INTERNATIONAL STANDARD

ISO 11863

First edition
2011-07-01

Buildings and building-related facilities — Functional and user requirements and performance — Tools for assessment and comparison

Bâtiments et biens immobiliers associés — Exigences fonctionnelles, exigences de l'utilisateur et performances — Outils pour l'évaluation et la comparaison

Reference number
ISO 11863:2011(E)

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Published in Switzerland

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Foreword

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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 11863 was prepared by Technical Committee ISO/TC 59, *Buildings and civil engineering works*, Subcommittee SC 3, *Functional/user requirements and performance in building construction*.

Buildings and building-related facilities — Functional and user requirements and performance — Tools for assessment and comparison

1 Scope

This International Standard specifies how to determine functional performance requirements (demand) for buildings and building-related facilities, and how to check the capability of buildings and facilities to meet identified requirements (supply). It specifies how to determine the relative importance of each requirement, establish thresholds for capability, and evaluate the significance of differences between what is required and actual capabilities.

This International Standard is applicable to any size or scope of assets of buildings and building-related facilities, e.g. to a portfolio of assets at a single site or multiple sites, to assets of a single small building, and to any constituent system, sub-system, component or element thereof. It is applicable to a range of roles, from owners and managers to occupants, tenants, or other users or stakeholders. It is applicable to any asset type within the field of buildings and civil engineering works, including certain public works, equipment and materiel. It is particularly useful for entities having control or occupancy of a portfolio of such assets.

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.

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

ISO 15686-10, *Buildings and constructed assets — Service life planning — Part 10: When to assess functional performance*

3 Terms and definitions

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

3.1
aspect
⟨functionality or serviceability⟩ part or set of parts of the **functionality** (3.15) or **serviceability** (3.28) of an **asset** (3.2), building or building-related **facility** (3.10)

NOTE An aspect usually encompasses multiple **topics** (3.33) of functionality or serviceability.

3.2
asset
⟨building or building-related facility⟩ whole building or structure or unit of construction works, or a system or component or part thereof

3.3
behaviour in service
manner in which an **asset** (building or building related facility) (3.2) actually functions in its intended place and use

3.4
calibrate
set the proper intervals between marks or **levels** (3.17) (3.18) (3.19) of a **scale** (3.26) (as a measuring instrument)

3.5
calibration
act of marking the **scale** (3.26) of a measuring instrument used to determine the proper separation between marks or **levels** (3.17) (3.18) (3.19)

3.6
capability
measure of ability to perform and support a **function** (3.12)

3.7
critical level
⟨of functionality⟩ **level** (3.17) (3.18) (3.19) at which resources necessary for work or other **functions** (3.12) are essential or critical

3.8
demand
⟨of a facility⟩ requirement for **functionality** (3.15)

3.9
demand scale
scale (3.26) for use in determining the **level of functionality** (3.17) of a **facility** (3.10) on one **topic** (3.33) of **functional performance** (3.13)

3.10
facility
physical setting used to serve a specific purpose

NOTE 1 A facility can be part of a building, or a whole building, or more than one building, and can include related constructions (such as roads and walkways), which, taken as a whole, serve a specific function.

NOTE 2 The term encompasses both the physical object(s) and its (their) use.

3.11
feature
element or attribute of a **facility** (3.10) which indicates an aspect of its **serviceability** (3.28)

3.12
function
purpose or activity of **users** (3.34) and other **stakeholders** (3.29) for which an **asset** (3.2) or a **facility** (3.10) is designed, used, or required to be used

3.13
functional performance
⟨of a facility⟩ **performance** (3.20) of a **facility** (3.10) to support required **function**(s) (3.12) under specified use conditions

NOTE See also **performance** ⟨of a facility⟩ (3.20).

3.14
functional performance requirement
type and level of **functional performance** (3.13) which is required by stakeholders of a **facility** (3.10), building or other constructed **asset** (3.2), or of an assembly, component or product thereof, or of a movable asset, for a specific activity or **function** (3.12)

3.15
functionality
suitability or usefulness for a specific purpose or activity

3.16
gap
difference between the **level of functionality** (3.17) (or other attribute) which is required and the **level of serviceability** (3.19) (capability) which is or will be provided

3.17
level of functionality
number indicating the relative **functionality** (3.15) for a group of **users** (3.34) or other **stakeholders** (3.29) for one **topic** (3.33) on a predetermined **demand scale** (3.9) from the level of the least **functionality** (3.15) to the level of the most **functionality** (3.15)

NOTE Level of functionality can be the consequence of several distinct **functions** (3.12) required to act in combination.

EXAMPLE Scale of integers from 0 to 9.

3.18
level of performance
number indicating the relative **performance** (3.20) required or provided for one topic on a predetermined scale (3.26) ranging from the level of the least **performance** (3.20) to the level of the most **performance** (3.20)

NOTE **Level of performance** can be the consequence of several distinct **performances** [**behaviours in service** (3.3)], of which one can be **functional performance** (3.13), which act in combination.

EXAMPLE Scale of integers from 0 to 9.

3.19
level of serviceability
number indicating the relative capability of a **facility** (3.10) for a group of **users** (3.34) or other **stakeholders** (3.29) for one **topic** (3.33) on a predetermined **supply scale** (3.31) from the level of the least **serviceability** (3.28) to the most **serviceability** (3.28)

NOTE Level of serviceability can be the consequence of several physical **features** (3.11) acting in combination.

EXAMPLE Scale of integers from 0 to 9.

3.20
performance
⟨of a facility⟩ **behaviour in service** (3.3) of a **facility** (3.10) for a specified use

NOTE The scope of this **performance** is of the **facility** (3.10) as a system, including its subsystems, components and materials, and their interactions, such as those of an acoustical, hydro-thermal, or economic nature, and the **relative importance** (3.25) of each **performance requirement** (3.21).

3.21
performance requirement
⟨of a facility⟩ **performance** (3.20) demanded or expected of a **facility** (3.10) for a specified use

NOTE Adapted from ISO 6707-1:2004, definition 9.1.16.

3.22
profile
⟨of a facility⟩ list of the **levels of functionality** (3.17) required by **stakeholders** (3.29) for a **facility** (3.10), or of the **levels of serviceability** (3.19) provided by a facility, with respect to various **topics** (3.33)

3.23
rater
individual who conducts the **rating** (3.24) of a **facility** (3.10), or of the design of a **facility**, to determine its **profile** (3.22) of **serviceability** (3.28)

3.24
rating
process of determining the **serviceability** (3.28) of a constructed **asset** (3.2), or of an **asset** which has been designed but not yet built

3.25
relative importance
importance of any one **topic** (3.33) of **functionality** (3.15) for the operations or mission of the **users** (3.34)

3.26
scale
single set of statements, in which intervals between statements, from the most to the least, are calibrated according to scalar rules

NOTE When people are asked to select one of the statements in a scale as most closely describing the **level of functionality** (3.17) required, or as best describing the physical features present in a facility, the scale in effect functions as a multiple choice questionnaire.

3.27
service life
period of time after installation during which a **facility** (3.10) or its component parts meet(s) or exceed(s) the **performance requirements** (3.21)

NOTE Adapted from ISO 6707-1:2004, definition 9.3.84.

3.28
serviceability
capability (3.6) of a **facility** (3.10), building or other constructed **asset** (3.2), or of an assembly, component or product thereof, or of a movable asset, to support the **function**(s) (3.12) for which it is designed, used, or required to be used

NOTE Adapted from ISO 6707-1:2004, definitions 9.1.11 (capability) and 9.3.05 (serviceability).

3.29
stakeholder
person or entity with an interest in, or concern about, a **facility** (3.10)

NOTE The interest can include a financial interest, and can be continuing or temporary, as of a visitor.

3.30
suitability
⟨of a facility⟩ appropriateness for supporting the **functions** (3.12) or activities of **users** (3.34) or **stakeholders** (3.29)

3.31
supply scale
scale (3.26) for use in determining the **level of serviceability** (3.19) of a facility on one **topic** (3.33) of **capability** (3.6)

3.32
threshold level
number indicating the **level of functionality** (3.17) which, if not provided, would significantly or completely impair the ability of **users** (3.34) to carry out their intended activities or operations

3.33
topic
single attribute of a **facility** (3.10) for which **level of functionality** (3.17), **level of serviceability** (3.19), **threshold level** (3.32) and **relative importance** (3.25) can be determined

3.34
user
organization, person, animal or object which uses, or is intended to use, a building or other construction works

NOTE 1 Includes any person or entity who uses a **facility** (3.10), whether as occupant, visitor, member of the public, or other **stakeholder** (3.29).

NOTE 2 Adapted from ISO 6707-1 2004, definition 8.1.

3.35
whole life
period of time commencing with the process of definition of need, before a project is explicitly launched, continuing through the process of acquisition and including the end of life period, decommissioning, deconstruction or disposal

NOTE 1 Whole life cycle includes all factors considered in whole life costing.

NOTE 2 Life cycle is less inclusive. It is the period of time from completion of construction or from a selected date to the end of life of the **asset** (3.2), including the end of life period, decommissioning, deconstruction or disposal, or to termination of a period of analysis.

4 How to determine levels of functional performance requirements and levels of serviceability

4.1 Requirements for functional performance

The requirement for each topic (or aspect) of functionality of an asset building or building-related facility shall incorporate either one specific function or several specific functions which act in combination for that topic. Each such requirement shall be expressed as a level of demand. The level of demand for each function shall be identified using a demand scale.

Typically, the level of demand is a minimum level. If the level of demand is a maximum value, that shall be so indicated, as an exception.

Each demand scale shall contain a set of statements of functional performance requirements, one statement for each level from the lowest requirement to the highest requirement and one statement for “no requirement” or “shall not have” (which shall be level 0).

Demand scales for any functional type (category) of building or building-related facility shall be written in language (terms and concepts) which are familiar to the users of that functional type. The scales shall enable any occupant, owner, manager, user, visitor or other stakeholder — without guidance or technical assistance — to select a block of text from a demand scale that best describes what they need to be able to do, see, feel, hear or experience while in or near a facility.

Demand scales shall use statements of requirements for functionality that will apply to many users of a functional category of facilities. A demand scale shall not be used to comply with this International Standard if a requirement in it is unique to a single stakeholder. This is because comparing requirement levels of different

stakeholders is only possible when each set of levels of demand is determined using the same scales, which are suitable for the same functional category.

If a suitable set of demand scales is not available, it shall be created.

Examples of the format for such scales are included in Annex B, and in References [1], [2], [3], [13], and [14] in the Bibliography.

4.2 Serviceability

The serviceability for each topic of functionality shall be indicated by one feature or by a combination of features which act in combination for that topic. The level of supply for each feature shall be indicated using one supply scale. The level of supply for a topic shall be indicated by the level of supply for the feature or combination of features

Each supply scale shall contain a set of statements of serviceability, one statement for each level from the lowest serviceability to the highest serviceability and one statement for “not present” (which shall be level 0).

Supply scales shall use, as indicators of serviceability, descriptions of features for serviceability that will apply to many facilities of a functional category. A supply scale shall not be used to comply with this International Standard if the indicator in it is unique to a single unique asset. This is because comparing rating levels of different buildings or building-related facilities is only possible when each set of levels has been determined using the same scales, which are suitable for the same functional category.

If a suitable set of supply scales is not available, it shall be created.

Supply scales for any functional type of building or building-related facility shall be written in language (terms and concepts) which can be understood by individuals who work in or are qualified in the field of providing or managing facilities and related constructed assets, but who are not experts. The levels within each scale shall offer indicators of what is likely to be physically present in that functional category of facility. The indicators shall be observable, easily noted without instrumentation, and suitable as a consistent indicator of serviceability, that is the capability of a facility to meet a given functional performance requirement at a specific level of demand.

Examples of the format for such scales are included in Annex B, and in References [1], [2], [3], [13], and [14] in the Bibliography.

4.3 Number of statements and of levels in a scale

The demand and supply scales are matched so that the statement in a supply scale at any level indicates that the serviceability meets the performance requirement in the demand scale at that level.

There is not a mandatory count of levels or statements in a pair of scales (demand and supply scales on a topic). Five statements is the recommended count of statements in a demand scale and in the matching supply scale, plus a statement for level 0. If for a particular topic it is not possible to define five statements which are significantly different from each other, then it is recommended that the count be reduced to four or to three statements, or in exceptional and rare cases to two statements, one of which shall be at what would be taken as the middle level if there were five statements.

It is recommended that each level be designated by a single-digit integer, from 9 to 1, plus 0. If another count is used, for instance 5 to 1 plus 0, or 99 to 1 plus 0, or 9,99 to 1,00 plus 0, then provide guidance on how to compare such levels to scales in which the levels do conform to the recommendation. When there are five statements plus zero, and the levels are expressed as single-digit integers; the recommended numbering of statements in a scale is 1, 3, 5, 7 and 9, with 1 being the statement for least of that topic, and 9 being the statement for most of that topic. This enables the in-between even levels to be used when the individual choosing a level considers that the correct level is in between two statements. For some topics, it can be helpful to also provide a statement at level 2.

If five statements is the normal count, but less than five statements are used, then the statements shall be numbered so as to represent what their positions would be if there were five statements. For instance, if there are only three statements, then one shall be numbered 5 for typical, one shall be numbered 9 for most, and one shall be numbered 1 for least.

4.4 Calibration and normalization of scales

In each of the supply scales, one of the statements, typically the middle supply statement, shall describe the indicators of the feature which is actually most typically provided or installed in that region, country or locality, for that topic. The demand statement at that typical level shall be the demand (requirement) statement which would require that typical supply level of serviceability. Therefore, this demand statement is not automatically what is typically required. Instead, it can actually be more or less demanding than what is most typically provided or installed.

4.5 Complex topics with multiple functions

For a complex topic, for which the functional performance requirement involves several functions which act in combination to define that requirement, a separate demand scale shall be created for each function, and the scales shall then be grouped under one topic.

The demand level for a complex topic, involving several functions which act in combination, shall be taken as the whole number (integer) closest to the arithmetic mean (average) of the demand levels for the various functions. If the average is at the mid-point between two whole numbers (e.g. $\times$ 0,5), the level shall be reported as the nearest odd whole number.

For a complex topic, for which the serviceability is indicated by a combination of features which act in combination for that topic, a separate supply scale shall be created for each feature, and the scales shall then be grouped under one topic.

The supply level for a complex topic, involving several features which act in combination, shall be taken as the whole number (integer) closest to the arithmetic mean (average) of the supply levels for the various features. If the average is at the mid-point between two whole numbers (e.g. $\times$ 0,5), the level shall be reported as the nearest odd whole number.

4.6 Relative importance of requirements

When people are setting requirement levels for a topic, they shall be asked to indicate whether that requirement is “exceptionally important”, “important”, or of “minor importance” compared to other topics being considered.

For individual stakeholders or groups of stakeholders, at a specific time, requirements on some topics are more important than requirements on other topics. Setting more fine-grained distinctions of relative importance is discouraged, because experience shows that asking for more than three possible responses leads to results which are not sufficiently replicable.

4.7 Threshold or critical level

When identifying a demand level on each demand scale, the respondent shall be given the opportunity to indicate a critical level of functionality which, if not provided, would significantly or completely impair the ability of users or other stakeholders to carry out their intended activities or operations or mission. This level can be the same as, or can be quite different from, the level of demand. This level shall be designated as the “threshold level”.

Typically, the threshold level is a minimum level of demand. If the threshold level is a maximum value, that shall be so indicated, as an exception.

NOTE Threshold levels are often indicated for “exceptionally important” topics, and less frequently for “important” topics or topics of “minor importance”.

4.8 Main and variant requirement profiles

A functionality requirement profile is a list of the levels of functionality with respect to various topics required by stakeholders for a facility. Similarly, a serviceability rating profile is a list of the levels of serviceability with respect to various topics provided by a facility.

The set of requirement levels corresponding to the majority of users or stakeholders shall be identified as the main requirement profile. Within any building or building-related facility used by more than a few dozen individuals, it is common for some users to have requirement levels on some of the topics which are more demanding than in the main requirement profile. The more demanding profile shall be identified as a variant requirement profile. A main requirement profile can be augmented in specific zones as required by the variant profiles for those zones.

The functionality requirement profile of a group of stakeholders shall not be reported as the simple average of the main and variant profiles, but appropriately weighted averages may be used. This is because the extent and variance of the variant requirement profiles of an organization, or of the various serviceability profiles in a building or building-related facility, would be unknown if the profiles were simply averaged, or if only a consensus were recorded.

Typically, the base building is designed to accommodate the main demand profile, and the variant requirement profiles are accommodated during fit-out. In that way, if the zone for a particular requirement profile is required to be expanded because more people have those needs, the building can accommodate them by modifying its fit-out. For instance, the organization using a headquarters office building housing several hundred workplaces can have one variant requirement profile for the legal department, who work mostly in enclosed offices with a high level of speech privacy, and another for the facility management personnel who work mostly in open plan workstations for ease of communication. Accounting and human relations personnel can often work in open plan but have a variant requirement profile because they require added security for personnel files and checks. Yet another variant requirement profile might be for the information technology personnel who require extra electrical supply, complete freedom from interruptions to electricity for their servers and testing equipment, and extra heat removal for their server rooms. The marketing department can need some enclosed offices for developing confidential plans and proposals, and convenient on-floor holding rooms for sample point-of-sale displays being reviewed. In a courthouse, the main profile would likely be for areas where user occupants work and have contact with the public; among the variant profiles would be one for the courtrooms, with special acoustic, illumination and security requirements, one for the judges' office suites and circulation, and another for the prisoner holding areas and related facilities. Typically, the variant profiles would only differ from the main requirement profile, and from each other, on a limited count of topics, perhaps ten topics and rarely as many as twenty.

4.9 Generic profiles of demand

If it is desired to consolidate demand profiles of organizations conducting similar functions into a generic demand profile for that category of functions, the same set of scales shall be used to create those individual demand profiles.

Organizations conducting similar functions tend to have similar demand profiles. One category of organizations which has been found to have similar demand profiles is that of corporate headquarters of large organizations in the private sector, which are far more similar to one other than they are to the administrative offices of the same organizations, in the same geographic area. Some other categories of facilities with similar demand profiles include the following:

a) call centres;

b) offices for software development which typically have a lot of high technology and undergo rapid change;

c) offices for control of high-technology systems such as pipelines or telecommunications, which have a lot of high technology but have much slower rates of change;

d) offices with a special need for high security;

e) maintenance shops and service yards; and many others.

This permits the development of generic requirement profiles for a wide range of functional categories of users. Organizations with access to such generic profiles are able to compare their own requirement profiles to the generic profile(s), and perform a kind of benchmarking.

4.10 Calibration of scales

For each functional category of building or building-related facility, a calibration rule using terms and factors adapted so as to be appropriate to its functions and features shall be used, and shall be identified in the set of scales for that category. Such rules for calibration shall conform to the general guidance in Annex B. The calibration rules for demand and supply for each functional category of building or building-related facilities shall be matched.

4.11 Gap analysis — Comparing demand and supply

When conducting a gap analysis, the level of demand and the level of supply for each topic for which such levels are known shall be compared. The significance of the result of this comparison on all topics for which both levels are known shall be determined. The default rule for finding that the difference for a given topic is "significant" shall be as follows.

— The topic is exceptionally important and the gap is two levels.

— The topic has ordinary importance, and the gap is four levels.

— The topic has minor importance, and the gap is six levels.

— Regardless of the above, the gap is significant if the level of serviceability is lower than a minimum threshold level of demand, or is higher than a maximum threshold level of demand, or if there is any positive level of serviceability when the threshold is level zero (shall not have or shall not provide).

If a different rule is used for determining significance of difference between demand and supply, it shall be clearly documented.

When single-number reporting is required for comparing the usefulness of facilities, or for prioritizing projects, a helpful metric is often the total count of significant gaps.

4.12 Applicability in different cultures

This approach can be used in any culture, and for buildings constructed in any way of building, but the scales shall be appropriate for that culture and way of building. Existing scales that have been created elsewhere shall be confirmed as appropriate, or shall be adjusted and/or translated as necessary.

Those differences can result in the need for differently worded scales. In some cases, it can be necessary to create new scales, even though some exist already. For instance, partition walls between rooms in an office are constructed differently in France than in North America, and office doors are more likely to be closed in France than in North America, so practices and requirements for voice privacy are different in the two cultures. In consequence, when the paired scales for demand and supply which are American National Standards were translated for use in France, the texts reflected different ways of using offices, and different ways of building in France – but the French scales produced equivalent levels for functional performance requirements and for ratings of serviceability. (See Reference [5] in the Bibliography.)

4.13 Consistency and replicability of responses

In large organizations, demand levels of functional performance requirements shall be consistent within a range of plus or minus one level, if the work processes of selected user groups are in fact closely similar and if the individuals setting requirement levels are first-line supervisors, that is, people close to the work being done but with a managerial perspective. If this consistency is not found, then the reasons for absence of consistency shall be provided with the findings. If levels of demand are determined by groups or group interviews, the individuals who lead such groups shall be professionals in the fields of real estate, facility

management, or human resource management, and shall have had at least two days of instruction and practice in the role of informed facilitator and interviewer.

Similarly, the levels of capability assigned by different raters separately assessing the level of serviceability of a facility shall be consistent, plus or minus one level, in more than 95 % of rated topics. If this level of consistency is not achieved, then the reasons for the absence of such consistency shall be provided with the findings. The individuals who assess levels of serviceability shall be professionals in the fields of real estate, facility management, design or construction, and shall have had at least 2 days of instruction and practice in the role of assessing capability, or know the properties well.

Because an average level of functional performance requirements is used for topics with several specific functions (4.5), and an average level of serviceability is used for topics with a combination of several features (4.5), it is possible that the difference between level of requirements and level of serviceability can actually be only one tenth or a few tenths of a level, even though it will be reported as the difference between whole-number integers. Therefore, since the target for consistency of rating levels is plus or minus one level in more than 95 % of rated topics, an exact match between levels set independently by different individuals or groups of individuals is not likely.

4.14 Application during the whole life of a facility

The rules and guidelines in this document shall apply throughout the whole life of a facility, as required in ISO 15686-10.

4.15 Inclusion in the building information mode (BIM)

The building information model (BIM) contains the database about a building or other constructed asset, and about each project to create or modify a constructed asset. The ISO specification giving the platform and rules for data format and exchange in a BIM is ISO/PAS 16739.

Release IFC2x3 includes a property set giving guidance on how to store information about the functionality and serviceability profiles, and gaps, in the BIM. The name and internet location of that property set is given in Reference [4] in the Bibliography.

Annex A
(informative)

Concepts of functionality and serviceability

A.1 How functionality and serviceability work together

A.1.1 Matched terms

This annex discusses how the concepts of functionality (see 3.15) and serviceability (see 3.28) work together, and how these terms relate to other terms used in this International Standard and in other related standards.

Users or other stakeholders usually document their requirements for functionality in a program or brief written using vocabulary and technical terms that they understand. These documents summarize the purposes, needs, functions and activities of the users and other stakeholders to be met by a facility.

The concept of serviceability complements that of functionality. The serviceability of a facility is its capability to provide that functionality, that is, how serviceable is it for supporting those who have that requirement.

A.1.2 Using the terms

The description of what people require in order to be able to do what they want or need to do is called the required level of functionality (see 3.17) on a given topic (see 3.33). Taken together, levels of functionality on different topics form a profile (see 3.22) of the requirements of the users and stakeholders. The extent to which the place is suitable or useful in relation to one of the topics describing the users' requirements is called a level of serviceability (see 3.19) for that topic. Taken together they form a matching profile of serviceability. The suitability (see 3.30) of a facility is assessed when the two profiles are compared.

For instance, consider the place where an individual does office work in an accounting firm, or the place where a family eats dinner at home, or the place where a family doctor examines a patient. Each such place can be more or less suitable or useful for what the respective individuals want to do. If the place is not as suitable or useful as is required, then there is a gap between the level of functionality required and the level of serviceability provided for that use by the place.

When considering what level (how much or how little) of a particular topic of functionality is required to support the users (see 3.34) or other stakeholders (see 3.29), one thinks of the several topics which together describe their needs. For instance, the functionality required by users of an office is affected by topics such as illumination, speech privacy, load capacity of floors (e.g. strong enough to support desks and file cabinets, etc.) and freedom from distracting sounds. How much of each such topic is needed by the users, or other stakeholders, is their level of functional performance requirement (see 3.14), such as enough illumination for people to read very small print, or sufficient freedom from reflected glare to easily read a computer screen.

As an example, to simplify stating how much and what kind of illumination is required, this International Standard calls for users and other stakeholders to be able choose from a range of options, expressed in a scale (see 3.26), from least to most. For instance, a level 9 might be the most of a topic that one might reasonably require, and a level 1 might be the least.

A.2 Usability and satisfaction

A.2.1 General

Two other concepts, “usability” and “satisfaction”, need to be explained to show how they relate to the terms functionality (see 3.15), serviceability (see 3.28) and capability (see 3.6).

A.2.2 Usability

Usability has been defined in ISO in terms of certain products. A product of manufacture, made in quantities of identical products, such as a computer terminal, should meet the functional requirements of its users. For instance, ISO 9241-11:1998 defines the term “usability” as follows:

> “extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use”.

As explained in Annex D of ISO 9241-11:1998, usability of a product could be measured

— “by analysis of the features of the product, required for a particular context of use”,

— “by analysis of the process of interaction” with the product, and

— “by analysing the effectiveness and efficiency which results from use of the product in a particular context and measuring the satisfaction of the users of the product”.

Usability as defined in Annex D of ISO 9241-11:1998 also depends on software qualities which “contribute to quality of the work system in use. … This broad approach has the advantage that it concentrates on the real purpose of design of a product – that it meets the needs of real users carrying out real tasks in a real technical, physical and organizational environment.”

If buildings are also considered as tools or aids to users, then the concept of usability also applies, though unlike manufactured products, each building or building-related facility is unique at least in its physical location and typically in many other features (see 3.11) as well.

A.2.3 Satisfaction

Satisfaction of users has been an indicator of serviceability, and of when to give priority to resolving problems in a building. Many large corporations and government providers of facilities in many countries use satisfaction surveys as part of their facility management toolkit. For instance, for some years, the US General Services Administration (GSA), the provider and facility manager of offices for the US government, conducted a comprehensive user satisfaction survey of all the offices it provided. It adapted the survey developed for the International Facility Management Association (see Reference [8] in the Bibliography) and set a target level for occupant satisfaction. GSA found that occupant satisfaction was not actually telling it which buildings most needed fixing, because of two intervening variables:

a) occupant satisfaction was dominated by the perceived responsiveness and helpfulness of the personnel providing facility management, rather than by the serviceability of the physical building;

b) typically, respondents mistakenly thought that the facility administrators in their own units, to whom they took their complaints, were the facility managers, rather than the GSA staff who actually managed their buildings.

Annex B
(informative)

Principle of calibration for scales

B.1 General guidance on the meaning of levels in a functionality requirements scale

9 = Most functionally demanding.

7 = Clearly more than level 5, but not the most demanding.

5 = Typical mid-range and normal functional requirement.

3 = Least requirement of this occupant function, program or service.

1 = Least required, or functionally demanding, or can be a temporary requirement, or minimal, or not accepted in a permanent facility, or appropriate because minimal.

0 = Never acceptable, “shall not have” or not required or not applicable.

Reason if a level is not provided:

☐ Decision postponed ☐ Lacking information

☐ In-depth study required

Relative importance:

☐ Exceptionally important ☐ Important

☐ Minor importance

Minimum allowable level (threshold) or level of criticality (if any) =
9 8 7 6 5 4 3 2 1 0

Maximum allowable level (threshold) or level of criticality (if any) =
9 8 7 6 5 4 3 2 1 0

B.2 General guidance on the meaning of levels in a serviceability rating scale

9 = Indicators of the highest level of functional capability likely to be found in facilities.

7 = Clearly more than level 5, but not the most capable.

5 = Typical mid-range facility in the inventory for this functional category of facility, in the whole country or region.

3 = Clearly less than level 5, but appropriate for some situations.

1 = Lowest level of functional capability likely to be found.

0 = Not present or “does not have” or not applicable.

Reason if a level is not provided:

☐ Decision postponed ☐ Lacking information

☐ In-depth evaluation required

Annex C
(informative)

Example of scales

C.1 Intent of the figures

Figure C.1 shows an example of demand scales; Figure C.2 shows the supply scales for a single topic. In this example, the precise wording is of minor importance, because it is informative only. This example is from an application in North America, but in France the scale on this topic has different wording, which is more appropriate to the culture and ways of building for that country and region.

C.2 Demand scales

Each demand scale is for use in determining the level of functionality of a facility on one topic of functional performance.

C.3 Supply scales

Each supply scale is used in determining the level of serviceability of a facility on one topic of capability.

DEMAND (FUNCTION) SCALES **Office**
Group and Individual Effectiveness **Image to Public and Occupants**
Topic 6. Identity Outside Building

Subject Matter.
Note.

After completing the options below, calculate the level of demand for this whole topic:
Level = O 9 O 8 O 7 O 6 O 5 O 4 O 3 O 2 O 1 O 0

From the options below, please select the level that best describes the REQUIREMENT.

Demand Scale 6.1. Public Exposure	
9	O Operations require maximum exposure to the public.
8	O
7	O Operations require above average exposure to the public.
6	O
5	O Operations require average exposure to the public.
4	O
3	O Operations do not require much exposure to the public.
2	O
1	O Operations require that the office is obscure to the public, e.g. for security reasons.
0	O No requirement.

Select Relative Importance level of this scale = O Extremely Important O Important O Minor Importance

Select Threshold level: O Minimum (or O Maximum) O None Level = O 9 O 8 O 7 O 5 O 3 O 1

Demand Scale 6.2. Ease of Locating and Identifying Building	
9	O The address, building, and signage shall be ***very easy*** for pedestrians or motorists to find and recognize, even for those unfamiliar with the locality.
8	O
7	O The address, building, and signage shall be ***easy*** to find and recognize, even for those unfamiliar with the locality.
6	O
5	O The address, building, and signage shall be easy to find and recognize, even for those ***familiar*** with the locality.
4	O
3	O Most visitors are regulars. Corporate ***image*** is not a high priority.
2	O
1	O The building is required to be ***obscure*** for security reasons.
0	O ***No*** requirement.

Select Relative Importance level of this scale = O Extremely Important O Important O Minor Importance

Select Threshold level: O Minimum (or O Maximum) O None Level = O 9 O 8 O 7 O 5 O 3 O 1

OR Select OTHER (unable to choose scale level for one or more scales): O Lack information

O Postpone decision O Refer question to someone else O In-depth study required

Relative Importance level of this whole topic = O Extremely Important O Important O Minor Importance

Select Threshold level for this whole topic O Minimum (or O Maximum) O None Level = O 9 O 8 O 7 O 5 O 3 O 1

Figure C.1 — Example of a pair of demand scales

SUPPLY (FEATURE) SCALES **Office**
Group and Individual Effectiveness: **Image to Public and Occupants**
Topic 6. Identity Outside Building

Subject Matter.
Note.

After completing the options below, calculate the level of supply for this whole topic:
Level = O 9 O 8 O 7 O 6 O 5 O 4 O 3 O 2 O 1 O 0

From the options below, please select the level that best describes WHAT IS PROVIDED.

Supply Scale		**6.1. Identity of Building**
9	O	The building is a well known landmark. The building and entrance are clearly visible and recognizable.
8	O	
7	O	The building and building entry are clearly visible to passing motorists and pedestrians, and are recognizable.
6	O	
5	O	The building and building entry are visible to passing motorists. The building is identifiable, and not easily confused with its neighbours.
4	O	
3	O	The building is obscured by other buildings from some directions, and from people approaching along the street from one direction. The building is very similar and hardly distinguishable from adjacent buildings.
2	O	
1	O	The building is obscured by other buildings until viewed from directly in front, or the building is not distinguishable from adjacent buildings, e.g. facades are almost the same.
0	O	***Not*** a factor.
Select if scale Not Applicable:		O Not applicable

Supply Scale		**6.2. Corporate Identity**
9	O	The organization's identity is clearly recognizable, and readily visible from all directions. Direction signs are placed at main transit stops nearby.
8	O	
7	O	The organization is well identified from all directions. Signage is adequate, and clearly visible on every approach to passing motorists and pedestrians.
6	O	
5	O	The organization is identified to a minimum level. Signage is generally visible to passing motorists and pedestrians.
4	O	
3	O	The organization is not clearly identified. Signs are obscured from some directions or are in poor light.
2	O	
1	O	There is no evidence of the organization's identity on the exterior of the building. Signs are obscured, e.g. by vehicles or other buildings. Signs are very poorly located or hard to read, e.g. signs are too high on the building, too small, the lettering is too small or low in contrast, or signs are in shadow.
0	O	***Not*** a factor.
Select if scale Not Applicable:		O NA

Supply Scale		**6.3. Quality of External Signs**
9	O	The building has special custom signage, e.g. stand-alone elements, special lighting, and full information. All signs are in as-new condition.
8	O	
7	O	Building signage is appropriate and typical, e.g. street address, building name, principal occupant group(s). Signs have no visible deterioration.
6	O	
5	O	Building signage is appropriate and typical, e.g. street address, building name and, if appropriate, principal occupant group(s). Signs have no damage or major deterioration.
4	O	
3	O	Signage is minimal or impaired, e.g. minimal information, weathered surfaces, partly damaged.
2	O	
1	O	Signage is minimal or badly damaged, with incomplete information, e.g. no street number or building name.
0	O	***Not*** a factor.
Select if scale Not Applicable:		O NA

OR Select OTHER (unable to choose scale level for one or more scales): O Lack information
O Postpone decision O Refer question to someone else O In-depth evaluation required

Figure C.2 — Example of three supply scales

Annex D
(informative)

Comparison and matching of profiles

D.1 Types of comparison

D.1.1 Comparing profiles

This International Standard sets out to normalize tools for assessing and comparing functional performance of buildings and constructed assets. This annex gives guidance and examples of comparing demand and supply, that is, required levels of functionality and supplied levels of serviceability. These comparisons are most useful when made between profiles of functionality and serviceability, rather than just on one or two individual topics.

D.1.2 Four common types of comparison

D.1.2.1 General

Unless otherwise directed, when a profile is reported, it may be reported both as stand-alone data and in comparison with one or more relevant profiles. Demand levels for a group of users or other stakeholders may be compared to a specific requirement profile, or to a generic requirement profile for the users of that functional category of facility or to a generic rating profile for that type of facility, or to some other relevant facility. Types of comparisons include those given in D.1.2.2 to D.1.2.5.

D.1.2.2 Demand compared to supply

Demand compared to supply, that is, the profile of what is required compared to the rating profile of what is currently occupied, or to what is proposed in a design, or to what is being considered as a possible future location, or to what is typically available in that locality, or to a generic rating profile for that category of facilities.

D.1.2.3 Demand compared to demand

Demand compared to demand, that is, the profile of what is required compared to the demand profile of other entities considered comparable, in that locality or elsewhere, or to a generic demand profile for that functional category.

D.1.2.4 Supply compared to demand

Supply compared to demand, that is, the profile of a facility which exists, or which is proposed, compared to the requirement profile of one or several potential users, or to a generic demand profile in that locality.

D.1.2.5 Supply compared to supply

Supply compared to supply, that is, the rating profile of a facility which exists, or which is proposed, compared to the rating profile of other facilities in the locality or in the portfolio, or to a generic rating profile for that category of facilities.

D.1.3 Typical practice in comparing profiles

The most common comparison of profiles is to compare what is required and what is provided or proposed. Figure D.1 is an example of this. It shows part of the comparison between a demand profile and a supply profile, and presents the gaps graphically.

Another frequent comparison is to assess the gaps between the demand profile of a single occupant group and the rating profiles of several facilities being considered for them to occupy. Figure D.2 is part of such a comparison.

When a large organization has several regions or branches performing essentially the same functions, it can be important to compare what each region or branch gives as its requirement profile. Differences between those requirement profiles can be due to differences in climate or culture among the regions, or to differences between how the branches are managed, or for other reasons that senior management would likely want to understand.

Supply profiles may also be compared directly. For instance, the manager of a portfolio of buildings can seek to identify differences between the serviceability of various buildings in the portfolio, in order to identify shortfalls requiring correction, and surpluses of serviceability which can explain differences in occupant satisfaction, or indicate opportunities for cost reduction.

D.2 Matching and appropriateness of fit

D.2.1 The best fit

The best fit is almost always a close fit between demand and supply profiles. Then, the functional performance requirements are met and funds are not expended unnecessarily. The benefit for the users and their organization is that their operations are supported appropriately, and that this fact can be documented.

D.2.2 Graphic display of a comparison

D.2.2.1 Forms of graphic display

Decision-makers need to understand whether the fit is good or not, and to judge the effects of a poor fit on their organization. Because these decision-makers are often not knowledgeable about the specific functionalities needed or provided by a building, a clear graphic display is often the best way to communicate the issues of a poor fit. Over two decades of comparing profiles, a form of bar charts has been evolved, using specific colours to indicate goodness of fit.

D.2.2.2 Widely used convention for colouring comparison charts

One widely used convention is as follows.

— Dark grey indicates that the facility is capable at that level.

— Green indicates that the required level of serviceability is provided or exceeded.

— Red indicates a shortfall in serviceability.

— White “T” on black indicates a threshold level was met.

— White “T” on red indicates that serviceability is below the minimum threshold.

D.2.2.3 Newer, more complex convention for colouring comparison charts

Another convention, giving more information but adding to the complexity of a diagram, is as follows.

— Dark grey indicates that the facility is capable at that level.

— Green indicates that the required level of serviceability is provided.

— Blue indicates that the required level of serviceability is exceeded.

— Amber indicates a shortfall of one or two levels of serviceability.

— Red indicates a shortfall of more than two levels of serviceability, or a shortfall below threshold level.

— White “T” on black indicates a threshold level was met.

— White “T” on red indicates that serviceability is below the minimum threshold.

D.2.3 Comparing demand and supply for a single facility

The example in Figure D.1 is the comparison between part of the requirement profile for a corporate headquarters, shown in the three columns to the left of the coloured bars, and the rating of a design-build proposal in the bars to the right. This example shows only the topics which were considered as exceptionally important requirements for the occupant organization, indicated by “E”.

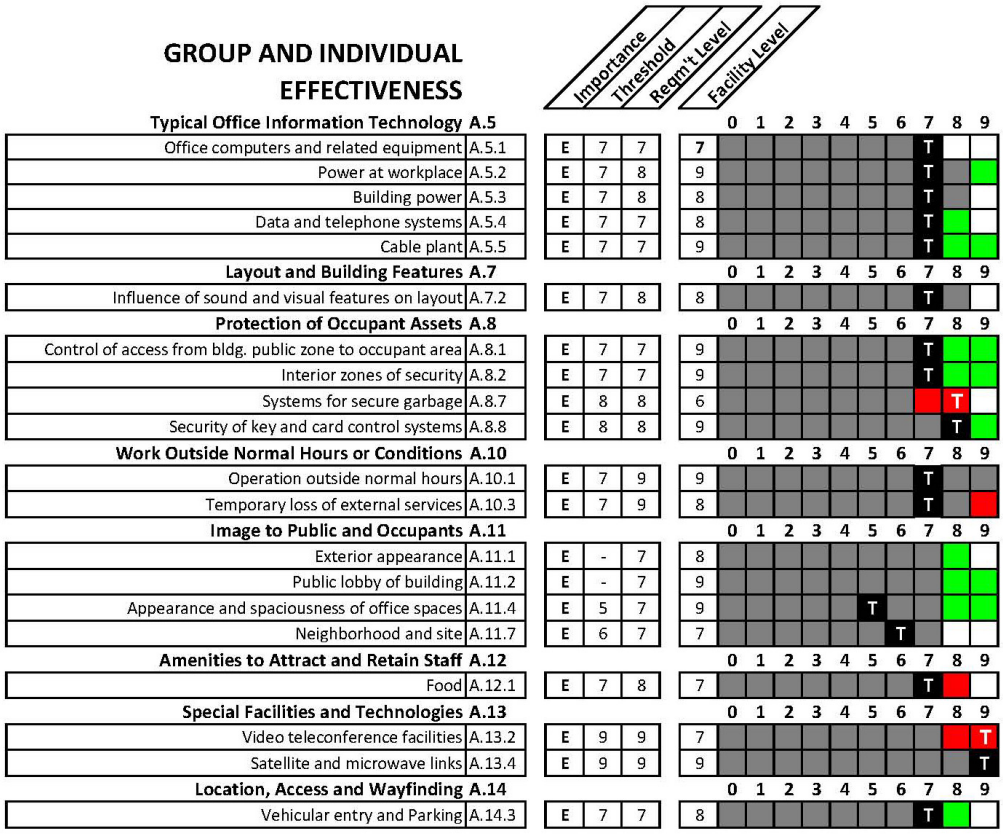

Figure D.1 — Comparison of demand and supply profiles

D.2.4 Comparing one demand profile to three possible facilities

The example in Figure D.2 is part of a comparison of three facilities on offer to the organization with the requirement profile in the three columns to the left of the coloured bars. For those topics for which there is not sufficient information to determine the rating level, the bar is left without colour, and LI for “lack of information” is entered in the column for Facility Level. In the column “Importance”, I stands for important and E for exceptionally important.

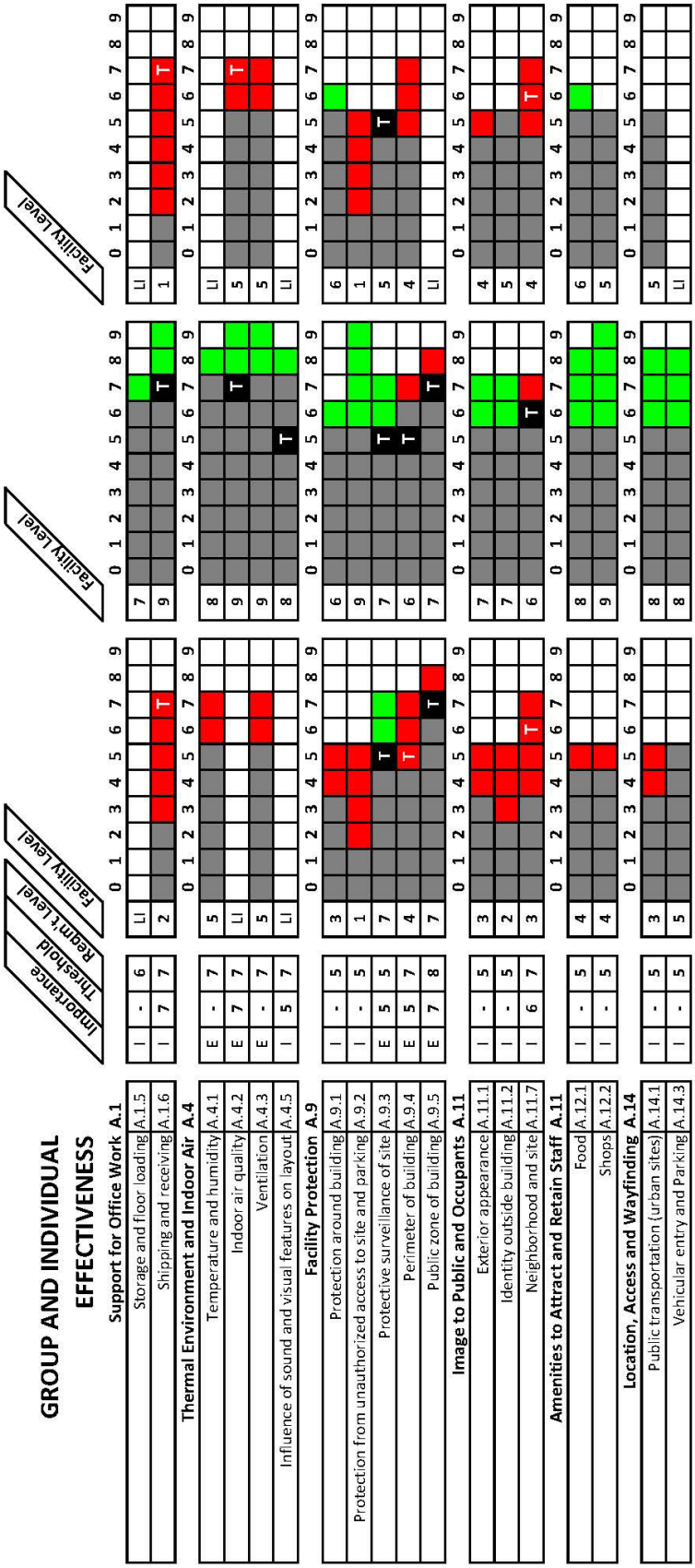

Figure D.2 — Example of comparison of three facilities to a single demand profile

Annex E
(informative)

Terms used for functionality and serviceability

E.1 Demand and supply terms are compatible with the “performance approach”

To accomplish the aims, objectives, goals, and targets of society, groups, and individuals, there is a trend to use a “performance approach” to define levels of expected results, describe levels that indicate that the service or product would provide the required results at the same level, and measure actual results. Levels of demand and supply are compared to determine suitability of a building or building-related facility. The terms in Table E.1 reflect this dialogue between Demand and Supply in a consistent way. These terms are compatible with the Performance System Model being proposed by the Inter-jurisdictional Regulatory Collaboration Committee (IRCC) and with the terms used in CIB Report 64[7].

The terminology also takes into account the fact that demand scales can serve as multiple-choice questions used by occupants or other stakeholders to set the functionality requirement levels needed to do their required or desired functions or activities. Supply scales use descriptions of physical features as indicators of levels of serviceability.

In Building Condition Reports (BCRs) or Facility Assessment Reports, if “functionality” is referred to, it is often a category of technical deficiency, which addresses the operative capabilities of a building component or system, not the user's functional requirements to be satisfied by the facility as it would be defined in this International Standard.

E.2 Correctly matching terms for demand and supply

In the dialogue between demand and supply, if demand terms and supply terms are not correctly matched, then clarity is impaired and confusion introduced. In Table E.1, concepts and terms in each band on the right correctly match those on the left.

Table E.1 — Matched terms relative to functionality and serviceability

Demand Considers: uses, needs, requirements, wants, wishes	**Supply** Considers: what is provided in response to demand
Users Occupants, facility managers, building managers, portfolio managers, visitors, other stakeholders such as investors, insurers, municipalities, code officials, etc.	**Constructed assets and other assets** Facilities, properties, buildings, building systems, components, products and materials; infrastructure assets such as bridges, highways, municipal waste systems, etc., and materiel
define, state, or set requirements	provide, assess, rate or evaluate assets
inputs	outputs
ends, results, outcomes	means, solutions
functional statement	performance statement
statement of requirements (SOR)	explicit and implicit performance
functionality	serviceability
functional performance	technical performance
functionality requirement scale	serviceability rating scale
demand scale	supply scale
user functional requirement	capability of asset or facility
functionality profile	serviceability profile
functionality requirement profile	serviceability rating profile
functional element	physical feature
bundle of functions	combination of features
bundle of required functional elements	combination of physical features
description of functional element	indicator of capability
demand for functionality	supply of serviceability
demand for service life	estimated or predicted service life
level of functionality (0 and 1 to 9)	level of serviceability (0 and 1 to 9)
level of demand (0 and 1 to 9)	level of service (0 and 1 to 9)
criteria	unit of measure, verification, test method, etc.

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ICS 91.040.01

Price based on 23 pages