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NORMATIVE BASE OF UKRAIN IN THE AREA OF SOLAR SHADING OF BUILDINGS

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Abstract. When designing houses in the southern regions of Ukraine there is a problem of protection of premises from direct solar radiation, which causes thermal and light discomfort. The practice of building construction in the southern areas shows that many houses are designed without taking into account the excess thermal action of insolation in the summer. In buildings with significant access of insolation to the premises, technical means of sun protection (air conditioning, internal cooling systems) are used, which leads to significant energy consumption. The rigidity of energy saving requirements leads to the need to develop new standards for the design and use of sun protection devices. They are able to significantly reduce the load on the cooling systems of buildings during the overheating period in summer and maintain or slightly reduce passive solar heating in winter.

Due to the high brightness of sunlight and the appearance of glare on the mirror-reflecting surfaces, there is light (visual) discomfort. Sunscreens should be designed to provide protection against overheating in summer, reduce heat loss during the cold season, increase viewer comfort and visual contact with the environment.

The norms set the minimum duration of insolation, but an excess of direct solar radiation can also lead to negative consequences. The practice of building construction in the southern areas shows that many houses are designed without taking into account the excess thermal action of insolation in the summer. In buildings with unlimited access of insolation to the premises, technical means of sun protection (air conditioning, internal cooling systems) are used, which leads to significant energy consumption.

Currently in Ukraine there is no normative document that regulates the rules of design of sun protection devices, their types, requirements for them; basic efficiency criteria; methods of their determination.

The peculiarity of the method is the use of a minimum amount of climatological information about the construction area. To perform calculations, it is enough to know: latitude, monthly average values of air temperature and its daily amplitude.

Keywords: insolation, solar devices, energy efficiency of buildings, sun protection control.

The relevance of research. The research of the regulatory framework of Ukraine in the field of solar protection of buildings is very relevant, because in the conditions of rising temperatures and climatic changes, the use of solar protection systems in construction is becoming more and more important. Solar protection systems allow you to increase indoor comfort, reduce the use of air conditioners and energy consumption in general, as well as reduce the harmful impact on the environment.

The research of the regulatory framework will make it possible to understand what requirements are set for sun protection systems in Ukraine, what norms and rules must be observed during their design and installation. In addition, the research of the regulatory framework will identify gaps in legislation and regulations that require improvement.

Also, the research of the regulatory framework in the future will determine which new technologies and materials are used in sun protection systems, which are the most efficient and energy efficient.

Therefore, the research of the regulatory framework of Ukraine in the field of sun protection of buildings is very important and relevant, since this will provide more comfortable and energy-efficient buildings, as well as reduce the harmful impact on the environment.

Formulation of the problem. The view from the windows has a significant impact on the perception of the interior. Outdoor sun protection allows you to maintain a visual connection with the external environment, but at the same time minimize its negative manifestations. It was found that indoor solar protection systems reduce the heating of the room by about seven degrees Celsius, while the minimum values of outdoor sun protection are almost one and a half times more. External systems cut off the luminous flux before it reaches the window. They are also more effective for glare control. External systems, in addition, can protect the glass during rain and snowfall and slightly reduce external noise.

External solar protection systems have already become so firmly embedded in the lives of every European that it is difficult to imagine a new house designed without the use of at least its basic elements. In our country, it is rather rare that at the project stage we receive window openings in which the use of roller shutters or outdoor venetian blinds is provided. Although as early as May 1, 2017, the state standard [1,] came into force, which clearly states that when air-conditioning a room, sun protection must also be provided.

Analysis of recent research and publications. Modern requirements for insolation of the premises of residential and public buildings are established by sanitary and construction regulations [1, 4]. Calculations of the duration of insolation are a mandatory section in the pre-design and design documentation [4]. According to DBN "Thermal insulation" [1] during design, it is necessary to provide solar protection devices.

The state standards set the minimum duration of insolation, but an excess of direct solar radiation can also lead to negative consequences. The practice of building construction in the southern regions shows that many buildings are designed without taking into account the excess thermal effect of insolation in the summer. In buildings with unlimited insolation access to the premises, technical means of sun protection (air conditioning, internal cooling systems) are used, which leads to significant energy consumption.

Light (visual) discomfort arises due to the high brightness of sunlight and the appearance of reflections on mirror-reflective surfaces. Dazzling light and oppressive heat adversely affect the body and psycho-emotional state of a person.

The purpose of the study. The main goal of this work is to analyze existing regulatory sources and select a methodology that allows you to determine the optimal type of sun protection devices without complex calculations and using the minimum necessary information that can be found in public sources on the worldwide web.

The tasks of the research. The tasks of the research are the analysis of existing normative sources, methodical materials and literary sources, as well as the analysis of sun protection devices and the selection of optimal sun protection devices.

Isolation of unsolved parts of the general problem. The insufficiency of the regulatory framework in the field of sun protection, the virtual absence of state standards for the development, application and testing of sun protection devices (SPD) complicates their actual design. Measures to limit the thermal effect of insolation come down in practice either to the use

of blinds (often internal, which is ineffective), or, with large areas of facade glazing, to the use of sun-protection glasses or films that change the spectrum of natural light in the room.

The tightening of energy saving requirements, high temperatures and high intensity of thermal solar radiation in the southern regions of our country necessitate the expansion of the use of sun protection devices in buildings for various purposes, and, consequently, the development of new regulatory documents.

The main goal of this work is to analyze existing regulatory sources and select a methodology that allows you to determine the optimal type of sun protection devices without complex calculations and using the minimum necessary information that is in the public sources of the worldwide network.

Presentation of the main material. The requirements for limiting solar heat apply to the premises of residential buildings, children's, secondary educational, medical institutions with south-western and western orientation of windows. To protect against insolation, architectural and planning measures are recommended primarily (orientation and planning of buildings, landscaping), and if they are not effective enough, constructive and technical means of sun protection (air conditioning, internal cooling systems, blinds).

Note that such standards for sun protection are of poor quality, as they do not contain clear recommendations for limiting the excessive thermal effect of insolation. If the requirements for insolation are differentiated by zones of the territory of Ukraine (for example, in the zone south of 48°N, the duration of continuous insolation should be at least 1.5 hours a day from February 22 to October 22), then there is no such division in the paragraph on sun protection. Determining the effectiveness of sunscreens on these maps requires significant additional calculations from designers. In addition, they are designed only for direct solar radiation.

As part of the "Thermal insulation" rules [1], it is recommended to provide solar protection devices for translucent structures oriented to the southwestern and western sectors of the horizon within (200-290) °C, depending on the percentage of glazing and the architectural and building climatic region. The geometric parameters of which must be calculated with the help of complex solar maps, which are a good graphical tool for determining the geometric parameters of optimized SZUs, but do not allow to quantitatively determine their efficiency.

To limit the annual overheating of premises from the influence of solar radiation, it is necessary to massively use sun protection devices (SPD). The value of SPD is currently underestimated, although they are able to significantly reduce the load on the cooling systems of buildings during the period of overheating while maintaining or slightly reducing passive solar heating in winter. In addition, designers do not know how to design them. One of the reasons for this is the lack of a simple and visual toolkit that allows you to quickly assess the effectiveness of the designed SPD.

Sun protection devices should be designed in such a way as to provide protection against overheating in the summer, reduce heat loss in the cold period of the year, and increase spectator comfort and visual contact with the outside environment.

In Ukraine, the DSTU standard B.A.2.2-12.2015 "Energy efficiency of buildings. The method of calculating energy consumption for heating, cooling, ventilation, lighting and hot water supply. [4], which determines the methodology for calculating energy for heating and cooling buildings. One of the main points of this standard is the method of calculating solar heat input. The source of heat input from the sun is solar radiation, the mode of which is characteristic in this area, and is determined by the orientation of receiving surfaces, permanent or moving shading, transmission and absorption of solar energy, and heat transfer characteristics of receiving surfaces. Solar heat gain is determined based on the equivalent insolation areas of the corresponding transparent building elements and corrections to the shading of the sun by external obstacles, which are expressed by the reduction coefficient of external shading.

To calculate the geometric parameters of sun protection devices (SPD) and to further identify the shading criterion, methods using solar maps (Fig. 1) and a set of shadow protractors-templates of shadow masks for horizontal, vertical sun protection devices and general position SPD are used, which are introduced into the regulatory framework [4] "Instructions for calculation of insolation of civil objects".

The influence of sun protection in construction on the territory of Ukraine was analyzed on the basis of various regions of Europe [6, p.40, 7, pp.114-118, 8, pp.16-19, 9, pp.15-18] Various scientific schools in Lviv and Mariupol are engaged in research on the territory of Ukraine [10, p.97-102, 11, pp.77-82]. On the basis of the conducted research, Ukrainian scientists proposed a method of calculating sun protection [5, pp.85-92]. But no matter how much Ukraine develops the sun protection topic of research in Ukraine, the biggest contribution was made by foreign organizations and grant institutions [12-14].

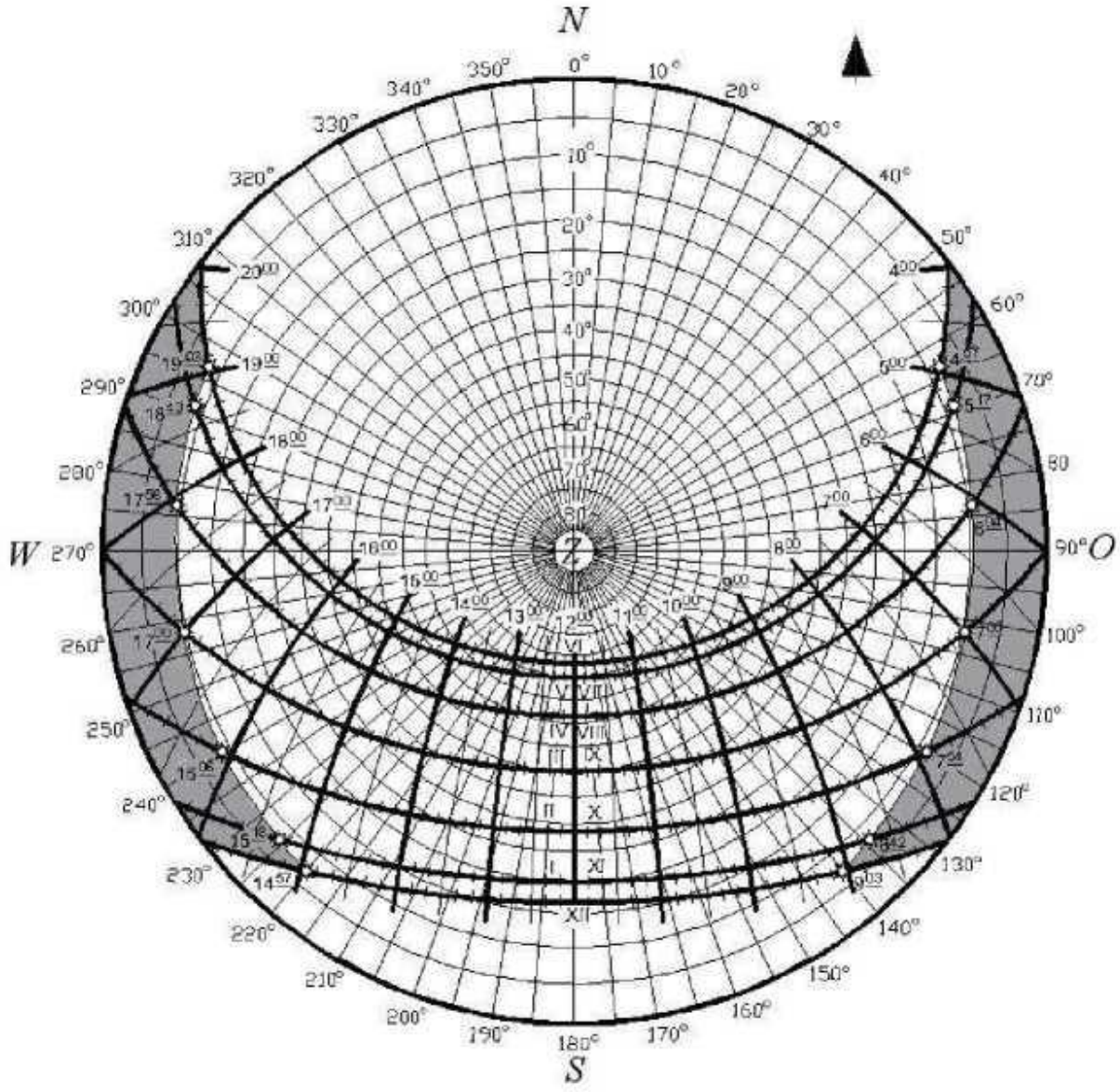

Fig. 1. Solar map for the city of Kyiv (50.5 N)

Also, in a fairly accessible form, simple and generally available methods of insolation calculations, determination of the optimal orientation of buildings and the selection of sun protection devices, solutions to all the main insolation problems that may arise in the design

process, as well as the method of insolation calculations for various types of residential and public buildings are given in Steinberg [2] "Calculation of insolation passed."

Masks of horizontal sunscreens will have a segmental shape, masks of vertical ribs will follow radial lines. By placing a "shadow mask" on the diagram of the movement of the sun, you can determine the time when the sun's rays will be delayed by the sunscreen. Knowing the diagram of the superwarm period, you can determine the necessary "shadow mask" and find the necessary sun protection device based on it (Fig. 2).

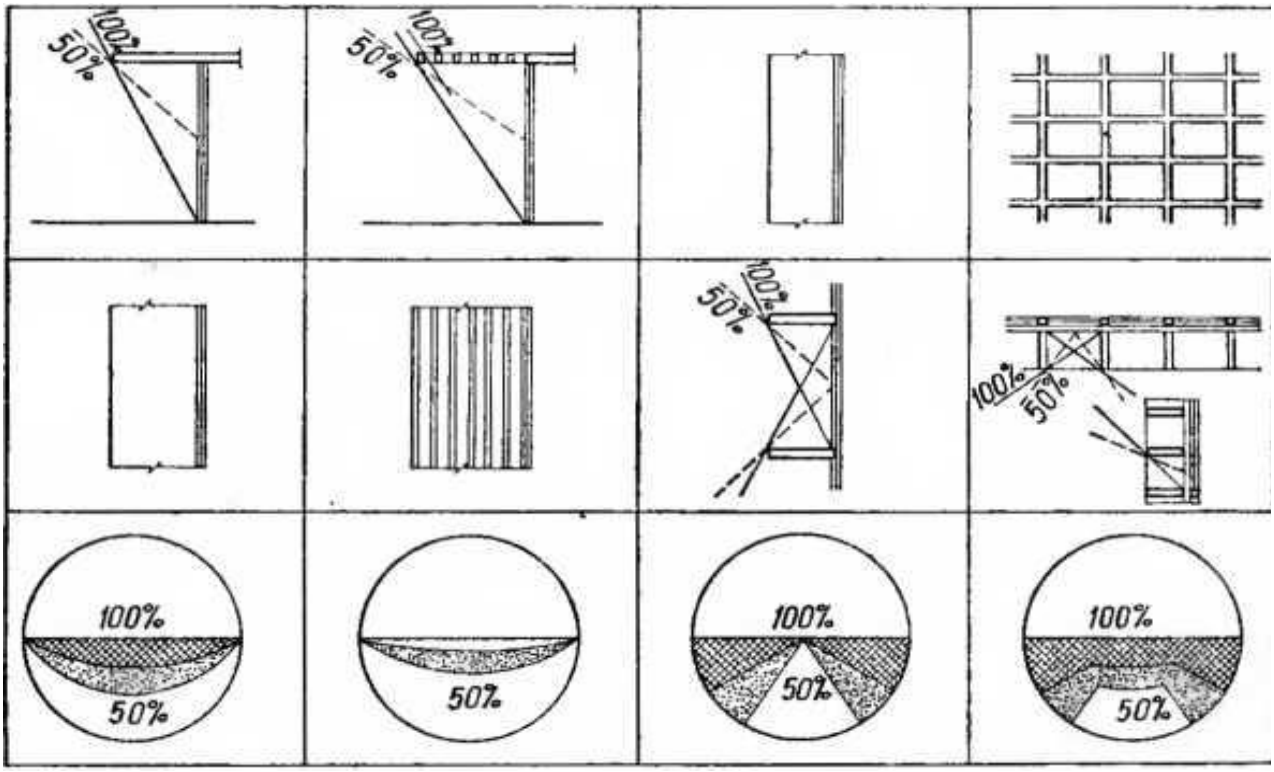

Fig. 2. The method of "shadow masks" calculation of various types of sun protection

The advantage of this method is that it takes into account the temperature and climate characteristics of the studied area. The disadvantage is the laboriousness of the calculation and its limitation, since only the issues of sun protection are solved, and not the insolation of objects in general.

Conclusions. The peculiarity of the technique is the use of the minimum amount of climatological information about the construction area. To perform calculations, it is enough to know: geographical latitude, monthly average values of air temperature and its daily amplitude. Currently, in Ukraine there is a regulatory document "Instructions for the calculation of insolation of civil objects", which regulates the rules for designing SZP, their types, requirements for them; main efficiency criteria; methods of their determination [5]. The provisions established in this Guideline make it possible to determine the value of the estimated duration of insolation of premises and territories and to draw up a section of the project documentation that relates to the implementation of the requirements for insolation of SanPiN [2], taking into account the impact of the duration of insolation on energy saving. In addition, the provisions of this Guideline make it possible to determine the maximum possible dimensions of a new building, provided that the insolation requirements are not violated in existing buildings and in the area of development at the stage of pre-project development.

Prospects for further research.

Prospects for further research into the regulatory framework of Ukraine in the field of solar protection of buildings may include the following areas:

- Research of the effectiveness of using different types of solar protection systems in the conditions of Ukraine, taking into account different climatic conditions and requirements for energy efficiency.
- Development of new norms and rules for sun protection of buildings, taking into account the latest technologies and materials used in this field.
- Research of the impact of sun protection systems on human health and determination of the most optimal options for using sun protection systems that would provide comfort in the premises and not harm health.
- Research of the impact of solar protection systems on the environment and determination of the most environmentally friendly options for solar protection systems.
- Development of recommendations for the installation and operation of solar protection systems, which would help reduce energy consumption costs and increase the efficiency of using solar protection systems.
- Researching issues of regulatory control over the installation and operation of solar protection systems in buildings and determining the most effective control mechanisms.
- Therefore, further researchies of the regulatory framework of Ukraine in the field of solar protection of buildings can be aimed at the development of more effective and energy-efficient solar protection systems, reducing the impact on the environment and ensuring comfort for people

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НОРМАТИВНА БАЗА УКРАЇНИ В ОБЛАСТІ СОНЦЕЗАХИСТУ БУДІВЕЛЬ

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Анотація. При проектуванні будинків в південних регіонах України виникає проблема захисту приміщень від прямої сонячної радіації, що викликає тепловий і світловий дискомфорт. Практика будівництва будівель в південних районах показує, що багато будинків проектуються без обліку надлишку теплової дії інсоляції в літній період. У будівлях зі значним доступом інсоляції в приміщення використовуються технічні засоби сонцезахисту (кондиціонування, внутрішні системи охолодження), що призводить до значних енерговитрат. Жорсткість вимог щодо економії енергії призводить до необхідності розробки нових норм з проектування і застосування сонцезахисних пристроїв. Вони здатні істотно зменшити навантаження на системи охолодження будівель в період перегріву влітку та зберегти або незначно зменшити пасивне сонячне опалення взимку. В статті проаналізовані нормативні документи що містять вимоги до організації сонцезахисту, які повинні дотримуватися при проектуванні і будівництві будівель. Вони визначають необхідність застосування засобів сонцезахисту, які мають забезпечувати оптимальні умови мікроклімату в приміщеннях, запобігати перегріву влітку та знижувати енергоспоживання в зимовий період.

Ключові слова: інсоляція, сонцезахисні пристрої, енергоефективність будівель, нормування сонцезахисту.