Summary

The abstract considers the features of the use of modern methods of welding. It is indicated that there are significant potential and opportunities for steel manufacture due to its applying because it provides improved speed, quality, accuracy of welds.

ЛІТЕРАТУРА

1. https://zvarka.info/zvaryuvalni-roboty/
2. https://zvarka.info/suchasni-i-klasichni-zvaryuvalni-texnologiyi/
3. http://surl.li/ruqbv
4. http://ua.chinagalvo.com/laser-welding
5. https://zvarka.info/vidi-i-osoblivosti-plazmovogo-zvaryuvannya/
6. https://remsvar.dp.ua/vakansii/novini-oglyadi-poradi/112-tekhnologii-highup-uk.html

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LIGHT COMFORT AND OPEN PUBLIC SPACE

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Introduction. Natural and artificial light is necessary for human habitat. It is known that most of the day a person needs artificial light. And at this time the lighting must be adapted to the needs of the human eye. Artificial lighting should provide visual comfort. Visual comfort (light comfort) - this is the proposed lighting, the most adapted to human vision. This is the main task of the science of lighting. The task of optimizing artificial lighting is that it should be as close as possible to natural daylight. But it turns out that such a solution is not always true, and often has a negative sign. Natural lighting today is still not fully understood.

The composition of daylight, the intensity mainly depends on the climate, the environment, the time of year and day. The man adapted to the natural light and to

the light of the fire in the cave. In a person in the evening, the light of fire seems to be natural light, and in the afternoon the sun's light seems natural too. Lighting with the spectral composition of sunlight can cause an unpleasant feeling (discomfort) in the evening.

The designer must take into account the physiology and psychology of the person. The quality of natural lighting is not possible to pass in the evening. Human activities require specific coverage. The task of the designer is to create lighting in an open and closed architectural environment.

Comfortable light environment in designing largely depends on the choice of interior and exterior lighting architectural objects. Supplement to the annexes of the state building norms of Ukraine on lighting (the index of comfort C, visual comfort, criteria of the quality of natural light) is an actual task.

Thus, the problem of creating a comfortable light environment in architecture is in the center of social attention, in the field of basic issues of ecology, architecture and urban planning.

The purpose of the study is to determine the term of light comfort and calculate the indicator of comfort of the light environment.

Materials and methods. The proposed theoretical materials on the comfort of the light environment take into account the impact on the energy efficiency of buildings. Ecological criteria in architecture are criteria of functional comfort. Integral criterion or functional comfort is considered as a functional state. Functional comfort includes two basic components - psychological and psychophysiological.

Creating a light comfortable environment for life and self-realization is possible. A comfortable light environment is a system of functional comfort in the interior plus aesthetic comfort in the exterior and interior.

Cost-effective light redistribution systems. They have special fillings for window openings. The light is transported farther from the window (deep into the premises). This increases the uniformity of illumination and increases the size of the room [5].

The methodology for calculating natural light has been improved in Amendment No. 2 to state building codes. Today, European architects use several computer methods to calculate illumination [6].

Natural and artificial lighting meets comfortable, aesthetic, sanitary, hygienic, and economic requirements. In modern times, new types of artificial lighting, new materials for window fillings. Urban-ecological approach to the formation of the human life environment is the scientific direction of ecological architecture, which

allows the use of solar energy and innovative light technologies. Under the influence of various anthropogenic factors, reducing the transparency of the atmosphere in connection with the growth of cities and industry there are significant changes in climatic, insulation and other life-saving human resources, especially in urban development.

Light as a natural substance in combination with artificial lighting is a modern means of creating an expressive architectural composition, providing favorable conditions for the interaction of man and the environment. Daylight reveals the shape of an architectural object and creates a luminous image. At night, architecture becomes a source of artificial lighting with the use of technical means and the creation of aesthetic image.

Basic lighting characteristics. Illumination characterizes light energy (Q), light flux (Φ_v), luminous intensity (I_v), bulk density of light energy (U_v), luminosity (M_v), brightness (L_v), integral brightness (Λ_v), luminous intensity (M_e), energy brightness (L_e), illumination (E_v), light exposure (H_v), spectral density of light energy ($Q_{v\lambda}$).

Light energy (Q) is one of the main photometric values. It characterizes the ability of energy. Energy is transmitted by light. Energy causes visual sensations in humans.

Luminous flux (Φ_v) – the value characterizes the amount of light power in the radiation flux. Light power is light energy. Luminous flux is a quantity proportional to the flux of radiation. The value of "radiation flux" is defined as the power carried by radiation through a specific surface.

Light intensity (I_v) – the physical quantity characterizes the amount of light energy. Light energy is transferred in the specified direction per unit of time. Light intensity is the ratio of the light flux to the solid angle.

Bulk density of light energy (U_v) is a physical quantity. It is determined by the ratio of light energy (dQ) to small light volume (dV).

Luminosity (M_v) – light value. In this case, the luminous flux of radiation comes out from a small portion of the luminous surface of a unit area. Luminosity is the ratio of the luminous flux to the area of a particular area.

Brightness (L_v) – luminous flux. Brightness is the ratio of the intensity of light to the area of its projection on the plane. The plane is perpendicular to the axis of observation.

Integral brightness (Λ_v) – is a physical quantity. Integral brightness is measured in ($kd \cdot s \cdot m^{-2}$).

Energetic luminosity (M_e) – is a physical photometric quantity. It characterizes the power of optical radiation.

Energy brightness (L_e) – the ratio of the radiation flux to the area of the projection of this area on a plane perpendicular to the direction of propagation, and the value of the solid angle.

Illumination (E_v) – light value equal to the ratio of the luminous flux to its area.

Light exposure (H_v) – is a physical quantity measured in(lk·s).

Energy exposure (amount of exposure) is the ratio of the radiation energy to the area of this element. The unit of measurement in SI is J/m^2.

The spectral density of light energy (Q_v) is a physical quantity measured in (lm·s·m^{-1}).

The spectral radiation density ($Q_{v,\lambda}$) is a characteristic of the emission spectrum (Table 1). Equal to the ratio of the intensity (flux density) of radiation in a narrow frequency interval to the magnitude of this interval [1, 2].

Natural lighting is most favorable for humans. The desire to optimize artificial lighting leads to the need to solve other problems.

The lighting that is created by nature is called natural. In the interior spaces of buildings, natural light is provided through the upper and side light openings.

The spectral composition of the natural illumination of internal spaces differs from the spectral composition of the luminous flux from the outside due to the different fillings of the light openings. For a quantitative assessment of natural lighting there is a **daylight factor**. The daylight factor is determined by the formula in percent.

$$D_s = \frac{E_{in\cdot}}{E_{out\cdot}} \cdot 100\%, \qquad (1)$$

where E_{in} is the illumination at any point of a given plane in the internal spaces of the building; E_{out} – illumination at the same point of a given plane outside the building. Illumination is taken only from a completely evenly covered sky of clouds.

Table 1

Light photometric values of SI

Name	Designation of magnitude	SI unit designation	Energy equivalent
Lightenergy	Q_v	lm·s	Radiation energy
Lightflow	Φ_v	lm	Radiation flux
The power of light	I_v	kd	Radiation power (power of light)
Bulk density of light energy	U_v	lm·s·m^{-3}	Bulk density of radiation energy
Luminosity	M_v	lm·m^{-2}	Energy luminosity
Brightness	L_v	kd·m^{-2}	Energy brightness
Integral Brightness	Λ_v	kd·s·m^{-2}	Integrated Energy Brightness
Illumination	E_v	lk	Irradiation
Light exposure	H_v	lk·s	Energy exposure
Spectral density of light energy	$Q_{v,\lambda}$	lm·s·m^{-1}	The spectral density of the radiation energy

Unequal lighting. According to this feature, the rooms are differentiated in two groups: Group 1 is a room in which uniform illumination of the working surface is required; Group 2 is a room in which the requirements for uneven illumination are determined by the need to better distinguish the subject under consideration by adapting the eye.

Designers seek to create conditions in which the background of uniform brightness occupies a significant part of the field of view and affects a person for some time (background brightness L) coincides with the brightness of adaptation.

When the calculated field with brightness (L) has a small angular radius β in a dark environment, visual acuity depends on β and the value decreases with decreasing β. Lowers visual acuity and brighter surroundings. Negatively affected and brighter spots on the periphery of the visual field. No light creates a uniform illumination of the surrounding environment or the same level of brightness [5].

Uneven illumination needs to be controlled count to regulate. And this is one of the main tasks of comfortable lighting.

Definition. The appearance of bright spots in the building that affect the function of vision is called a brilliant source. The blinding indicator (P) is the criterion of the blinding effect of the lighting source, which is determined by the expression:

$$P = (S - 1) \times 100\%, \quad (2)$$

where S - is the blindness factor equal to V_1 / V_2; V_1 – visibility of the object of observation when shielding brilliant light sources; V_2 – visibility of the object of observation in the presence of brilliant light sources in the field of view.

When designing, the glare index is calculated by the engineering method.

The brilliance of the light source blinds (the threshold contrast increases (K). The threshold contrast (K) creates a veiling brightness ($L_в$).

$$\frac{K_в}{K} = 1 + \frac{L_в}{L}, \quad (3)$$

This attitude is the basis for the introduction of the blindedness indicator.

$$S = 1000 + \frac{L_в}{L}, \quad (4)$$

The value of $L_в$ is calculated according to the recommendation of the International Commission on Illumination:

$$L_в = m_в \cdot \frac{E}{\theta^2}, \quad (5)$$

where E – is the illuminance from the brilliant source, lx; θ - is the angle between the direction to the brilliant source and the visual axis of the observer; $m_в$ – is a constant coefficient.

According to calculations, the brightness $L_б$ of the bright source lies in the range from $5 \cdot 10^3$ to 10^6 kd/m^2, and the coefficient $m_в$ depends on $L_б$.

Discomfort. Discomfort is the presence of bright spots in the field of view, exceeding the brightness of the adaptation and causing unpleasant sensations. In the building codes of Ukraine, visual discomfort is indicated and determined. Visual discomfort is a feeling of inconvenience or tension.

The appendix of the state building norms of Ukraine "Natural and artificial lighting" has a discomfort index. Discomfort is a criterion for evaluating uncomfortable brilliance. Indicator discomfort causes discomfort in uneven distribution of brightness in sight and expressed by the formula:

$$M = \frac{L_c.\omega^{0,5}}{\varphi_0.L_{\text{ad}}^{0,5}} \rightarrow \min, \qquad (6)$$

L_c – brighten source brightness, kd/m^2; ω - angular size of sparkling source, ster;

φ_o – the index of the position of the black source relative to the line of sight;

L_{ad} – brightness adaptation kd/m^2.

From the quantitative methods of determining discomfort, there is a known method:

$$M = \frac{L_\sigma}{\varphi(\theta)}\sqrt{\frac{\varphi}{L}}, \qquad (7)$$

L_σ – spot brightness; ω - light spot size (solid angle); L – brightness adaptation; $\varphi(\theta)$ – index of position nomogram.

Results. Comfortable conditions. Integral ecological criteria in architecture are criteria for functional comfort. Functional comfort is considered as an optimal functional state. At an optimal functional state compliance of the environment with the activity of human capabilities is achieved. As a system education, functional comfort includes two basic components - psychological and physiological.

Creating a light comfortable environment for human life is possible. Comfortable architectural light environment – a system that provides functional comfort in the interior environment plus visual aesthetic comfort in the exterior environment.

Extremely economically advantageous systems of redistribution of light flux, which have special filling of window openings. The light is directed further from the window (deep into the room). The uniformity of the illumination increases, the dimensions of the room increase. European architects use several computer methods to calculate the illumination. At designing the index of visual discomfort and comfort is calculated by the engineering method. There are no criteria for the quality of natural light in Ukrainian construction norms. The main task of the study is to determine the calculation of the comfort parameter C. A diagram for finding a zone of discomfort makes it possible to find the zone of comfort of the light environment. Vision comfort – a favorable light environment in the interior. Vision comfort creates the optimal choice of lighting options.

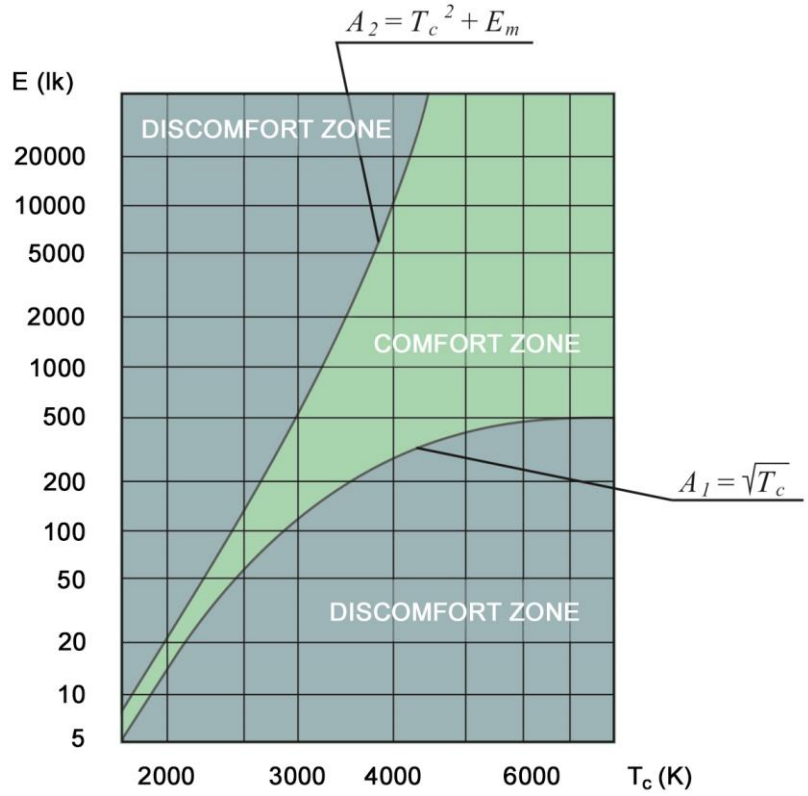

Figure 1. Diagram for comfort zone

The indicator of comfort C (Figure 1) is a criterion for assessing the comfort of brilliance. An indicator of comfort is the favorable light environment in the interior. The indicator of comfort creates the optimal choice of lighting parameters. The indicator of comfort is expressed by the formula [3]:

$$C = T_c^2 + E_m - \sqrt{T_C}, \tag{8}$$

where T_c – s the color temperature of the radiator (Planck temperature); E_m – free lightness factor (E_m = 8, 25, 130… – diagram for finding the comfort zone); A_1 - curve of the zone of discomfort with insufficient light ($A_1 = \sqrt{T_C}$); A_2 – the curve of the border of the zone of discomfort at a high light ($A_2 = T_c{}^2 + E_m$); $A_2 - A_1$ – comfortable interval of illumination.

Dependency of brilliance φ_0 is expressed for the natural light by the formula:

$$\varphi_0 = \frac{L_н \omega^{0,8}}{L_a^1} P, \tag{9}$$

where φ_0 – index of the brilliant source position relative to the line of sight; $L_н$ – brightness of the sky, Nt; ω - angular size of the source, ster; $L^1{}_a$ – brightness of the field of adaptation; P - position index.

Comfortable interval of illumination sharply increases with increase of color temperature of a source (Table 2).

Table 2

Comfort zone

T_c (K)	E_1	E_2
1500	5	8
2000	15	25
2500	50	130
3000	125	500
4000	300	8000

Conclusions. he main characteristics of the illumination are determined, and this is light energy *(Q)*, luminous flux (Φ_v), luminous intensity (I_v), volume density of light energy (U_v), luminosity (M_v), brightness (L_v), integral brightness (Λ_v), energy luminosity (M_e), energy brightness (L_e), luminance (E_v), light exposure (H_v), spectral density of light energy ($Q_{v\lambda}$).

A comparative analysis of light photometric values with an energy analog is presented (Light energy - Radiation energy. Luminous flux - Radiation flux. Light intensity - Radiation strength. Volumetric density of light energy - Volumetric radiation energy density. Luminosity - Energy luminosity. Brightness - Energy brightness. Integral brightness - Integrated energy brightness. Illumination - Irradiation. Light exposure - Energy exposure. Spectral density of light energy - The spectral density of the radiation energy).

Considered uneven lighting. The blindness index (P) is determined. The definitions of discomfort index (M) and comfort index (C) are proposed. A table is provided for determining the comfort zone of the light environment.

Improvement and supplements of regulatory documents on lighting is the main thing that determines the solution to the problems of providing a high-quality architectural environment, psychological comfort for people's livelihoods, effective use of the aesthetic potential of natural light and innovative light technologies.

Анотація

У дослідженні запропоновано доповнення до нової редакції державних будівельних норм України "Природне і штучне освітлення". Теоретичні матеріали, що стосуються світлотехнічних розрахунків та врахування впливу

світлового комфорту на енергоефективність будівель. Зовнішньому і внутрішньому простору не вистачає природного денного світла. Значна частина роботи і відпочинку проходить при штучному освітленні. Освітлення повинно бути адаптоване до потреб ока. В процесі архітектурного проектування потрібно розуміти важливість комфортності світлового середовища. Розрахунок підтверджується коефіцієнтом світлового комфорту. Ключові слова - коефіцієнт світлового комфорту, критерії якості природного освітлення.

Summary

The study proposed an addition to the new edition of state building standards of Ukraine "Natural and artificial lighting." Theoretical materials related to lighting calculations and taking into account the influence of light comfort on the energy efficiency of buildings. Man lacks natural daylight. A significant part of the work and rest proceeds under artificial lighting. Lighting should be adapted to the needs of the eye. In the process of architectural design, you need to understand the importance of the comfort of a light environment. The calculation is confirmed by the coefficient of light comfort. Keywords - light comfort coefficient, quality criteria for natural lighting.

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