ANSI/ASHRAE/USGBC/IES Addenda a and b to

ANSI/ASHRAE/USGBC/IES
Standard 189.1-2009

Standard for the Design of High-Performance Green Buildings

Except Low-Rise Residential Buildings

A Jurisdictional Compliance Option of the International Green Construction Code™

Approved by the ASHRAE Standards Committee on June 26, 2010; by the ASHRAE Board of Directors on June 30, 2010; by the USGBC Board of Directors on June 5, 2010; by the IES Board of Directors on June 21, 2010; and by the American National Standards Institute on July 1, 2010.

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FOREWORD

This addendum changes the daylighting definitions to coincide with those in ASHRAE/IESNA Standard 90.1 to facilitate consistent use of these terms. Some changes are semantic, such as changing from daylight zone *to daylight* area *and changing from* adjacent to vertical fenestration *to* primary sidelight area*. For the daylight area under skylights and under roof monitors, geometric relationships between obstructions, heights, and distances from glazing are provided to allow daylight areas to extend beyond obstructions where appropriate. Clerestory was deleted since* roof monitor *sufficiently describes roof elements other than skylights. The changes to toplighting are not substantive but are proposed to utilize the same text as ASHRAE/IESNA Standard 90.1 to ensure consistent use.* Effective aperture *has been replaced with* sidelighting effective aperture*, again to coincide with ASHRAE/IESNA Standard 90.1. For background documentation on the analysis used to derive sidelighting effective aperture, refer to www.h-m-g.com/ASHRAE_Daylighting.*

Note: In this addendum, changes to the current standard are indicated in the text by underlining (for additions) and ~~strikethrough~~ (for deletions) unless the instructions specifically mention some other means of indicating the changes.

Addendum a to Standard 189.1-2009

Modify the Definitions section of the standard as follows.

Note: delete current Figures 3.1 through 3.5 and replace with those provided in this addendum.

daylight ~~zone~~area:

a. ~~***adjacent to vertical fenestration* (see Figure 3.1):** the area illuminated by vertical glazing, calculated as the daylit depth multiplied by the daylit width, where the daylit depth is the lesser of one window head height (head height is the distance from the floor to the top of the glazing) or the distance on the floor, perpendicular to the glazing, to the nearest 56 in. (1.4 m) or higher permanent partition; and the daylit width is the width of the window plus, on each side, either the distance to a 56 in. (1.4 m) or higher permanent partition or one half the distance to the closest *skylight, roof monitor, clerestory,* or *vertical fenestration*, or 2 ft (0.6 m), whichever is least. (See *skylight, roof monitor, clerestory, tubular daylighting device,* and *vertical fenestration*.)~~ ***primary sidelighted area* (See Figure 3.1)**: The total *primary sidelighted area* is the combined *primary sidelighted area* without double-counting overlapping areas. The floor area for each *primary sidelighted area* is directly adjacent to *vertical fenestration* in exterior wall with an area equal to the product of the *primary sidelighted area* width and the *primary sidelighted area* depth. The *primary sidelighted area* width is the width of the window plus, on each side, the smallest of:

1. 2 ft (0.6 m) or
2. the distance to any 60 in. (1.5 m) or higher vertical obstruction.

The *primary sidelighted area* depth is the horizontal distance perpendicular to the glazing which is the smallest of:

1. the distance from the floor to the top of the glazing or
2. the distance to any 60 in (1.5 m) or higher vertical obstruction.

b. ~~***under skylights and tubular daylighting devices* (see Figure 3.2):** the area illuminated by *skylights*, calculated by adding the rough opening of the *skylight* plus, in each~~

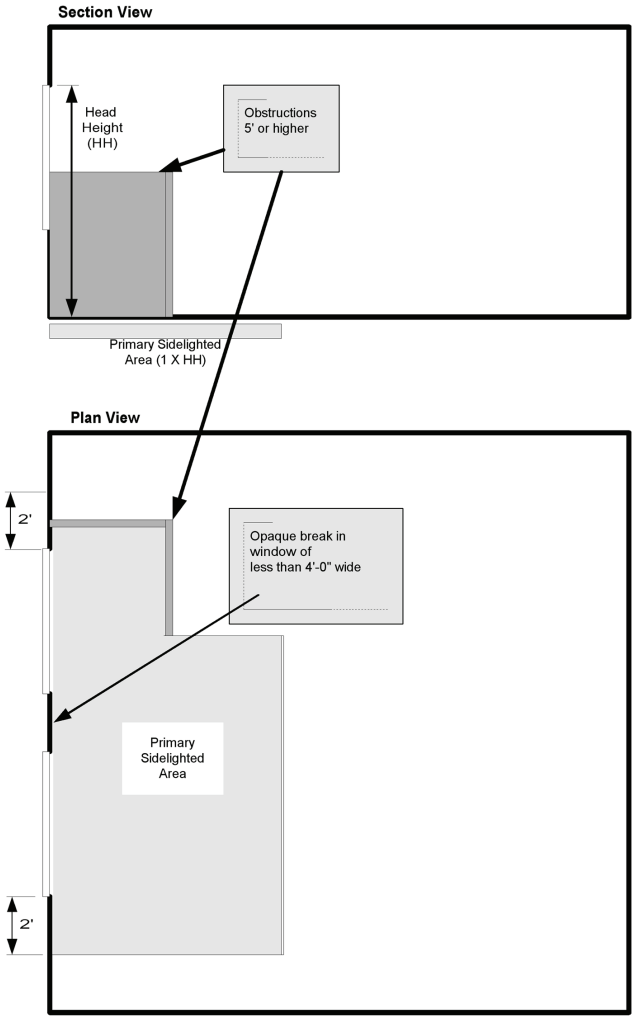

Figure 3.1 Section view and plan view of primary sidelighted area.

~~of the lateral and longitudinal dimensions of the *skylight*, the lesser of 70% of the floor to ceiling height, the distance to the nearest 56 in. (1.4 m) or higher permanent partition, or one half the horizontal distance to the edge of the closest *skylight*,*roof monitor*, *clerestory* window, *tubular daylighting device*, or *vertical fenestration*. (See *skylight, roof monitor, clerestory, tubular daylighting device,* and*vertical fenestration*.)~~. **_under skylight_ (see Figure 3.2):** The total *daylight area* under *skylights* is the combined *daylight area* without double-counting overlapping areas. The *daylight area* under *skylights* is bounded by the *skylight* opening, plus horizontally in each direction, the smallest of:

1. 70% of the ceiling height [0.7 × CH] or
2. the distance to any *daylight area* under *roof monitors* or
3. the distance to the front face of any vertical obstruction where any part of the obstruction is farther away from the nearest edge of the *skylight* opening than 70% of the distance between the top of the obstruction and the ceiling [0.7 × (CH – OH)].

where

CH ≡ the height of the ceiling at the lowest edge of the *skylight*

OH ≡ the height to the top of the obstruction

~~c. **_under clerestory_ (see Figures 3.3 & 3.5):** the area illuminated by *vertical fenestration* in a *roof monitor*, calculated by adding the rough opening of the *roof monitor* plus, in each of the lateral and longitudinal dimensions of the opening, the lesser of 70% of the floor to ceiling height, the distance to the nearest 56 in. (1.4 m) or higher permanent partition, or one half the horizontal distance to the edge of the closest *skylight*, *roof monitor*, *clerestory* window, or *vertical fenestration*. (See *skylight, roof monitor, clerestory, tubular daylighting device,* and *vertical fenestration*.)~~

c. ~~d.~~ **_under roof monitor_ (see Figures 3.3):** ~~the area illuminated by *vertical fenestration* in a *clerestory*, calculated as the daylit depth multiplied by the daylit width, where the daylit depth is the lesser of 70% of the floor to ceiling height, the distance to the nearest 56 in. (1.4 m) or higher permanent partition, or one half the horizontal distance to the edge of the closest *skylight*, and the daylit width is the length of the window plus the lesser of 70% of the floor to height, the distance to the nearest 56 in. (1.4 m) or higher permanent partition, or one half the horizontal distance to the edge of the closest *skylight*, *roof monitor*, *clerestory* window, or *vertical fenestration* in each longitudinal direction. (See *skylight, roof monitor, clerestory,* and *vertical fenestration*)~~ The total *daylight area* under *roof monitors* is the combined *daylight area* without double-counting overlapping areas. The *daylight area* under *roof monitors* is equal to the product of the width of the *vertical fenestration* above the ceiling level and the smallest of the following horizontal distances inward from the bottom edge of the glazing:

1. the vertical distance from the floor to the bottom edge of the monitor glazing or
2. the distance to the edge of any *primary sidelighting area* or

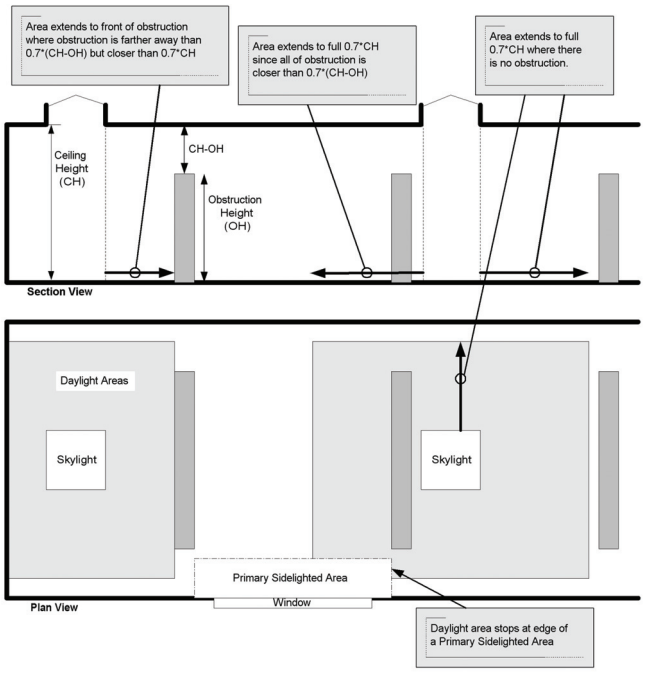

Figure 3.2 Section view and plan view of daylight area under skylight.

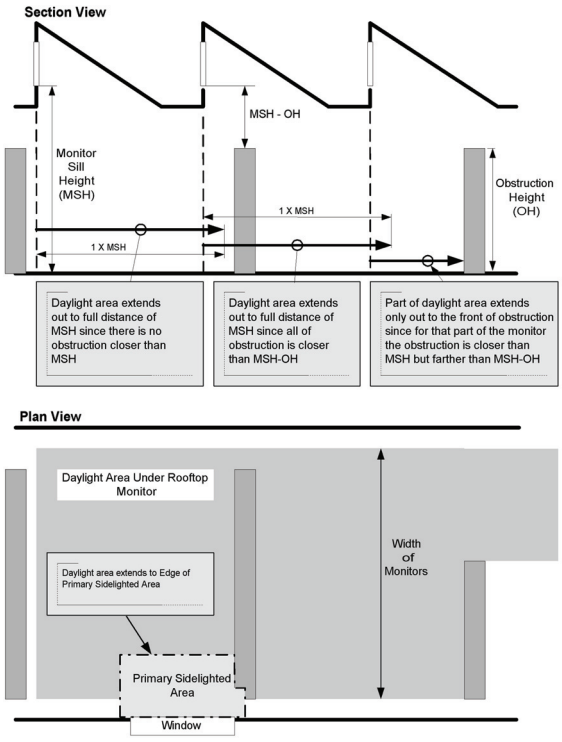

Figure 3.3 Section view and plan view of daylight zone under roof monitor.

3. the distance to the front face of any vertical obstruction where any part of the obstruction is farther away than the difference between obstruction height and the monitor sill height (MSH – OH).

toplighting: lighting building interiors with daylight admitted through *fenestration* located on the *roof* such as *skylights* and *roof monitors*. ~~daylighting provided by *fenestration* mounted above the ceiling plane, including *skylights*, *tubular daylighting devices*, and *vertical fenestration* in *roof monitors*; and *fenestration* mounted above a lower adjacent ceiling plane in the space in clerestories.~~

~~***clerestory:*** see ASHRAE/IESNA Standard 90.1.~~

sidelighting effective aperture for vertical fenestration (EAvf): ~~the product of the visible transmittance of the overall *vertical fenestration* product (entire rough opening, including glass, sash, and frame) and the *vertical fenestration* area as a percentage of the *gross wall area*.~~ the relationship of daylight transmitted through windows to the *primary sidelighted areas*. The *sidelighting effective aperture* is calculated according to the following formula:

$$\text{Sidelighting Effective Aperture} = \frac{\sum \text{Window Area} \times \text{Window VLT}}{\text{Area of Primary Sidelighted Area}}$$

where Window VLT is the visible light transmittance of windows as~~is~~ determined in accordance with Section 5.8.2.6 of ASHRAE/IESNA Standard 90.1. ~~(See *fenestration area*, *gross wall area*, and *vertical fenestration*.)~~

7.4.6.5 Automatic Controls for Lighting in Daylight ~~Zones~~Areas. Lighting in all *daylight ~~zones~~areas*, ~~including *daylight zones under skylights* and *daylight zones adjacent to vertical fenestration*~~, where the combined *daylight ~~zone~~ area* per enclosed space is greater than 250 ft^2 (25 m^2), shall be provided with controls that automatically reduce lighting power in response to available daylight by either:

a. *Continuous daylight dimming*, or
b. A combination of stepped switching and daylight-sensing automatic controls, which are capable of incrementally reducing the light level in steps automatically and turning the lights off automatically.

Exceptions to 7.4.6.5:

1. Window display and exhibition lighting.

....

8. *Daylight ~~zones~~areas* where the height of existing adjacent structures above the window is at least twice the distance between the window and adjacent structures measured from the top of the glazing.

8.3.4.1 Minimum Daylight ~~Zone~~ Area by Toplighting. A minimum of 50% of the floor area directly under a *roof* in spaces with a lighting power density or *lighting power allowance* greater than 0.5 W/ft^2 (5 W/m^2) shall be in the *daylight ~~zone~~ area*. Areas that are daylit shall have a minimum *toplighting* area to *daylight ~~zone~~ area* ratio as shown in Table 8.3.4.1. For purposes of compliance with Table 8.3.4.1, the greater of the space lighting power density and the space *lighting power allowance* shall be used.

TABLE 8.3.4.1 Minimum Toplighting Area

~~General~~ Lighting Power Density or Lighting Power Allowances in Daylight ~~Zone~~ Area W/ft^2 (W/m^2)	Minimum Toplighting Area to Daylight ~~Zone~~ Area Ratio
1.4 W/ft^2 (14 W/m^2) < LPD	3.6%
1.0 W/ft^2 (10 W/m^2) < LPD < 14 W/m^2 (1.4 W/ft^2)	3.3%
0.5 W/ft^2 (5 W/m^2) < LPD < 1.0 W/ft^2 (10 W/m^2)	3.0%

8.4 Prescriptive Option

8.4.1 Daylighting by Sidelighting.

8.4.1.1 Minimum Sidelighting Effective Aperture. Office spaces and *classrooms* shall comply with the following criteria:

a. All north, south-, and east-facing facades for those spaces shall have a minimum *sidelighting effective aperture ~~for vertical fenestration~~* (EA_{vf}~~)~~ as prescribed in Table 8.4.1.1.
b. The combined width of the *primary sidelighted areas* shall be at least 75% of the length of the façade wall.
~~b.~~c. Opaque interior surfaces in *daylight ~~zones~~ areas* shall have visible light reflectances greater than or equal to 80% for ceilings and 70% for partitions higher than ~~56~~ 60 in. (~~1.54~~ 1.8 m) in *daylight~~zones~~ areas*.

TABLE 8.4.1.1 Minimum Sidelighting Effective Aperture ~~for Sidelighting Vertical Fenestration~~

Climate Zone	Minimum Sidelighting Effective Aperture ~~for Sidelighting by Vertical Fenestration~~
1, 2, 3A, 3B	0.10
3C, 4, 5, 6, 7, 8	0.15

Exceptions to 8.4.1.1:

1. Spaces with programming that requires dark conditions (e.g. photographic processing).
2. Spaces with *toplighting* in compliance with 8.3.4.
3. *Daylight ~~zone~~areas* where the height of existing adjacent structures above the window is at least twice the distance between the window and the adjacent structures, measured from the top of the glazing.

8.5 Performance Option

8.5.1 Daylighting Simulation.

8.5.1.1 Usable Illuminance in Office Spaces and Classrooms. The design for the *building project* shall demonstrate an illuminance of at least 30 fc (300 lux) on a plane 3 ft (1 m) above the floor, within 75% of the area of the *daylight ~~zones~~area*. The simulation shall be made at noon on the equinox using an accurate physical or computer daylighting model.

(This foreword is not part of this standard. It is merely informative and does not contain requirements necessary for conformance to the standard. It has not been processed according to the ANSI requirements for a standard and may contain material that has not been subject to public review or a consensus process. Unresolved objectors on informative material are not offered the right to appeal at ASHRAE or ANSI.)

FOREWORD

This addendum changes the height of Illuminance calculations required for the performance option of daylighting simulations from 3 ft (1 m) to 2.5 ft (0.8 m) to coincide with standard industry practice.

Note: In this addendum, changes to the current standard are indicated in the text by underlining (for additions) and ~~strikethrough~~ (for deletions) unless the instructions specifically mention some other means of indicating the changes.

Addendum b to Standard 189.1-2009

Modify the standard as follows.

8.5 Performance Option

8.5.1 Daylighting Simulation.

8.5.1.1 Usable Illuminance in Office Spaces and Classrooms. The design for the *building project* shall demonstrate an illuminance of at least 30 fc (300 lux) on a plane ~~3~~ 2.5 ft (~~1~~ 0.8 m) above the floor, within 75% of the area of the *daylight zones.* The simulation shall be made at noon on the equinox using an accurate physical or computer daylighting model.

POLICY STATEMENT DEFINING ASHRAE'S CONCERN FOR THE ENVIRONMENTAL IMPACT OF ITS ACTIVITIES

ASHRAE is concerned with the impact of its members' activities on both the indoor and outdoor environment. ASHRAE's members will strive to minimize any possible deleterious effect on the indoor and outdoor environment of the systems and components in their responsibility while maximizing the beneficial effects these systems provide, consistent with accepted standards and the practical state of the art.

ASHRAE's short-range goal is to ensure that the systems and components within its scope do not impact the indoor and outdoor environment to a greater extent than specified by the standards and guidelines as established by itself and other responsible bodies.

As an ongoing goal, ASHRAE will, through its Standards Committee and extensive technical committee structure, continue to generate up-to-date standards and guidelines where appropriate and adopt, recommend, and promote those new and revised standards developed by other responsible organizations.

Through its Handbook, appropriate chapters will contain up-to-date standards and design considerations as the material is systematically revised.

ASHRAE will take the lead with respect to dissemination of environmental information of its primary interest and will seek out and disseminate information from other responsible organizations that is pertinent, as guides to updating standards and guidelines.

The effects of the design and selection of equipment and systems will be considered within the scope of the system's intended use and expected misuse. The disposal of hazardous materials, if any, will also be considered.

ASHRAE's primary concern for environmental impact will be at the site where equipment within ASHRAE's scope operates. However, energy source selection and the possible environmental impact due to the energy source and energy transportation will be considered where possible. Recommendations concerning energy source selection should be made by its members.