



Standard Practice for Building Floor Area Measurements for Facility Management¹

This standard is issued under the fixed designation E1836/E1836M; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This practice provides a definitive procedure for measuring and classifying floor area in buildings for use in facility management, specifying occupant requirements, space planning, and for strategic facility planning.

1.2 This practice specifies the sequence in which to measure floor area.

1.3 This practice is applicable to owned, rented, and leased buildings.

1.4 Use **Annex A1** to measure floor area in office facilities. The measurement practice in **Annex A1** may also be suitable for use in other functional types of building which include offices, such as research, laboratory, or manufacturing buildings and building-related facilities.

1.5 The practice in **Annex A1** is not intended for use in lease negotiations with owners of commercial office buildings or related properties. For that purpose, refer to the American National Standard published by the American National Standards Institute under the designation ANSI/BOMA Z65.1–1996 and commonly known as the ANSI-BOMA standard.

1.6 This practice is not intended for and not suitable for use for regulatory purposes, fire hazard assessment, and fire risk assessment.

1.7 This practice was developed for use within North America and includes some rules comparable to ISO 9836 Performance Standards in Building—Definition and Calculation of Area and Space Indicators.

1.8 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the standard.

¹ This practice is under the jurisdiction of ASTM Committee E06 on Performance of Buildings and is the direct responsibility of Subcommittee E06.25 on Whole Buildings and Facilities.

Current edition approved March 1, 2016. Published June 2016. Originally approved in 1996. Last previous edition approved in 2009 as E1836/E1836M – 09^ε. DOI: 10.1520/E1836_E1836M-09R16.

1.9 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 ASTM Standards:²

E631 Terminology of Building Constructions

E2619/E2619M Practice for Measuring and Calculating Building Loss Features That Take Up Floor Area in Buildings

2.2 ANSI Standard:³

ANSI/BOMA Z65.1–1996 Standard Method for Measuring Floor Area in Office Buildings

2.3 ISO Standards:⁴

ISO 9836 Performance Standards in Building—Definition and Calculation of Area and Space Indicators

3. Terminology⁵

3.1 Definitions:

3.1.1 *floor, n*—in a building, supporting structure (generally horizontal) and constituting the bottom level of each story.

E631⁶

3.1.2 For standard definitions of additional terms applicable to this practice, see Terminology **E631**.

² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

³ Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, <http://www.ansi.org>.

⁴ Available from International Organization for Standardization (ISO), ISO Central Secretariat, BIBC II, Chemin de Blandonnet 8, CP 401, 1214 Vernier, Geneva, Switzerland, <http://www.iso.org>.

⁵ Certain definitions of terms in this practice were agreed in 2007 by a Working Group established jointly by the Building Owners and Managers Association (BOMA) International and the International Facility Management Association (IFMA). Certain terms were derived from referenced ASTM standards or from referenced ANSI standard, or from published IFMA documents. Ownership of copyright to specific terms is indicated by footnotes. Certain terms are quoted from other ASTM standards, in which case the ASTM source is identified at the end of the definition.

⁶ Information such as this, inserted at the end of a definition, gives the number of a standard from which this definition was quoted or derived. If a number follows a dash at the end of this information, it indicates the year of approval of the standard.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *amenity area, n*—portion of a building that provides a convenience to an occupant or occupants of a building or group of buildings.⁷

3.2.1.1 *Discussion*—In general, occupancy codes and regulations do not govern these areas, although there may be codes and regulations that relate to their specific uses.

3.2.2 *assignable area, n*—portion of the plannable area on a floor that can be assigned to occupant groups or functions.

3.2.3 *building, n*—contiguous and undivided shelter comprising a partially or totally enclosed space, erected by means of a planned process of forming and combining materials.⁷

3.2.4 *dominant portion, n*—the inside surface of the outside wall, as defined in ANSI/BOMA Z65.1–1996.⁸

3.2.4.1 *Discussion*—ANSI/BOMA Z65.1–1996 specifies when to consider the inside surface of the window glass as the dominant portion to measure to, and when to measure to some other part of the outside wall.

3.2.5 *excluded area, n*—portion of a floor within a building that is not suitable for occupancy by people or equipment.⁷

3.2.5.1 *Discussion*—While excluded areas may meet the criteria of adequate clear headroom there is owner/landlord documentation which indicates that these areas are to be excluded from floor interior gross area calculations. Examples of excluded areas include but are not limited to unfinished attic areas, attic areas with obstructed access, damp or flooded basements, and confined areas requiring permits for entry. Areas temporarily unusable due to flood, fire damage, construction or renovation activity are *not* excluded areas.⁷

3.2.6 *exterior gross area, n*—the area of the floor measured to the outside face of the walls that enclose the floor(s) of the building.

3.2.6.1 *Discussion*—Areas which are not enclosed, such as patios and balconies, are not part of exterior gross area. Cornices, pilasters, buttresses, and so forth that extend beyond the wall face are disregarded. The exterior gross area of a basement space includes the area measured to the outside face of basement or foundation walls.

3.2.7 *finished surface, n*—inside face of a wall, window, ceiling, or floor that is provided as part of the base building for the general use of occupants, excluding the thickness of any special surfacing materials applied to meet the particular needs of specific occupants.⁹

3.2.8 *floor area, n*—area in the horizontal plane of the bottom level of a story or stories in a building.

3.2.9 *interior encroachment, n*—base building element that is located inside a building, not on an outer wall, and that

prevents the use of the floor area for furniture, equipment, circulation, or other occupant function.⁹

3.2.10 *interior gross area, n*—portion of the floor(s) that is totally enclosed within the dominant portion.⁹

3.2.11 *interior parking, n*—totally or partially enclosed area that is within a building and that is normally used to circulate and station vehicles.¹⁰

3.2.12 *interstitial floor area, n*—area of load-bearing surfaces located above or below occupied building floors that is not available for general occupancy.⁷

3.2.12.1 *Discussion*—Interstitial floor area is often not available for occupancy due to inadequate clear headroom. Typically interstitial floor area contains building mechanical or electrical systems predominantly serving adjacent floors or to provide access to such systems.

3.2.13 *major vertical penetration, n*—opening in a floor that serves a building or system distribution function.⁷

3.2.14 *matrix, n*—a grid-like array of elements.¹¹

3.2.15 *occupant, n*—of a building, one who has certain legal rights to or legal control over the premises occupied.⁹

3.2.15.1 *Discussion*—An occupant may be a tenant in a building or the owner of a building.

3.2.16 *occupant void area, n*—opening in a floor created for the specific benefit of an occupant.¹⁰

3.2.16.1 *Discussion*—Examples of occupant void areas are private elevators, communicating stairs within tenant premises, and the opening in the floor above in tenant rooms that are multi-story in height.

3.2.17 *perimeter encroachment, n*—base building element or restricted area that is located inside the dominant portion of a building on the outer wall and that prevents the use of the floor area for furniture, equipment, circulation, or other occupant function.⁹

3.2.18 *plannable gross area, n*—portion of a floor that is totally enclosed within the interior face of perimeter encroachments at the floor plane and where there are no perimeter encroachments enclosed at the inside finished surface of the exterior walls.¹⁰

3.2.19 *polygon, n*—closed plane figure made up of several line segments that are joined together.¹²

3.2.20 *primary circulation area, n*—minimum path on a floor for access to egress stairs, elevator lobbies, toilet rooms, refuge areas, building lobbies, and entrances.⁹

3.2.21 *restricted area, n*—portion of floor area that would normally be available for use by an occupant, but the occupant is limited from using the area, either by regulatory authority or from a governing document.⁹

3.2.22 *restricted headroom, n*—large portion of a floor that does not have sufficient clear, unobstructed headroom to

⁷ Copyright is shared with BOMA International.

⁸ In the 1996 edition, which is copyright by BOMA, the dominant portion is defined as the inside face of the portion of the wall which is window glass where it is more than 50 % of the vertical distance from finished floor to finished ceiling, and elsewhere as the inside face of the outside wall, or of a pilaster or column attached to the outside wall where they occur. Note that the reader is cautioned that the dominant portion is not defined as a part of this ASTM standard. Instead, ANSI/BOMA Z65.1–1996 is developed by and subject to the authority of BOMA International, which may change it from time to time at its sole option.

⁹ ASTM copyright is shared with BOMA International.

¹⁰ New term for which copyright is shared by ASTM and BOMA International.

¹¹ *Oxford English Dictionary*, 2nd ed., Oxford University Press, 1989, s.v. “matrix.”

¹² Mathway Math Glossary, s.v. “polygon,” <http://www.mathway.com/glossary.aspx?section=p>.

conform to local building codes or that has headroom less than that required for occupancy.

3.2.22.1 *Discussion*—Restricted headroom is primarily intended to exclude large areas such as low attics and crawl-spaces from being defined as “floors.” It also establishes, in a sloped ceiling attic or sloped exterior wall, where the effective outer wall is located. Restricted headroom does not apply to reduced or no headroom conditions (that is, walls, columns, stairs, door headers, limited piping, railings, alcoves, and so forth) typically found on a floor, unless they are part of an overall restricted headroom condition.

3.2.23 *secondary circulation area, n*—portion of a floor required for access to some subdivision of a floor, that does not serve all occupants on a floor and that is not defined as primary circulation area.

3.2.24 *service area, n*—portion of a building that provides services that enable occupants to work in a building.

3.2.24.1 *Discussion*—Service areas make it possible to accommodate occupants within a building without violating existing building codes and occupancy controls, or both.¹³

3.2.25 *unassigned area, n*—portion of the plannable area on a floor that is not assigned to occupant groups or functions.¹⁰

3.2.25.1 *Discussion*—Unassigned area includes all plan-nable area that cannot be classified as either assignable area, or restricted area, or occupant void, or interior encroachment, or secondary circulation. Examples are: (1) small areas between furniture panels and columns where furniture does not fit; and (2) area set aside to install future workstation or other functions.

3.2.26 *usable area, n*—portions of a building that can be classified as tenant area or amenity area.¹⁴

3.2.27 *void area, n*—absence of a floor inside the dominant portion where a floor might otherwise be expected or measured, that is typically in the plane of the upper floors of

multi-story atria or lobbies, light wells, auditoria or the area adjacent to a partial-floor mezzanine.

4. Significance and Use

4.1 This practice can be used to facilitate comparison of areas that have been measured but it does not specify what measurements must be conducted.

4.2 This practice can be used in space programming and forecasting of space requirements.

4.3 This practice can be used to classify areas for internal cost accounting purposes.

4.4 This practice can be used to compare space use between organizations.

5. Basis of Practice

5.1 The basis for classification of floor area measurements for certain functional types of building is contained in **Annex A1**.

NOTE 1—In the future, additional annexes are expected to be added to this practice to contain the classifications for floor area measurements in other functional types of building and to compare measurements of floor area for different purposes or from different countries.

6. Measurement Procedure and Report

6.1 **Annex A1** provides a procedure for measuring floor area and for reporting such measurements for certain functional types of building for those purposes stated in Section 1.

6.2 When reporting floor area, measured in accordance with the procedure in **Annex A1**, note any exceptions to the prescribed method. Where possible, also assess the extent of variation and state as an estimate.

6.3 If Practice **E2619/E2619M** is also used, findings from that practice may be included in the report of building floor area measurement, but the area of building loss features shall be clearly identified.

7. Keywords

7.1 area; building; building floor area; facility; facility management; floor area; measurement; occupant requirement

¹³ Terms from BOMA and ASTM standards were used as the starting point to develop this term. The copyright of this term is shared by ASTM and BOMA.

¹⁴ Term in the BOMA standard used as the starting point to develop this term. BOMA shares the copyright with ASTM.

ANNEXES

(Mandatory Information)

A1. PRACTICE FOR MEASUREMENT IN OFFICE FACILITIES AND RELATED FUNCTIONAL TYPES OF BUILDINGS SUCH AS RESEARCH, LABORATORY, AND MANUFACTURING BUILDINGS AND BUILDING-RELATED FACILITIES

A1.1 Introduction

A1.1.1 The purpose of **Annex A1** is to provide consistent terms, definitions, and measurement procedures for floor area measurements to facilitate comparison of measurements among different organizations and for financial chargeback.

A1.2 Scope

A1.2.1 Use **Annex A1** to measure floor area in office facilities. This measurement practice may also be suitable for use in other functional types of building which include offices, such as research, laboratory, or manufacturing buildings and building-related facilities.

A1.2.2 **Annex A1** is applicable to the measurement of space whether owned or leased.

A1.2.3 **Annex A1** is intended for use by facility managers and occupants of building and facilities. It is suitable for such purposes as strategic planning, space management, and internal chargeback to occupant organizations.

A1.2.4 **Annex A1** gives rules for measurement for use in facility management, space planning, and chargeback to occupant units.

A1.2.5 **Annex A1** is not intended for use in lease negotiations with owners of commercial office buildings or related properties. For that purpose, refer to the American National Standard published by the American National Standards Institute under the designation ANSI/BOMA Z65.1–1996, and commonly known as the ANSI-BOMA standard.

A1.3 Relationships Between Categories of Floor Area

A1.3.1 This annex includes four categories of floor area: Exterior Gross Area, Interior Gross Area, Plannable Gross Area, and Plannable Area. (Refer to **Fig. A1.1**.)

A1.3.2 These four categories of floor area, and the elements (sub-categories of floor area) within each of these four categories, relate one to the other in the following ways:

A1.3.2.1 Interior Gross Area is equal to Exterior Gross Area less Dominant Portion to Exterior Gross Area, Excluded Areas, Interstitial Areas, Restricted Headroom Areas, and Interior Parking Areas.

A1.3.2.2 Plannable Gross Area is equal to Interior Gross Area less Perimeter Encroachments.

A1.3.2.3 Plannable Area is equal to the sum of the following areas: Restricted Areas, Interior Encroachments, Occupant Void Areas, Unassignable Areas, Assignable Areas, and Secondary Circulation.

A1.4 Rules for Measurement

A1.4.1 Measurements shall include only floor areas that are totally enclosed within a building. Climate conditions and construction practices will dictate the degree of weather tightness typical for exterior walls in a local area. Basements, enclosed porches, penthouses, mechanical equipment rooms, lobbies, mezzanines, corridors, interior parking, and enclosed loading docks are included. Spaces outside the exterior walls or without a roof covering are not included in the floor area measurement. A space, such as balcony, which has a roof or ceiling but is not fully enclosed, is not included.

A1.4.2 For space planning and chargeback, measure the *plannable gross area* and the various elements of floor area within the *plannable gross area*. However, there are likely to be instances when additional measurements may be needed. Therefore, elements of floor area shown in **Fig. A1.1** under the *exterior gross area* and the *interior gross area* are described to give context to the cascade of relationships from the gross exterior to the plannable area. However, to ensure correct measurement of elements outside the plannable gross area will require using the procedures contained in ANSI/BOMA Z65.1–1996.

A1.4.3 All measurements shall be made along the plane of the floor to the points where floors and walls intersect.

A1.4.4 In the case of a sloped floor measure the floor area in the horizontal plane as depicted on a floor plan.

A1.4.5 Stair landings shall not count as floor area, but as part of the stair.

A1.4.6 The finished surface of a wall normally consists of gypsum wallboard, glass, plaster, concrete, brick, or masonry units. Special wall materials used to surface a wall are furring strips, paneling or casework, tile, mirrors, and any materials referred to as “wall coverings” or “window coverings” that are applied over base building finished walls or windows.

A1.4.7 The finished surface of an exterior window shall be the glass surface that is in direct contact with the interior environment of the building.

A1.4.8 The finished surface of a floor is the top of a deck, typically concrete or wood, without special surfacing materials that are applied over the base building finished floor, such as carpeting, tile, resilient flooring, or any materials referred to as “floor coverings.”

A1.4.9 The finished surface of a ceiling is typically the underside of acoustical tile, plaster, gypsum, wallboard, or similar surface. In the absence of a continuous ceiling surface, measurement to the finished surface of the ceiling shall be to

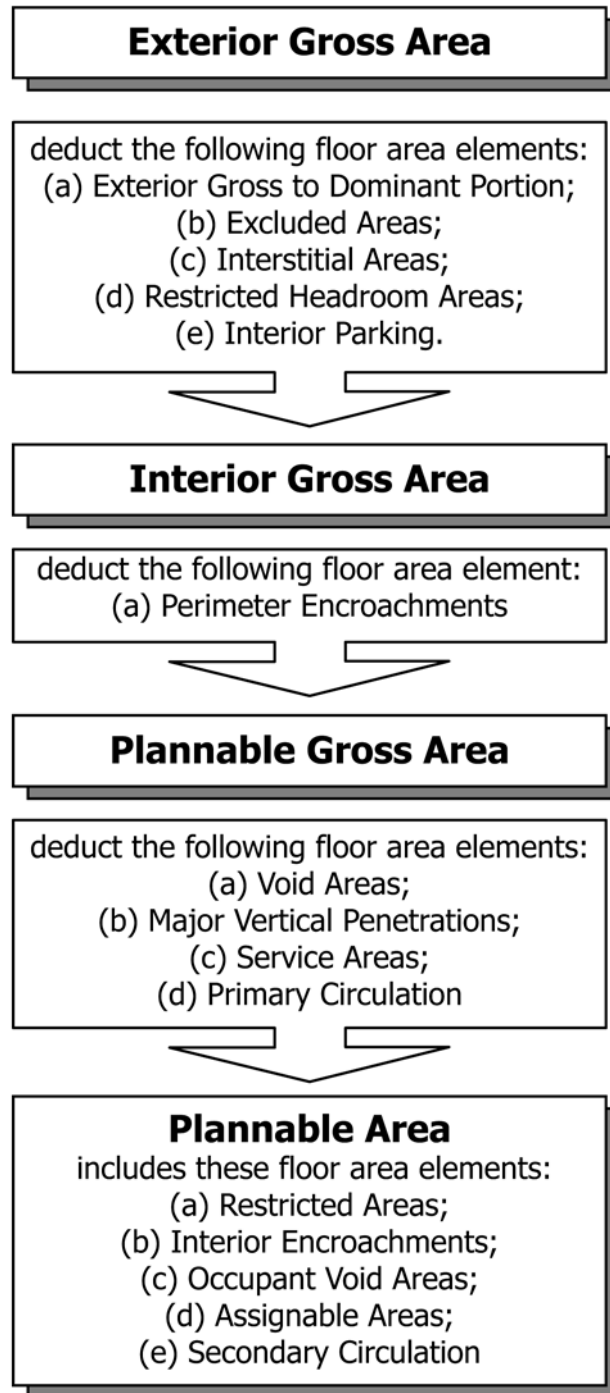


FIG. A1.1 Floor Area Relationships

the bottom of any suspended ceiling grid, or, if no ceiling grid exists, to the lower of (1) the underside of exposed building structure elements or (2) the lowest general level of the bottom of light fixtures (not including up-lighting), air diffusers, sprinkler heads or similar base building fixtures that are suspended below the underside of building structural elements, or (3) the typical ceiling height established by the intended building design; provided that a finished ceiling height as designed does not create a restricted headroom condition.

A1.4.10 Restricted headroom is typically 2.0 to 2.3 m [6.5 to 7.5 ft] or less. This category is primarily intended to exclude large areas such as low attics and crawlspaces from being defined as “floors.” It also establishes, in a sloped ceiling attic or sloped exterior wall, where the effective outer wall is located. The category of restricted headroom does not apply to places with reduced or no headroom conditions (that is, walls, columns, stairs, door headers, limited piping, railings, alcoves,

and so forth) typically found on a floor, unless they are part of an overall restricted headroom condition.

A1.4.11 *Exterior Gross Area—Measured Elements:*

A1.4.11.1 Exterior Gross to Dominant Portion—Building exterior gross area is the sum of the floor areas on all levels of a building that are totally enclosed within the building. When users of this practice also use the ANSI/BOMA standard, measure building exterior gross area to the outside face of exterior walls, disregarding canopies, cornices, pilasters, buttresses, balconies that are not fully enclosed and that extend beyond the wall face, and courtyards that are enclosed by walls but have no roof. A balcony that is not fully enclosed is not included in the exterior gross area even if it does not extend beyond the line of the outside wall face. The building gross area of basement space includes the area measured to the outside face of basement or foundation walls.

(1) If Property Line is Within a Building—If the property line lies within a building wall that is common with an adjoining building, measure the building exterior gross area to the property line. If the property line does not lie within a building wall but the wall is structurally common with an adjoining building, measure building exterior gross area to the center of the structural portion of the common wall.

A1.4.11.2 Exterior Bridges and Tunnels—Exterior tunnels bridges and tunnels which are totally enclosed constructed areas connecting two or more buildings are included in the interior building gross area but are not included in the gross plannable area. Assign exterior bridges and tunnels to one building or apportion between buildings.

A1.4.11.3 Excluded Areas—Measure each excluded area. While excluded areas may meet the criteria of adequate clear headroom, if there is owner/landlord documentation that indicates that these areas are to be excluded from the gross interior floor area calculations then measure each excluded area and deduct from the exterior gross area. Examples of excluded areas include, but are not limited to, unfinished attic areas, attic areas with obstructed access, damp or flooded basements, and confined areas requiring permission for entry. Areas temporarily unusable due to flood, fire damage, construction, or renovation activity are *not* excluded areas.

A1.4.11.4 Interstitial Areas—Measure the areas of load-bearing surfaces that are located above or below occupied building floors and that are not available for general occupancy.

A1.4.11.5 Restricted Headroom Areas—Measure each restricted headroom area. These are large portions of a floor that do not have sufficient clear, unobstructed headroom to conform to local building codes or that has headroom less than that required for occupancy, typically 2.0 to 2.3 m [6.5 to 7.5 ft].

A1.4.11.6 Interior Parking—Interior parking that is totally enclosed within the building is included in exterior gross area but is not included in the gross plannable area.

A1.4.12 *Interior Gross Area—Measured Elements:*

A1.4.12.1 This practice can be used to determine the Interior Gross Area, which will be consistent with the measurement methodology within the ANSI/BOMA Z65.1–1996 Standard. To facilitate use of both standards, measure and calculate the

total floor area taken up with perimeter encroachments while determining the interior gross area.

A1.4.12.2 Perimeter Encroachments—Measure the base building elements or restricted areas that are located inside the dominant portion of a building on the outer wall and that prevent the use of the floor area for furniture, equipment, circulation or other occupant function. (Dominant Portion is defined in ANSI/BOMA Z65.1–1996.¹⁵) Perimeter encroachments include but are not limited to: (1) window sills; (2) building projections such as convector, baseboard heating unit, radiator, or other building element that is located in the interior of a building and adjacent to a perimeter building wall that prevents the use of that space for furniture, equipment, circulation, or other functions; (3) horizontal floor area between adjacent encroachments where such area is 300 mm [12 in.] or less (such as the distance between a perimeter column and adjacent curtain wall HVAC distribution device); (4) structural columns located on the perimeter of the building or within 300 mm [12 in.] or less of the inside finished surface of the perimeter wall.

A1.4.12.3 Figs. A1.2–A1.5 each demonstrates how to measure perimeter encroachments. Each figure shows a different combination of building features at a perimeter wall.

A1.4.12.4 The first example in **Fig. A1.2** illustrates a perimeter encroachment at a windowsill. Measure the area of the encroachment from the inside face of the dominant portion to the inside face of the exterior building wall.

A1.4.12.5 In **Fig. A1.3**, a building structure component such as a radiator protrudes into the floor area. Measure the area of the encroachment from the inside face of the dominant portion to the interior face of the protruding encroachment.

A1.4.12.6 Fig. A1.4 is an example of an encroachment due to a distribution system for heating, ventilating, or air conditioning (HVAC). Measure the area of the encroachment from the inside face of the dominant portion to the inside face of the HVAC radiator.

A1.4.12.7 The example in **Fig. A1.5** demonstrates another type of HVAC distribution system. This HVAC system is a tube on the floor that is adjacent to the wall. Measure the area of the encroachment from the inside face of the dominant portion to the inside face of the HVAC tube.

A1.4.13 *Plannable Gross Area—Measured Elements:*

A1.4.13.1 Plannable gross area excludes perimeter encroachments since they prevent the placement of the occupant's furniture and equipment.

A1.4.13.2 Measure each of the floor area elements within the Plannable Gross Area, when such floor area elements are totally enclosed within the building. Note and report each exception to the measurement rules when calculating and reporting area measurement.

¹⁵ In the 1996 edition, which is copyright by BOMA, the dominant portion is defined as the inside face of the portion of the wall which is window glass where it is more than 50 % of the vertical distance from finished floor to finished ceiling, and elsewhere is the inside face of the outside wall, or of a pilaster or column attached to the outside wall where they occur. Note that the reader is cautioned that ANSI/BOMA Z65.1–1996 is developed by and subject to the authority of BOMA International, which may change it from time to time at its sole option. It is not defined as a part of this ASTM standard.

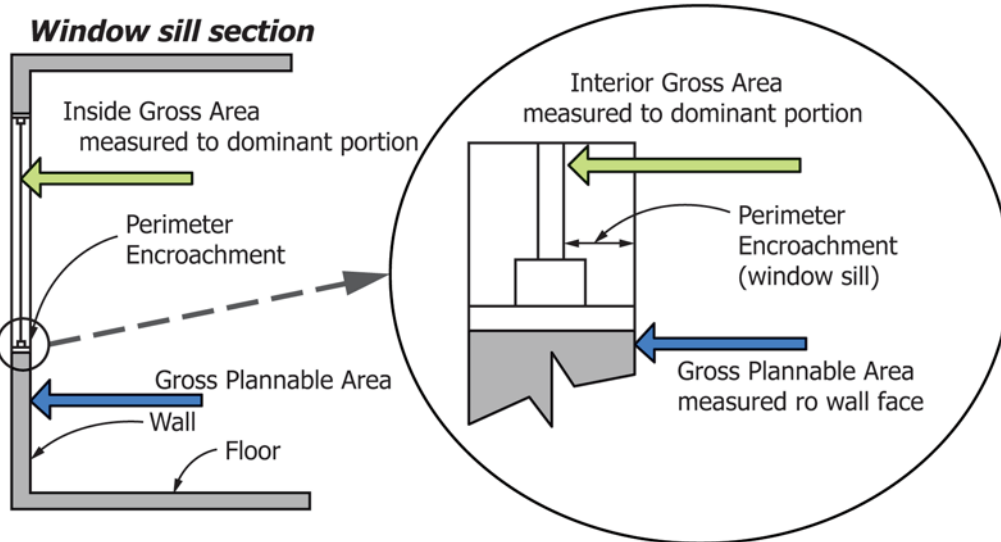


FIG. A1.2 Perimeter Encroachment at a Window Sill

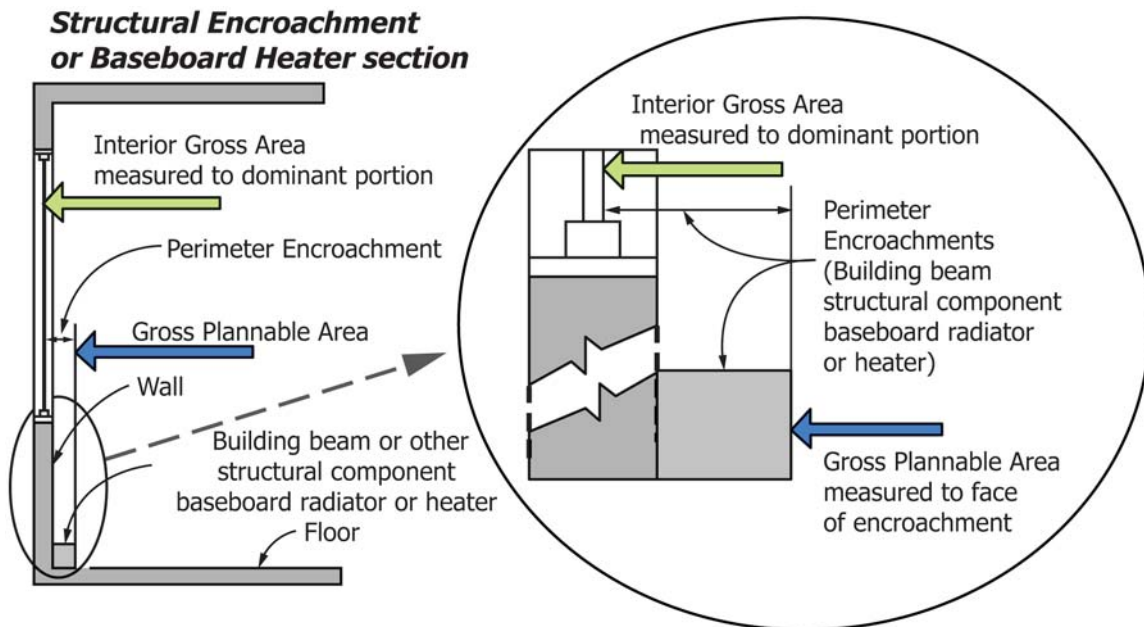


FIG. A1.3 Structural Encroachment or Baseboard Heater Section

A1.4.13.3 Major Vertical Penetrations—Measure major vertical penetrations such as stairs, elevator shafts, flues, pipe shafts, vertical ducts, and include their enclosing walls. Stairs and elevator shafts shall be considered major vertical penetrations for all affected floors, even the lowest level at which they originate. The floor area under stairs and elevators is included in the area of the major vertical penetration and when there is no enclosing wall the vertical penetration is measured to the nose of the tread of the first step (the back edge of the landing). Do not measure a major vertical penetration if the area of the major vertical penetration is less than 0.1 m² [1 ft²]. Major vertical penetrations do not include stairs, dumbwaiters, and lifts that do not serve a general building circulation function but exclusively serve a specific tenant.

A1.4.13.4 Void Areas—Measure only the lowest floor of a multi-story void, such as an atrium, light well, or lobby. Include the area of the enclosing walls or partial height walls or railing in this measurement. If there are no enclosing walls or partial height walls or railing then measure to the edge of the floor slab. Note that major vertical penetrations, by definition, are not void areas.

A1.4.13.5 Service Areas and Amenity Areas—Measure “Service Areas” and “Amenity Areas” that are located within the plannable gross area. Service areas are the portions of a building that provide services that enable an occupant or occupants to work in a building. Without service areas, it is impossible to accommodate occupants within a building without violating existing building codes and occupancy controls,

Convactor, Air Handling Unit or large sill section

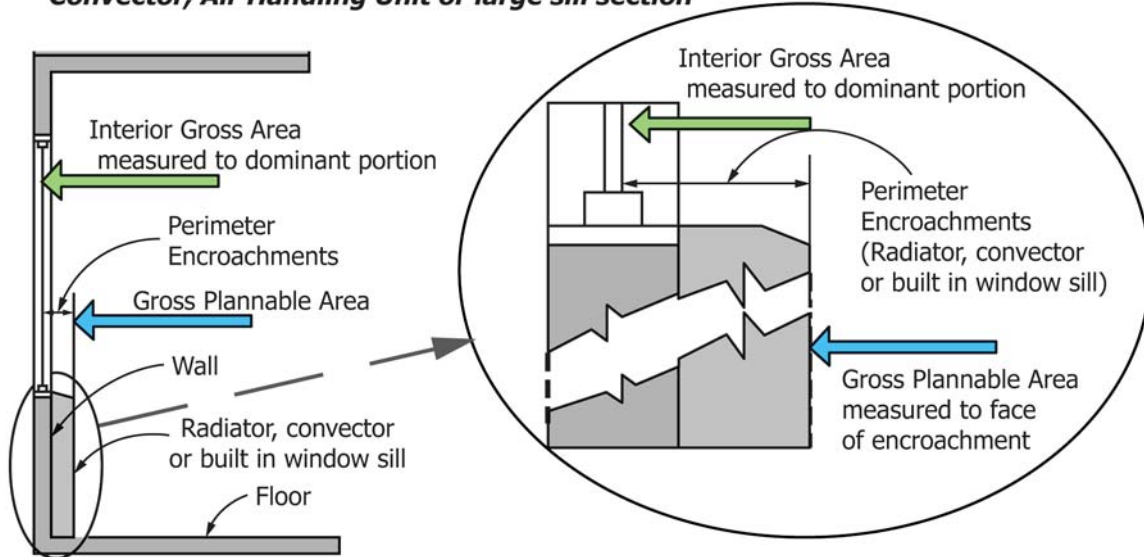


FIG. A1.4 Perimeter Encroachment Radiator, Convactor, or Built In Window Sill

Section including a HAVC element located away from the wall restricting the use of space

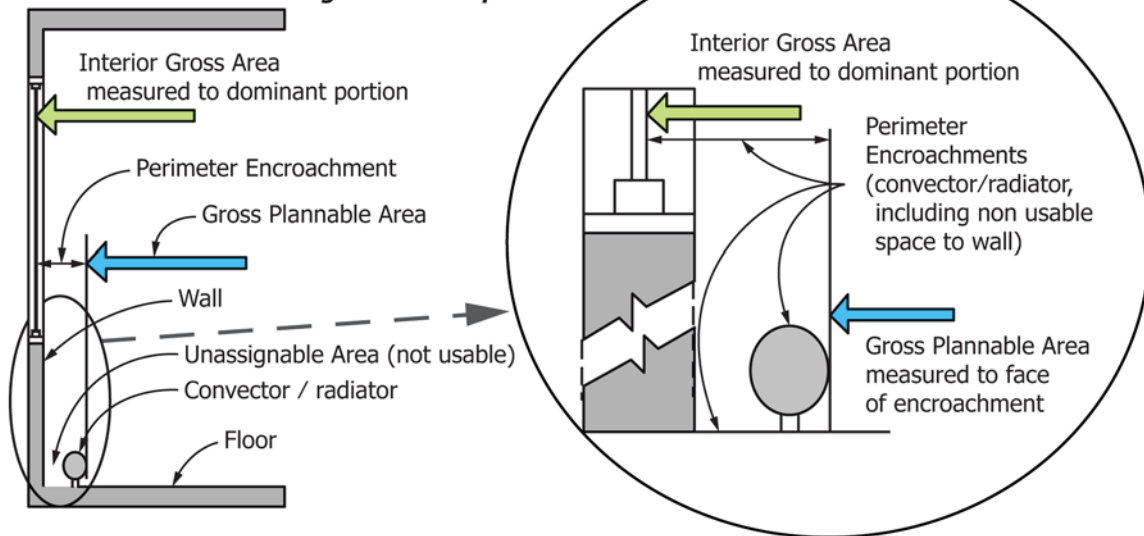


FIG. A1.5 HVAC Element is Located Away from Wall Restricts Use of Floor Area

or both. Service areas do not include areas that meet tenant/occupant specific accommodations or requirements. Amenity areas are the portions of a building that do meet tenant/occupant specific accommodations or requirements by providing additional services (in addition to service areas) to an occupant or occupants of a building or group of buildings. Generally, occupancy codes and regulations do not govern amenity areas, although there may be codes and regulations that relate to their specific uses.

(1) Note that parking, loading docks outside the building line, major vertical penetrations and any space outside the exterior enclosing walls of a building that is not fully enclosed, are neither service areas nor amenity areas.

(2) Service areas and amenity areas share four possibilities for allocation—both types can be allocated to all occupants of

the floor where the area is located, *or* to a limited group of occupants within a campus, building, or floor, *or* to all occupants in a building, *or* to all occupants of a campus. This allocation model makes it possible to identify four subcategories for both service areas and amenity areas:

(3) “Floor Service Areas” or “Floor Amenity Areas” are the portions of a building that provide services to only the occupant or occupants of a floor. An example of a floor service area is an on-floor electrical closet. An example of a floor amenity area is a floor-shared conference room that is not assigned to specific tenants/occupants.

(4) “Limited Service Areas” or “Limited Amenity Areas” are the portions of a building that provide services to the occupant or occupants of less than one floor, less than the entire building, or less than the campus. An example of a “limited

service area is an on-floor fan room that supports both the floor on which it is located and the floor below. An example of a limited amenity area is a conference facility serving specific tenants of a building.

(5) “Building Service Areas” or “Building Amenity Areas” are portions of a building that provide services or amenities to all occupants of a building or to all floors in a building. Common examples of building service areas include a ground floor entry lobby, auxiliary ground floor lobbies and exits, life-safety equipment areas such as fire-command centers, fully enclosed mechanical rooms, trash areas, receiving rooms and loading docks inside the building line. Examples of building amenity areas include: concierge and security desks; conference centers; lounges or vending areas; exercise, shower, and locker rooms; and mail rooms.

(6) “Campus Service Areas” or “Campus Amenity Areas” are portions of any building on a campus that provides services to all occupants or all buildings on the campus. Examples of campus service areas include fully enclosed walkways, bridges, or tunnels that connect multiple buildings, and mechanical plants that serve the campus. Typical examples of campus amenity areas include auditoriums, conference centers, cafeterias, and security facilities.

A1.4.13.6 Primary Circulation—Measure the reasonable minimum path of primary circulation that is necessary on a floor for access to egress stairs, elevator lobbies, toilet rooms, refuge areas, building lobbies, and entrances. This reasonable minimum path of primary circulation shall take tenant/occupant space configuration into consideration.

(1) Primary circulation may vary over time, for example, as space configurations change and from floor-to-floor (depending on the number of tenant/occupant groups on a floor). Circulation required to access rooms or closets for building electrical, building mechanical, and building telephone and data equipment when access to such rooms or closets is not dedicated to the use of a single tenant shall be considered primary circulation.

(2) Reasonable minimum path is defined with a width that is normal (either typical or designed) for the building. If unable to define what is normal for the building then use what is customary in the market place.

(3) Bridges and tunnels that do not meet this definition but that cannot be readily used for other purposes are considered part of primary circulation.

(4) Access to tenant telephone closets is not included in primary circulation area.

(5) Primary circulation does not necessarily include all circulation required for life safety access and egress. However, if dedicated circulation required for egress can serve no normal secondary circulation function, it shall be considered primary circulation.

(6) In space layouts where several alternative circulation routes connect stairs, elevators, toilet rooms, and entrances, one route should be designated as primary circulation with the remaining circulation routes designated as secondary circulation. This differentiation is important to ensure validity of measurements for comparison purposes.

(7) Primary circulation may differ from “Base Building Circulation,” since the path of primary circulation will reflect the actual tenant/occupant fit-up of the floor. Local regulations may apply and extend base building circulation to provide access to life safety equipment. Bridges and tunnels that cannot be readily used for other purposes are considered part of base building circulation. The width of the path is established by typical or designed path widths for the building and is often wider than the width required by code/regulation.

A1.4.14 Plannable Area—Measured Elements:

A1.4.14.1 Restricted Areas—Restricted areas are typically associated with maintenance of building systems that are adjacent to windows or with smoke evacuation requirements and are usually recorded in a governing document, for example, a lease agreement. Measure the floor area that would normally be available for use by an occupant if the governing document or regulatory authority did not restrict the occupant from using that portion of floor area.

A1.4.14.2 Interior Encroachments—Measure the floor area taken up by interior encroachments. Interior encroachments include, but are not limited to, the areas occupied by interior structural elements. Examples of interior encroachments are: (1) columns; (2) structural walls; (3) earthquake bracing; and (4) horizontal floor area between adjacent encroachments (where this distance is 300 mm [12 in.] or less); for example, the distance between two columns that are located beside each other, but not connected to each other.

A1.4.14.3 Occupant Void Areas—Measure all openings in the floor created for the specific benefit of an occupant. If an opening in the floor could be available for occupant use by re-installing the missing floor, then it is not a service area. Note that an occupant void area may be part of the original building design or it may be created later by removing a portion of the floor. Examples of occupant void areas are private elevators, communicating stairs within tenant premises, and the opening in the occupant’s floor(s) above for multi-story-height ceilings.

A1.4.14.4 Assignable Areas—Assignable area includes interior walls and interior encroachments. It does not include restricted areas, occupant void areas, unassignable areas, or secondary circulation. Users may choose to measure interior encroachments, and if measured, interior encroachments such as secondary circulation area are generally prorated back to the occupant(s), for example, not directly assignable. Record and note whether interior encroachments were measured and whether prorated or assigned when reporting floor area measurements.

A1.4.14.5 Unassignable Areas—Measure the portion of the plannable area on a floor that is not assigned to occupant groups or functions, for example, floor area that is unassignable. Unassignable area includes all plannable area that cannot be classified as assignable area, restricted area, occupant void, interior encroachment, or secondary circulation. Examples of unassignable area are (1) small areas between furniture panels and columns where furniture does not fit, and (2) floor area set aside to install future workstation(s).

A1.4.14.6 Secondary Circulation Areas—Measure all secondary circulation areas, for example, the portion of a floor required for access to some subdivision of a floor when it does

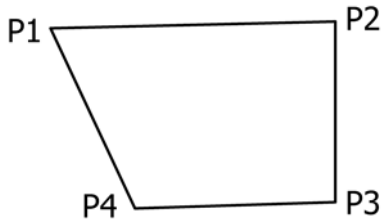


FIG. A1.6 Polygon is Created by Joining the Boundary Lines

not serve all occupants on a floor and when it has not been defined as primary circulation area.

A1.4.14.7 Walls or furniture panels may or may not surround secondary circulation area.

A1.4.14.8 Secondary circulation can be delineated and measured, or it can also be calculated and prorated to all occupants on a floor.

A1.4.14.9 To simplify chargeback to occupants some practitioners may choose to include unassigned areas within secondary circulation. This is not recommended because this exception to the practice can distort the percentage of secondary circulation. Note and record when unassigned area is included within secondary circulation area.

A1.4.15 Placement of Boundary Lines:

A1.4.15.1 Accurate measurement depends upon (1) determining the correct placement of boundary lines between adjacent elements of floor area, and (2) measuring the floor area elements in a specific order.

A1.4.15.2 To measure a floor area element, draw the boundary lines around the floor area. Connect each boundary line to form a polygon. These connected boundary lines (between P1, P2, P3, and P4) now enclose an area of the floor, as demonstrated in Fig. A1.6. In practice, Computer Aided Design—

Computer Aided Facilities Management (CAD-CAFM) software is typically used to draw polygons and automatically calculate the floor area enclosed within each polygon.

A1.4.15.3 To ensure proper placement of boundary lines, draw each boundary line so that all of the floor area being measured is defined and so that no floor area is measured or counted more than once.

A1.4.15.4 Draw boundary lines so that all of the floor area that is to be measured is enclosed within a single polygon.

A1.4.15.5 Do not overlap the boundary line of one polygon with the boundary line of another polygon. Fig. A1.7 shows correct placement with no-overlap and incorrect placement in which two polygons overlap.

A1.5 Sequence of Measurement Determines Boundary Line Placement

A1.5.1 The matrix in Fig. A1.8 uses the categories and elements of floor area identified in Section A1.3, with an identical sequence of categories and elements arrayed on both the x-axis and y-axis of the matrix.

A1.5.2 Use the matrix in Fig. A1.8 to determine the correct sequence of measurement and to determine the correct placement of boundary lines. The sequence of elements is ordered by *wall priority* to enable the correct placement of boundary lines between adjoining elements (as previously described in A1.4.15).

A1.5.3 Depending on the element of floor area to be measured a polygon will be drawn so that it either (1) includes all of the floor area taken up by its enclosing walls, *or* (2) includes part of the floor area taken up by its enclosing walls (the boundary line is drawn at the centerline of the wall), *or* (3) excludes the floor area taken up by its enclosing walls.

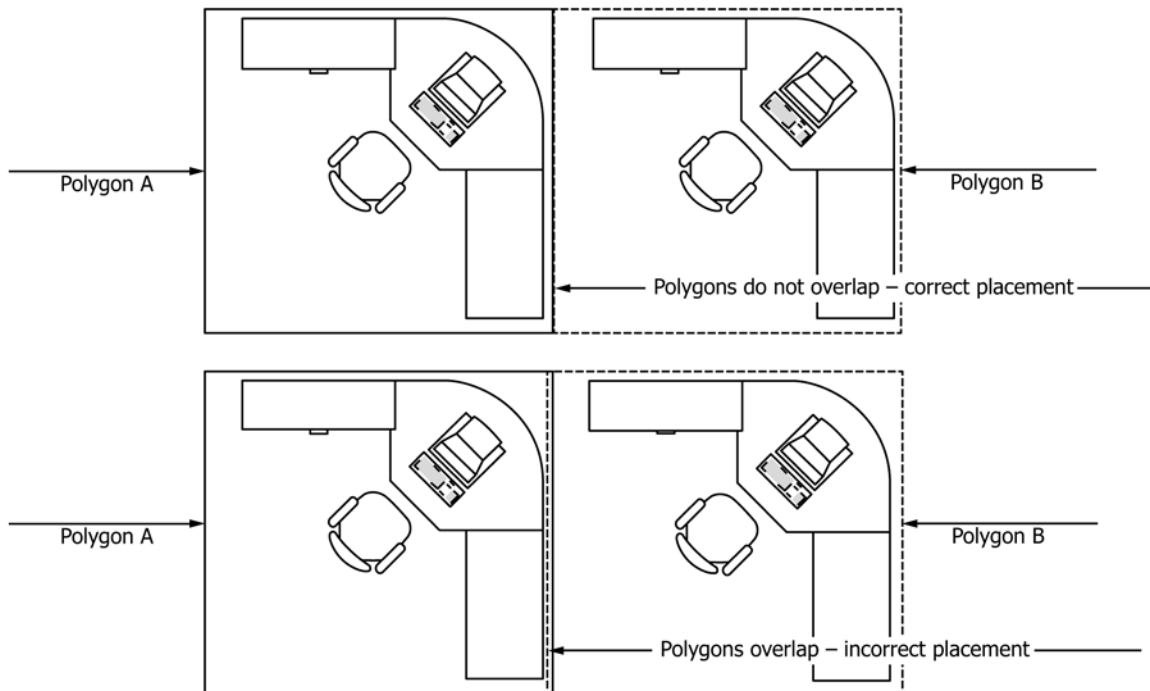


FIG. A1.7 Avoid Overlapping Polygons when Drawing Boundary Lines between Adjacent Floor Areas

Key to Measurement Rules for Facility Management

D1 = Defined boundary - Dominant Portion
D2 = Defined Boundary - Perimeter Encroachment and Plannable Gross Area
C = Measure area to the centre line of its enclosing walls
W = Measure area and include its enclosing walls
F = Measure area to the face of the finished surface of the adjacent area
OPT = Optional (Measurements needed for the ANSI BOMA Standard Z65.1)
N/A = Not applicable

Interior Gross Area	Dominant Portion		OPT	OPT	D1	D1	D1	D1	D1	N/A	D1	D1	D1	D1		
	Perimeter Encroachment		OPT	OPT	D1	D1	D1	D1	D2	D2	D2	D2	D2	D2		
	Plannable Gross Area	Major Vertical Penetration		D1	D1	C	W	W	W	W	W	W	W	W	W	
		Void Area		D1	D1	F	C	W	W	W	W	W	W	W	W	
		Service Area		D1	D1	F	F	C	W	W	W	W	W	W	W	
		Primary Circulation		D1	D1	F	F	F	C	W	W	W	W	W	W	
		Plannable Area	Restricted Area		D1	D2	F	F	F	F	C	W	W	W	W	W
			Interior Encroachment		N/A	D2	F	F	F	F	F	C	W	W	W	W
			Occupant Void Area		D1	D2	F	F	F	F	F	F	C	W	W	W
			Assignable Area		D1	D2	F	F	F	F	F	F	F	C	W	W
			Unassignable Area		D1	D2	F	F	F	F	F	F	F	F	C	W
Secondary Circulation			D1	D2	F	F	F	F	F	F	F	F	F	C	C	

FIG. A1.8 Matrix Provides the Rules for Measurement

A1.5.4 Note that where a polygon is drawn around an element of floor area and where the polygon includes the enclosing walls of this element, subsequent measured adjacent areas may not include these same walls.

A1.5.4.1 The left-hand column (y-axis) provides the correct order of measurement. Read the left-hand column from *top to bottom* and measure elements of floor area in this same order. For example, first measure the dominant portion, and then measure the perimeter encroachments. After measuring perimeter encroachments, measure the major vertical penetrations, followed by void areas, and so on.

NOTE A1.1—Measuring out-of-order or in the opposite order will result in incorrect measurements.

A1.5.5 Fig. A1.9 demonstrates (1) the correct order of measurement and (2) the correct placement of boundary lines between adjacent elements of floor area.

A1.5.6 To determine the correct placement of boundary lines between adjacent elements of floor area, *read the matrix from top to bottom and from left to right*. (1) Scan down the left-hand column (y-axis) of the matrix to locate the category of area to measure. (2) Scan across the top row of the matrix (x-axis) from left to the right and find the category of area that

is physically adjacent to the area to be measured. (3) Find the cell in which this row and column intersect.

A1.5.7 The cell at this intersection contains one of the keys that indicate where to place the segment of the polygon line that will become the boundary line between these two adjacent areas:

A1.5.8 Each intersecting cell contains one of the following seven keys that indicate how to place the boundary line of the polygon around the floor area that is to be measured:

A1.5.9 “D1” denotes “Dominant Portion”—When an intersecting cell contains “D1” measure the floor area to the dominant portion. For further information, refer to the current ANSI/BOMA Z65.1–1996 Standard for a full definition and discussion of dominant portion.

A1.5.10 “D2” denotes “Perimeter Encroachment/Plannable Gross Area”—Measuring perimeter encroachments is an option. If Interior Gross Area and perimeter encroachments are measured, deduct the total floor area taken by perimeter encroachments from the Interior Gross Area to determine the Gross Plannable Area. This, however, is not required for space management. Instead, measure the Gross

Key to Measurement Rules for Facility Management		Interior Gross Area											
D1 = Defined boundary - Dominant Portion		Plannable Gross Area											
D2 = Defined Boundary - Perimeter Encroachment and Plannable Gross Area		Plannable Area											
C = Measure area to the centre line of its enclosing walls		Dominant Portion	Perimeter Encroachment	Major Vertical Penetration	Void Area	Service Area	Primary Circulation	Restricted Area	Interior Encroachment	Occupant Void Area	Assignable Area	Unassignable Area	Secondary Circulation
W = Measure area and include its enclosing walls													
F = Measure area to the face of the finished surface of the adjacent area													
OPT – Optional (Measurements needed for the ANSI BOMA Standard Z65.1)													
N/A – Not applicable													
Interior Gross Area	Dominant Portion	OPT	OPT	D1	D1	D1	D1	D1	N/A	D1	D1	D1	D1
	Perimeter Encroachment	OPT	OPT	D1	D1	D1	D1	D2	D2	D2	D2	D2	D2
	Major Vertical Penetration	D1	D1	C	W	W	W	W	W	W	W	W	W
	Void Area	D1	D1	F	C	W	W	W	W	W	W	W	W
	Service Area	D1	D1	F	F	C	W	W	W	W	W	W	W
	Primary Circulation	D1	D1	F	F	F	C	W	W	W	W	W	W
	Restricted Area	D1	D2	F	F	F	F	C	W	W	W	W	W
	Interior Encroachment	N/A	D2	F	F	F	F	F	C	W	W	W	W
	Occupant Void Area	D1	D2	F	F	F	F	F	F	C	W	W	W
	Assignable Area	D1	D2	F	F	F	F	F	F	F	C	W	W
Plannable Area	Unassignable Area	D1	D2	F	F	F	F	F	F	F	F	C	W
	Secondary Circulation	D1	D2	F	F	F	F	F	F	F	F	F	C

FIG. A1.9 How to Use the Matrix

Plannable Area directly by drawing a polygon to the face of each perimeter encroachment. The area within the resulting polygon will be the Gross Plannable Area.

A1.5.11 “C” denotes “Centerline”—Draw the boundary line of the polygon to enclose an area and include only *part* of its enclosing walls (for example, to the centerline of enclosing walls). Normally, the *centerline* of a wall is the line that is equidistant from the finished outer face of the wall, parallel to the horizontal direction of the wall. To determine the outer face of a wall ignore architectural features such as trim, pilasters, and niches. For example, where one assignable area is adjacent to another assignable area, use the centerline method and draw the polygon so that the boundary line between the two assignable areas includes a portion of the wall that separates the two assignable areas. Note that in specific situations such as changes in wall thickness, for example, from a thick masonry wall to a thinner partition, continue the centerline through the center of each wall. This may require an adjustment (jog) in the line of the polygon. To measure an area with an enclosing double-wall or a thickened-wall measure to the centerline of the thickened- or double-wall. If a thickened-wall or double-wall was built as an accommodation to the user of the adjacent

area then draw the centerline through the original wall, for example, the boundary line is drawn as if a typical wall condition existed. If an adjacent area could remove a double-wall condition, draw the centerline through the original wall, ignoring the double-wall condition.

A1.5.11.1 “W” denotes “Enclosing Walls”—Draw the boundary line of the polygon to enclose an area and include its enclosing-walls.

A1.5.11.2 “F” denotes “Finished Surface”—Draw the boundary line of the polygon to the face of the finished surface of the adjacent area, for example, to exclude its enclosing walls.

A1.5.12 The example provided in Fig. A1.9 indicates that to measure an assignable area that is adjacent to a service area draw the polygon’s boundary line at the face of the finished surface of the adjacent service area. (Note that the intersecting cell contains the key, “F”.)

A1.5.13 When measuring in the sequence from top to bottom in Figs. A1.8 and A1.9, some of the floor area elements at the top of the list may be adjacent to some floor area elements that are lower in the list at left. Because of that,

boundary line placement may have already been determined by the polygons drawn around the previously drawn floor area elements.

A1.6 Sample Measurement

A1.6.1 The sample measurement that follows is demonstrated as follows:

A1.6.2 To measure a *Major Vertical Penetration*, first note that it is the third element listed in the matrix.

A1.6.3 Determine which element(s) area physically adjacent to the major vertical penetration.

A1.6.4 If an adjacent element is, such as an *Assignable Area*, is *lower* in the list of ordered elements do not include the

floor area of the wall between the assignable area and the major vertical penetration, because the floor area of the adjoining wall will have already been included within the polygon drawn around the major vertical penetration.

A1.6.4.1 If a *Major Vertical Penetration* adjoins an element that is *higher* in the list of elements, such as a defined boundary *D1 (Dominant Portion)*, the floor area of the major vertical penetration will not include the floor area of the adjoining exterior wall since the polygon is drawn to the boundary line established by the dominant portion (D1).

A1.6.4.2 If a *Major Vertical Penetration* is adjacent to another *Major Vertical Penetration*, (at the same level in the list), the boundary line between the two major vertical penetrations will be drawn at the centerline of the adjoining wall.

A2. QUESTIONS AND ANSWERS RELATED TO THE MEASUREMENT PROCEDURE

A2.1 Introduction

A2.1.1 **Annex A2** contains additional information related to the measurement procedure. Anticipate that **Annex A2** will be added to as users respond to this new standard practice and seek additional clarification.

A2.2 What is the Relationship Between Circulation and Service Areas/Amenity Areas?

A2.2.1 When a circulation area abuts a Service Area or Amenity Area that is located in the core of a building, the wall separating the two areas is included in the polygon of the Service Area/Amenity Area. This approach simplifies measurements of floor area in older buildings where telecommunication closets or janitor storage/slop sink closets were constructed as part of the building core. As demonstrated in **Fig. A1.1**, the walls surrounding the Service Area are included within the polygon of the Service Area, and not included in the polygon of the Circulation Area. This technique eliminates the need to draw a polygon around each small wall extension, (refer to the areas indicated by the arrows in **Fig. A2.1**) which would otherwise be needed because circulation areas are measured before Service Areas and Amenity Areas in the measurement hierarchy.

A2.3 How Does Base Building Circulation Differ from Primary Circulation?

A2.3.1 Building Circulation Area represents the minimum path necessary for access to egress stairs, elevators, toilet

rooms, refuge areas and building lobbies and entrances; ignoring tenant/occupant space configuration as represented in **Fig. A2.2**. The Base Circulation Area can be used to normalize floor load capacities and minimizes the variances that can occur over time in the BOMA R/U ratio. For further information, refer to the ANSI/BOMA Standard. Base Building Circulation Area remains constant throughout the life of the asset until a major renovation necessitates its update.

A2.3.2 Primary Circulation Area represents the reasonable minimum area required to connect the same building elements but is dependent on the tenant/occupant fit-up of the floor. The examples shown in **Figs. A2.3 and A2.4** represent the same floor with a common layout but different tenant/occupant grouping.

A2.3.3 *Circulation Applied in a Building Designed with a Remote Stair Location*—Circulation scenarios on a floor plate designed with remote stairs and washrooms requiring a circulation connection:

A2.3.3.1 **Fig. A2.5** represents the application of Base Building Circulation.

A2.3.3.2 **Figs. A2.6 and A2.7** represent actual Primary Circulation examples in the same building.

A2.4 Is “Millwork” a Base Building Encroachment?

A2.4.1 No, millwork is not a base building encroachment because it is installed for a tenant.

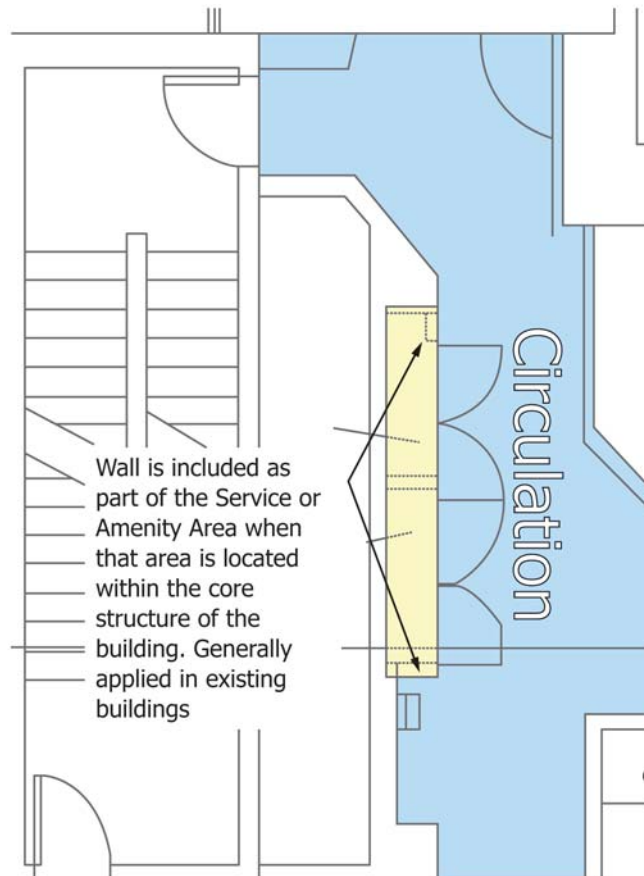


FIG. A2.1 Service/Amenity Area

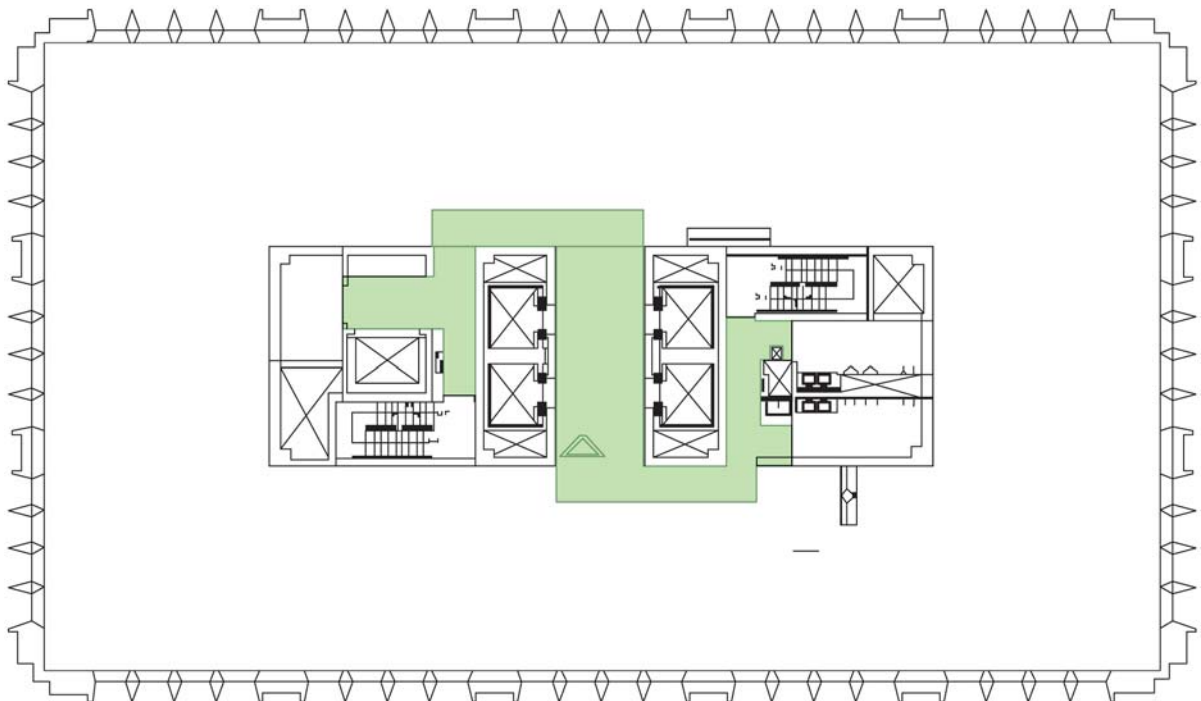


FIG. A2.2 Base Building Circulation (Shaded) Connecting Service Cores

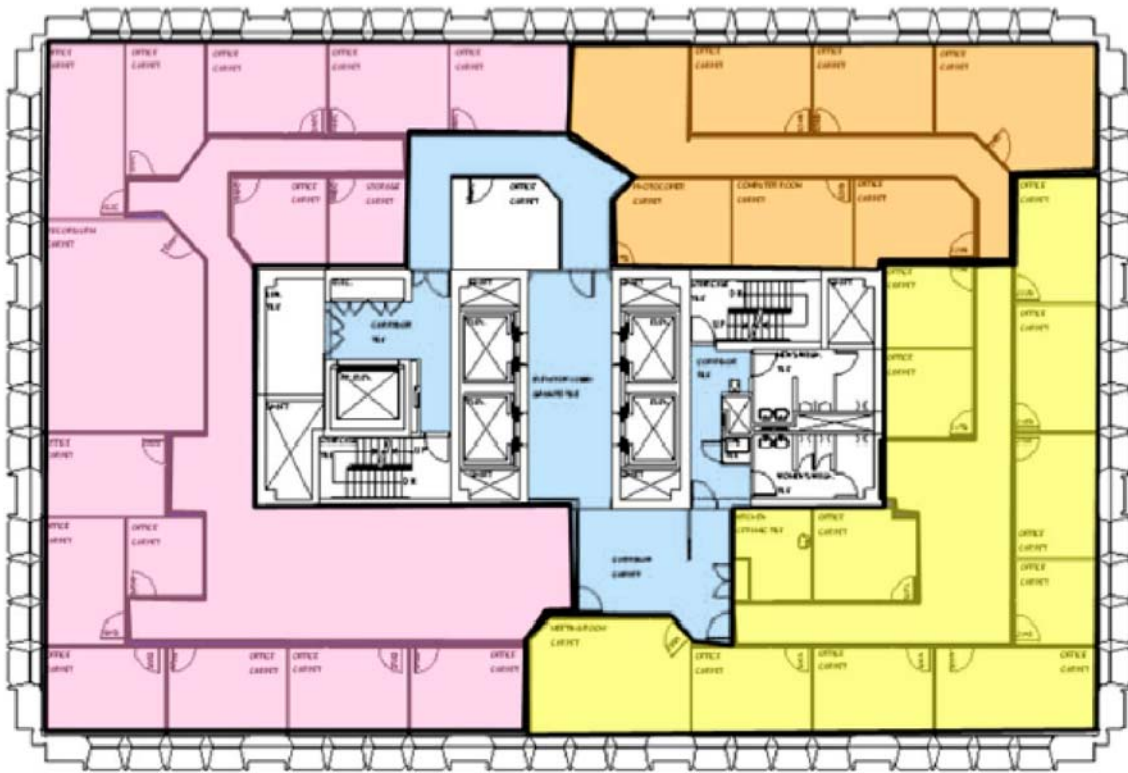


FIG. A2.3 Primary Circulation (Centermost Shaded) Where There are Three Large Tenants or Occupant Groups

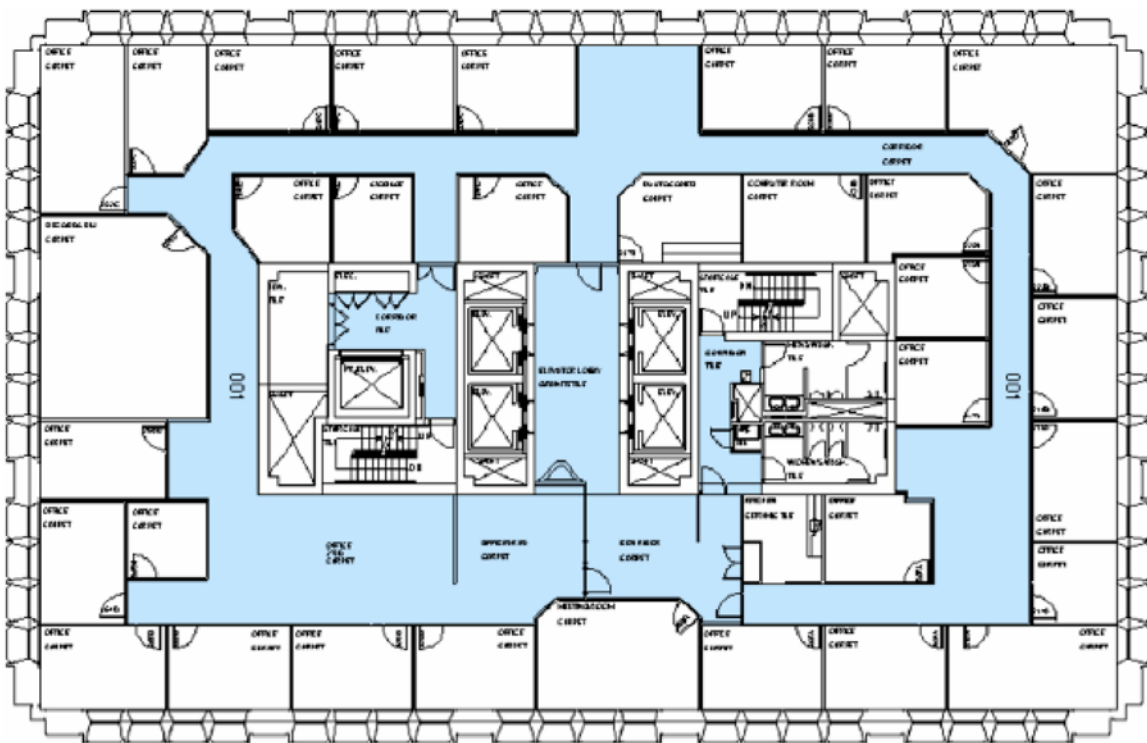


FIG. A2.4 Primary Circulation (Shaded) where Each Office Represents a Separate Tenant or Occupant Group

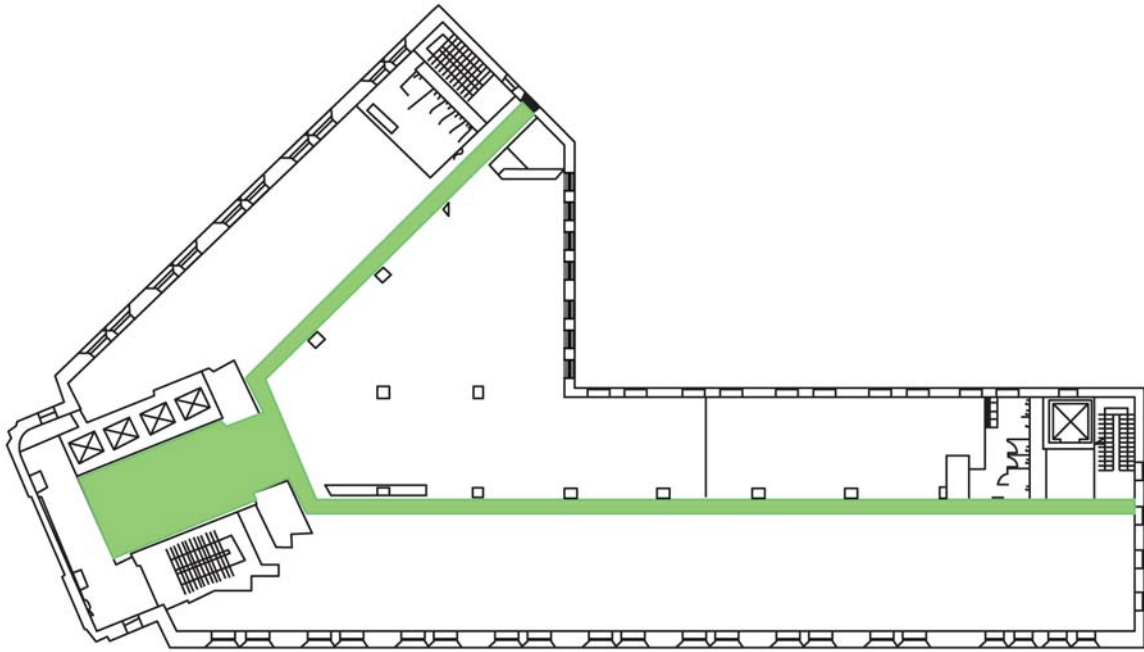


FIG. A2.5 Primary Circulation (Shaded) in Building with Remote Stairs

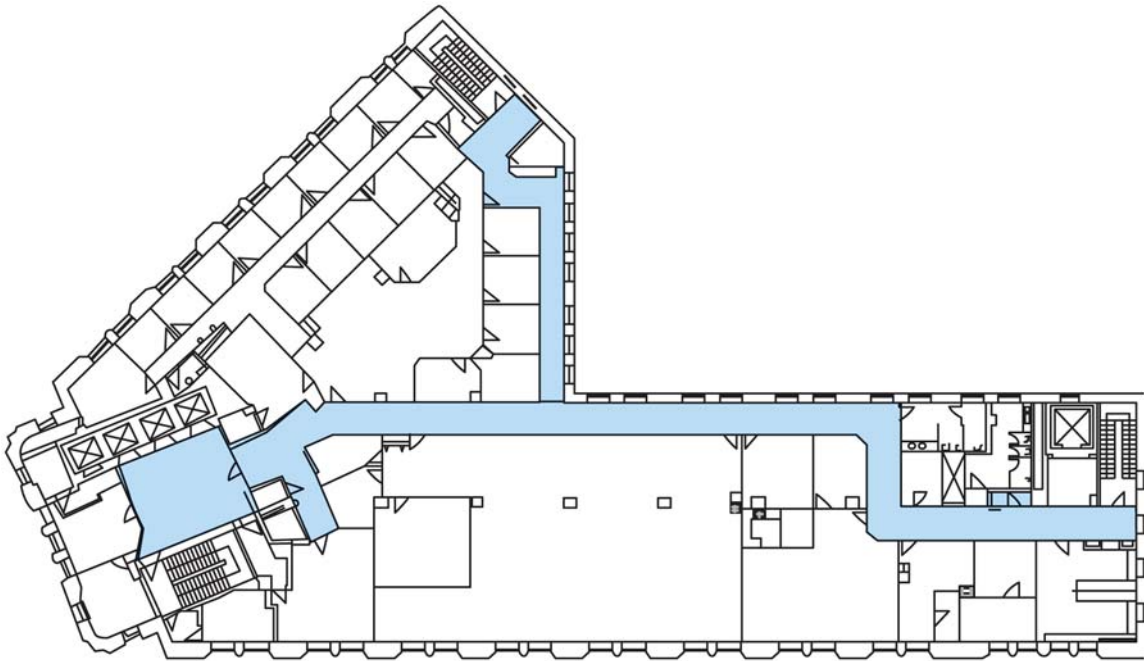


FIG. A2.6 Primary Circulation (Shaded) Existing Layout

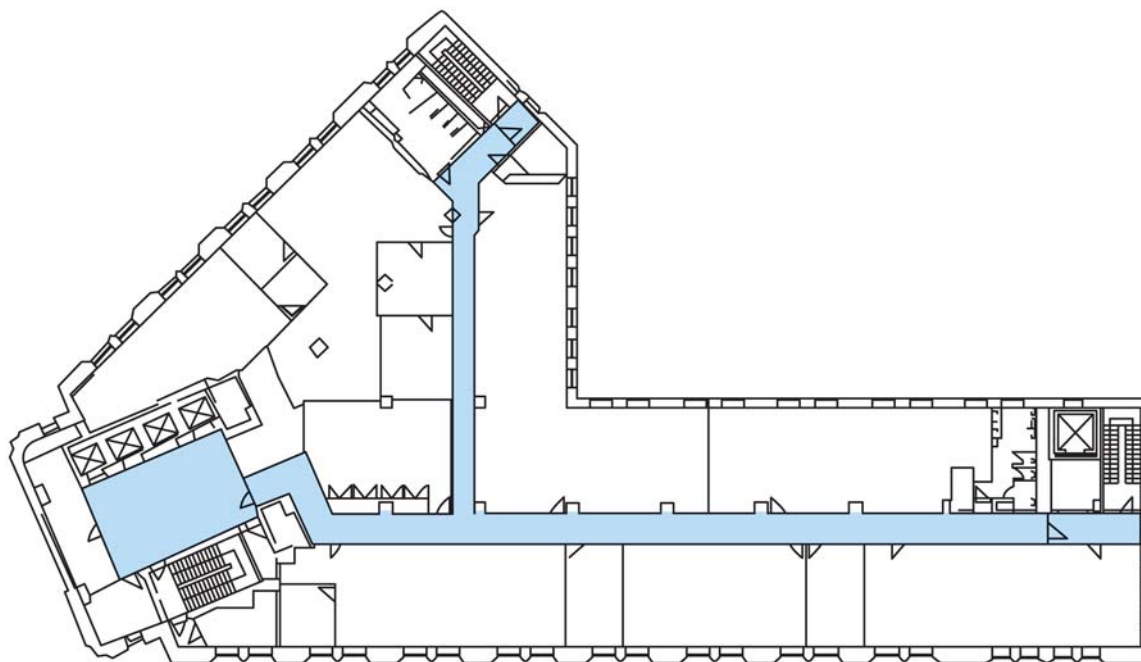


FIG. A2.7 Primary Circulation (Shaded) Existing Layout

ASTM International takes no position respecting the validity of any patent rights asserted in connection with any item mentioned in this standard. Users of this standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, are entirely their own responsibility.

This standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and if not revised, either reapproved or withdrawn. Your comments are invited either for revision of this standard or for additional standards and should be addressed to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing you should make your views known to the ASTM Committee on Standards, at the address shown below.

This standard is copyrighted by ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959, United States. Individual reprints (single or multiple copies) of this standard may be obtained by contacting ASTM at the above address or at 610-832-9585 (phone), 610-832-9555 (fax), or service@astm.org (e-mail); or through the ASTM website (www.astm.org). Permission rights to photocopy the standard may also be secured from the Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923, Tel: (978) 646-2600; <http://www.copyright.com/>