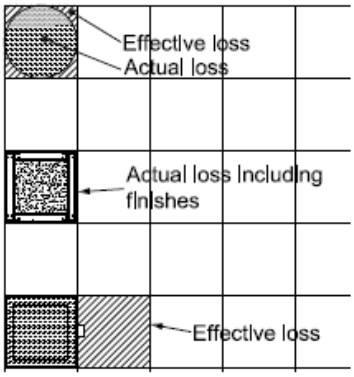


Figure 9 — Encroachments due to columns, their shape or attachments

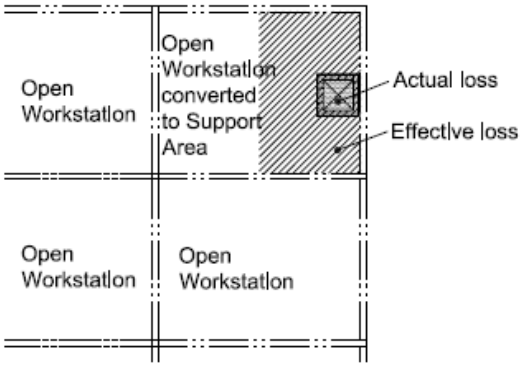


Figure 10 — Effective loss because of required access to a floor opening

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, 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).

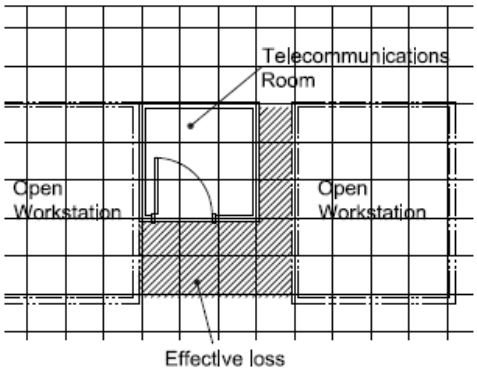


Figure 11 — Service room set back from circulation or grid line

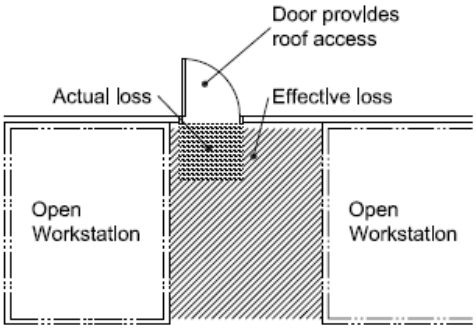


Figure 12 — Effective loss due to access to opening to roof

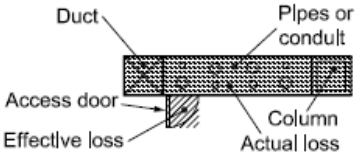


Figure 13 — Effective loss because of access to utilities

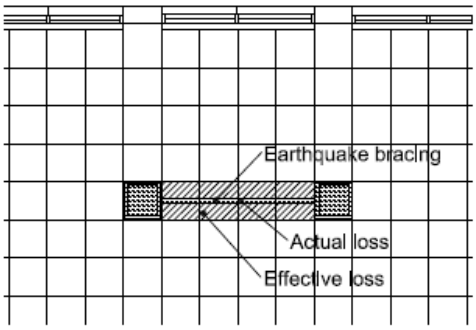


Figure 14 — Loss due to earthquake bracing between columns

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).

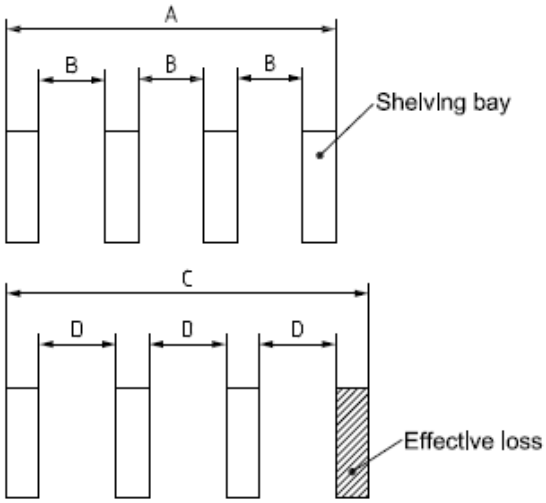


Figure 15 — Effective loss due to inadequate floor loading capacity

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, 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.

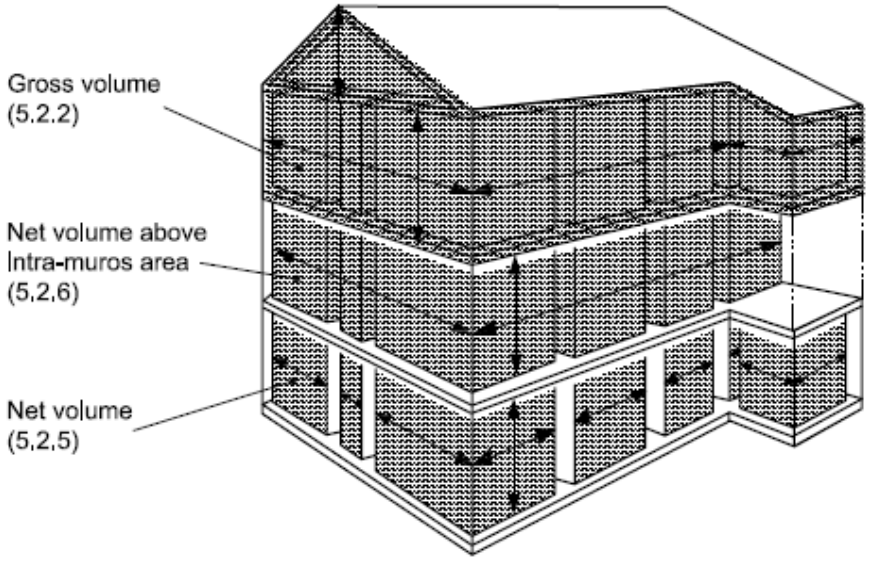


Figure 16 — Presentation of principal volumes

### 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).