

Daylighting

Lighting

- one of the important factors of the living and working environment;
- a person receives most of the information about the surrounding world through his eyes;
- sufficient and high-quality lighting – a condition for vision, prevents excessive and premature fatigue, increases efficiency and quality of work, contributes to reducing the number of occupational accidents.

Judging lighting

- basic orientation – subjective (sensory) assessment of lighting conditions;
- we note the results obtained by direct measurement;
- parameters for which we do not have a physical expression are also important (e.g. overall color treatment of the environment, aesthetic impression);
- an important factor of good visibility is the **contrast of brightness and colors**;
- in the ideal case of luminance contrast, a person with normal vision can distinguish two points that are 1 arc minute apart;
- when choosing color shades and arrangement, we base our knowledge on the psychological effect of colors on people (warm and cold colors, soothing and exciting colors, etc.);
- assessment of the overall effect of the color treatment of the environment takes into account the predominant activity, shape and size of the space, orientation of lighting openings, color of objects, lighting intensity and brightness contrasts, color of light, prevailing age and gender of the team, use of safety colors.

Units used

- Illumination with visible light (**380 to 760 nm**) is divided into issues of:
 - daylight;
 - artificial light;
 - combined lighting;
 - glare from light sources.
- We use light quantities and units for measurement and evaluation in these categories:
 - **Luminance I [cd]** – basic SI unit;
 - **Luminous flux Φ [lm]** – luminous flux emitted into space (for non-physicians: phi [lumen]);
 - **Illumination E [lx]** (illuminance intensity, illuminance);
 - **1 Lux [lx]** is the illumination of an area on which every square meter falls on a uniformly distributed luminous flux of 1 lumen;
 - **Luminance L [cd/m²]** – ratio of luminance and surface area of the source.

Daylighting

- Daylight (natural, natural) lighting is all sunlight of which:
 - one part falls on Earth as **direct sunlight**;
 - the second part is scattered by the atmosphere - **skylight**.
- Direct sunlight – illuminance intensity values on a sunny summer day up to 100,000 lx.
- The spectral composition of daylight is variable, depending on the height of the Sun above the horizon and the state of clouds.
- Due to the variability of daylight, we express the intensity of daylight using a relative quantity, the so-called **daylight factor e [%]**, which is defined as the ratio of daylight illuminance at a given point of a given plane E_{intr} [lx] to the current comparative illuminance of an outdoor unscreened plane E_{extr} [lx], under an assumed or known sky brightness distribution. Direct sunlight is excluded for both measurements:

$$e = \frac{E_{intr}}{E_{extr}} \times 100 [\%]$$

- The daylight illuminance factor does not indicate the intensity of illumination at a given moment (it depends on the outdoor situation), but only the percentage of illuminance that reaches the measured location in the room from the total daily sky radiation through the lighting openings.
- It is a certain criterion of the quality of lighting openings (windows).
- For the illumination of our own visual task, we consider light penetrating the illuminated space from the sky, light reflected from outdoor objects and light reflected from internal surfaces in the room.
- In addition to side window lighting, we also encounter overhead lighting (studios, factory halls, etc.), or with combined daylighting, which combines the side and top direction of light incidence into the room and with secondary lighting (illumination through another lighting space).
- Humans are by nature better adapted to light coming from above, usually guaranteeing a sufficient intensity of lighting at the given workplace.
- For living spaces, only overhead lighting (without the ability to see the outside world) would have a

psychologically negative effect, which is why side window lighting is better.

Daylight measurement and evaluation

- The actual measurement can be carried out as a measurement of the overall lighting of the room on a comparison plane (horizontal plane, at a height of 0.85 m above the floor) in predetermined control points forming a rectangular network of points, or as a measurement of the illumination of the work surface at individual workplaces in the plane of the visual task.
 - The rating of daylight is based on the maximum, minimum, or average values of the daylight factor and from the so-called evenness of lighting, which is defined as the ratio of the minimum and maximum (or minimum and average for overhead and combined lighting) of the measured values of the daylight factor:

$$r = \frac{e_{min}}{e_{max}}$$

- The decisive criterion for determining the requirements for daytime lighting of closed spaces is the visual demand of the activity carried out permanently in this environment.
- The minimum permitted values of the daylight illuminance factor are determined so that with a comparative (outdoor) illuminance of 5,000 lx, the intensity of illumination of the interior space is sufficient for the intended activity.
- Adequate daylight should be provided for the permanent stay of people (more than 4 hours a day) in the interior space. The minimum value of the daylight factor e_{min} is at least 1.5%, or an average value of e_{prum} of at least 3% (top and combined lighting), although lower values are sufficient for the given visual activity. A suitable uniformity varies from 0.15 to 0.3 depending on the complexity of the work. The possibility of solving a permanent workplace as windowless is tied to the fulfillment of a number of other conditions...
- A visual overview of room lighting is provided by isophotos drawn in the situation plan, lines connecting places with the same values of the daylight factor.

Links

Related articles

- Artificial lighting
- Light energy and intensity
- Visible light | Combined lighting, glare
- Color of fabrics

References

- BENCKO, Vladimír. *Hygiena : Učební texty k seminářům a praktickým cvičením*. 2. přepracované a doplněné edition. Praha : Karolinum, 2002. 205 pp. pp. 115 – 118. ISBN 80-7184-551-5.