

Hea 03 Non-visual effects of light

(non-residential and residential institutions only)

Aim

To ensure the non-visual effects of light are considered to promote positive impacts on psychology and physiology of the building occupants through a healthy circadian rhythm.

Overview

Assessment type	Credits available	Applicable assessment criteria
Fully fitted	1	All (see ref 1.0)
Shell and core	0	Not applicable
Shell only	0	Not applicable
Residential: fully fitted	0	Not applicable
Residential: partially fitted	0	Not applicable
EU-taxonomy	-	None

Minimum standards

Rating level	Criteria
-	None

Assessment type specific notes

Ref	Assessment type specific note
1.0	<p>When using criterion 2.b and fixed positions are unknown, both seated and standing eye heights must be assessed (see CN5).</p> <p>Where it is possible to designate separable ancillary areas that would be required in the space (such as toilets or server rooms), these can be excluded from the calculation (see CN6).</p>

Building type specific notes

Ref	Building type specific note
-	None

Assessment criteria

One credit – Non-visual effects of light

- 1 Achieve at least one credit for 'Daylighting' in Hea 01 Natural light.
- 2 All relevant areas achieve one of the below, as applicable:
 - 2.a Where occupant positions are known and fixed (see M1.1): All positions in all relevant building areas receive a vertical illuminance of at least 250 lux melanopic EDI at occupant eyes for at least four hours during the daytime (beginning by noon at the latest).
 - 2.b Where occupant positions are unknown or variable (see M1.2): Cylindrical illuminance at eye height across each relevant building area corresponds to at least 250 lux melanopic EDI for at least four hours during the daytime (beginning by noon at the latest).
- 3 Electric lighting systems and controls are in place to adjust the flux and spectral output of the emitted light over time (colour tuning) so that melanopic EDI at occupant eye level can be reduced in the afternoon and evening, as relevant for each type of application.

Residential areas (Healthcare, Residential institutions, and Hospitality)

- 4 For residential areas within a building, systems and controls are in place to ensure that no more than 10 lux melanopic EDI for a period of three hours before bedtime and no more than 1 lux melanopic EDI during sleep time are achieved at occupant eye level in all relevant building areas where residential occupancy type is expected (see Definitions).

Checklists and tables

None

Methodology

M1: Non-visual effects of light

Non-visual effects of light can be quantified through melanopic Equivalent Daylight Illuminance (EDI), expressed in lux. This is the illuminance from daylight that produces a melanopic irradiance, or a circadian stimulation, equivalent to that of the light source considered. It can be calculated or measured based on illuminance and spectral power density using the CIE S 026 Toolbox (cie.co.at/publications/cie-system-metrology-optical-radiation-iprgc-influenced-responses-light-0).

For each seated or standing occupant location in all relevant building areas, daylight should be the preferred light source for achieving the 250 lux melanopic EDI criterion during the daytime (criterion 2). To calculate the daylight contribution, see M1.3. In addition to daylight, electric lighting may also be used to achieve the criterion. For appropriate methodology on electrical lighting contribution, see M1.4.

M1.1: Known and fixed occupant positions

Where fixed seated or standing positions are known, and criterion 2.a is used, only those positions and viewing directions need to be assessed for compliance against the daylight and electrical light contribution (M1.3 and M1.4) using vertical illuminance at the eye.

M1.2: Variable or not known positions

Where positions are variable or not known, and criterion 2.b is used, cylindrical illuminance at eye height, seated and/or standing (see CN5), should be determined in each relevant building area. A calculation grid as defined in Guidance Note 50 must be used for each relevant area. The daylight and electric lighting contributions should be determined at all calculation grid points in the relevant areas. To comply with criterion 2.b, cylindrical illuminance should meet the target at each calculation grid point.

Examples of spaces with variable occupant positions include areas where occupants are not confined to static locations during activities. These can be healthcare facilities where staff move around patients, retail spaces where shopping assistants move about, industrial buildings where staff shift between different positions, and other similar environments.

M1.3: Daylight contribution

Following the procedures described in Guidance Note 50, daylight contribution should first be determined through computer-based calculations of daylight illuminance (expressed in lux) at occupant eye level (see CN5). This can be vertical illuminance at the eye for each occupant position where occupant positions are fixed and known, or cylindrical illuminance at eye height across a calculation grid covering each relevant area where occupant positions are unknown or variable.

Calculations should be carried out for each occupied day in a typical year, and at hourly steps over four hours during the daytime beginning by noon at the latest. For each calculation point, the lowest hourly daylight illuminance value calculated (expressed in lux) should be retained and deducted from the target value of 250 lux melanopic EDI. If the result is a positive value, it should be taken as the daytime melanopic EDI target for the electric lighting system.

For example, the lowest hourly daylight illuminance calculated at occupant eye level for a known and fixed seating location is 50 lux. In order to achieve the 250 lux melanopic EDI target, 200 lux melanopic EDI must be provided by electric lighting at occupant eye level for this location.

Note: Daylight illuminance (lux) is directly equivalent to melanopic EDI.

M1.4: Electric lighting contribution

The contribution from electric lighting can be determined through in situ measurements or computer-based calculations of vertical melanopic EDI at eye level for each seating location where occupant positions are fixed and known, or cylindrical melanopic EDI at eye height across a grid covering each relevant area where occupant positions are unknown or variable.

Measurements should prioritise melanopic EDI via spectral power density (using a spectrometer) although illuminance (using an illuminance meter) would also be acceptable see M1.4.1 and M1.4.2 respectively. Computer-based calculations will typically include illuminance.

Daylight should be completely excluded from measurements and calculations of electric lighting (spectral power density and/or illuminance).

M1.4.1: Measurement of melanopic EDI

Vertical melanopic EDI can be measured in situ using a spectrometer that records spectral power density and converts the readings into melanopic EDI. Alternatively, if the spectrometer only records spectral power density without converting it into melanopic EDI, the spectral power density measurement results will need to be entered into the CIE S 026 Toolbox to determine the corresponding melanopic EDI values. The International Commission on Illumination (CIE) provides user guides and introduction videos in this respect (available from: "<https://cie.co.at/publications/cie-system-metrology-optical-radiation-iprgc-influenced-responses-light-0>").

Where in situ measurements of cylindrical melanopic EDI are taken, a simplified methodology may be used. For each grid point, vertical melanopic EDI can be measured as above in all four cardinal directions corresponding to the main axes of the space, and the mean average of the four measurement results can be taken to represent cylindrical melanopic EDI.

M1.4.2: Measurement of illuminance

Where melanopic EDI or spectral power density measurements are not possible, illuminance can be measured or calculated via computer modelling. The illuminance measurement results will need to be multiplied by the melanopic Daylight Efficacy Ratio (DER) corresponding to the type of electric lighting used in each relevant building area. In this situation, the calculation cannot use the CIE S 026 Toolbox but instead should apply the melanopic DER given in Table 16 for the corresponding type of electric lighting. The multiplication results will constitute the melanopic EDI values for electric lighting.

Table 16 Typical melanopic DER for common types of electric lighting

Type of electric lighting	Typical melanopic DER
LED, warm white, CCT 2700K	0.42
LED, warm white, CCT 3000K	0.47
LED, neutral white, CCT 4100K	0.63
LED, cool white, CCT 5700K	0.72
Fluorescent lighting, warm white, CCT 3000K	0.40
Fluorescent lighting, neutral white, CCT 4000K	0.56
Fluorescent lighting, cool white, CCT 5000K	0.68
Incandescent lighting	0.50
Notes:	

Type of electric lighting	Typical melanopic DER
1 The correlated colour temperature (CCT) should be as per product datasheets or measured in situ using a spectrometer.	
2 Where the measured CCT differs from the values listed above, the melanopic DER corresponding to the nearest CCT listed may be used. Alternatively, for higher accuracy, the melanopic DER may be determined through interpolation or extrapolation.	
If there are other types of electric lighting not listed above, the CCT value should be determined and the corresponding values for fluorescent lighting should be used.	

Following on the example, where the lowest hourly daylight contribution at occupant eye level for a known and fixed seating location is 50 lux, 200 lux melanopic EDI of electric lighting is needed to meet criterion 2.a. The room assessed uses 'LED, neutral white, CCT 4100K' which has a melanopic DER of 0.63 (see Table 16). The measured illuminance at occupant eye level from electric lighting at the seating location is 500 lux. Therefore, the following can be confirmed:

The melanopic EDI from the electric lighting system = $500 \times 0.63 = 315$ (lux melanopic EDI)

The overall melanopic EDI for the seating location at occupant eye level = $50 + 315 = 365$ (lux melanopic EDI)

This is greater than the 250 lux melanopic EDI and therefore this seating location meets criterion 2.a.

This process will need to be repeated for all other known and fixed seating locations in the relevant building area.

The same lighting system must also be able to meet criterion 3 and 4. In the case of a residential institution asset type, the electric lighting system must not exceed the melanopic EDI benchmarks provided for three hours before bedtime and during sleep, respectively. The contribution from all forms of electric lighting present in each relevant building area should be accounted for.

For example, the lighting is dimmed and colour tuned to a 'LED, warm white, CCT 2700K' which has a melanopic DER of 0.42 (see Table 16) three hours before bedtime in a residential care home. The measured illuminance at occupant eye level is 50 lux.

The melanopic EDI from the electric lighting system = $50 \times 0.42 = 21$ (lux melanopic EDI)

This is higher than the 10 lux melanopic EDI. To meet the criteria, the lighting system would have to reduce the CCT or dimmed further to reduce the illuminance at occupant eye level.

Compliance notes

Ref	Terms	Description
CN1	Relevant building areas – occupation hours	Criterion 2 should only be considered for occupation during daylight hours. Where the relevant building areas are occupied during nighttime hours only this criterion is not applicable. The remaining criteria are still applicable.
CN2	Occupant age	Criteria 1–4 are designed for a typical healthy adult. Currently, there is not enough evidence to justify changing the melanopic EDI criteria to suit other age groups. Where young children will occupy relevant building areas, the daytime level of 250 lux melanopic EDI should be achieved from daylight alone.
CN3	Bedtime and sleep time – timeframes	Assessor and design team judgement can be used when defining the bed and sleep time frames. Where needed a bedtime of 23:00 and a sleep time of 7 hours can be assumed.
CN4	Areas exempt	Following the principles outlined in Section 5.3.5 of ISO/CIE 8995-1:2025, a band near the wall may be excluded unless occupants are expected to be in this zone for a significant amount of time (i.e. > 2 hours a day).
CN5	Eye height	Eye height is considered to be 1.2 m above floor level for seated positions and 1.6 m when standing. Where fixed positions are unknown, both seated and standing eye heights must be assessed.
CN6	Exclusion of non-relevant areas	Only relevant areas within rooms should be assessed. However, spaces such as circulation routes or other transient spaces within a relevant area can only be excluded if the route or area is clearly defined by the building layout. Features of the building layout which may be considered as dictating a function area would include, for example, the position of doors or fixed furniture such as a reception desk or canteen servery.

Evidence

Criteria	Interim design stage	Final post-construction stage
Non-visual effects of light		
All	<p>A letter of formal confirmation of compliance from the building services engineer or lighting designer.</p> <p>Lighting product datasheets and schedules or specification.</p> <p>Documentary evidence to confirm the measured or calculated inputs of illuminance or spectral power density.</p> <p>AND</p> <p>The calculated lux melanopic EDI confirming criteria has been achieved.</p>	<p>Assessor site inspection report and photographic evidence.</p> <p>Final construction drawings or equivalent, lighting product data sheets and schedules.</p> <p>Updated calculation or measurement inputs and results, where required.</p> <p>Formal confirmation of compliance from the building services engineer or lighting designer.</p>

Definitions

Computer simulation

Software tools that can be used to model more complex room geometries for daylighting and electric lighting.

Cylindrical illuminance

Average illuminance on the curved surface of a small imaginary cylinder with a vertical axis, unless stated otherwise. It does not include light falling onto the ends of the cylinder. It can be calculated using specialist software.

Illuminance

The amount of light falling on a surface per unit area, measured in lux.

Melanopic Daylight Efficacy Ratio (DER)

Metric used to quantify the effectiveness of a light source in stimulating the melanopic photoreceptors in the human eye, relative to its ability to provide visible light for general vision. It is defined as the ratio of melanopic irradiances for this light source to that for the CIE standard daylight illuminant D65 at the same visual illuminance.

Melanopic Equivalent Daylight Illuminance (EDI)

The illuminance from the CIE standard daylight illuminant D65 that produces an equal melanopic irradiance as the light source considered. Measured in lux.

Non-visual effects

Non-visual effects of light, also referred to as non-image-forming (NIF) or non-visual (NV) responses to light, are the physiological effects of light that are distinct from visual perception. These effects can include light-induced melatonin suppression; pupillary light reflex; circadian rhythm regulation; influence on heart rate and alertness; or impacts on mood and attention.

Occupied space

A room or space within the assessed building that is likely to be occupied for 30 minutes or more by a building user.

Relevant areas – Non-visual effects

BREEAM defines relevant areas for non-visual effects to include areas of the building where:

- There are or will be workstations, benches or desks for building users.
- Close work will be undertaken.
- Where occupants are expected to be for over 2 hours of the day and move about a space. Such as healthcare facilities where staff move around patients, retail spaces where shopping assistants move about, industrial buildings where staff shift between different positions, and other similar environments.

Exclusions apply to the following:

- Only the relevant areas listed above within a room need to comply, un-occupied areas in the same room such as corridors or storage areas are excluded (see CN6).
- See CN4
- The following areas exempt from the daylight criteria can be excluded (where present):
- Media, arts production, SEN sensory spaces, x-ray rooms and other areas requiring strictly controlled acoustic or lighting conditions.

Residential areas

Residential areas within a building include any room intended for long term residential use, including sleep and long-term occupation.

Spectral power density

A measure of the power per unit area emitted by a light source per unit wavelength. It describes how the light emitted by a light source is distributed across different wavelengths of the visible spectrum. Typically measured in watts per square metre per nanometre ($W/m^2/nm$).

Additional information

CIE S 026 Toolbox

The International Commission on Illumination provides user guides and introduction videos to support the use of the recommended CIE S 026 Toolbox (cie.co.at/publications/cie-system-metrology-optical-radiation-iprgc-influenced-responses-light-0).

Circadian lighting effects on health and wellbeing

Report on circadian lighting effects on health and wellbeing RI01: Circadian lighting (www.cibse.org/knowledge-research/knowledge-portal/research-insight-01-circadian-lighting).