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ВІДНОСНА ПЛОЩА ЗАСКЛЕННЯ ВІКОННОГО ПРОРІЗУ ТРИКУТНОЇ КОНФІГУРАЦІЇ

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RELATIVE GLAZING AREA OF WINDOW EMBRASURE OF TRIANGULAR CONFIGURATION

Almost always triangular windows were intended for use in mansards and attics. At first they used to ventilate the attics and now it is a complete construction, which performs a number of additional functions. Today, the role of mansards and attics in residential buildings is cardinally changing and the attitude towards the windows installation in them is also changing. Non-standard window designs help to change the design of the home and office, emphasize individuality of it.

The light engineering industry, only on lighting, consumes about 2650 TWh of electricity per year (≈19% of global production), exceeding its total production by all nuclear power plants in the world [1]. In Ukraine lighting consumes about 16% of the total electrical energy produced in the country. That is why the lighting system is a significant consumer of electricity, especially in administrative buildings (up to 80%).

In order to calculate the thermal insulation properties and radiation heat transferring of translucent structures of exterior wall envelope (TSEWE), it is necessary to know which part of the window embrasure (WE) is occupied by glazing (transparent part), profile and foam filling. Determination of the relative glazing area a rectangular WE of a single-sectional and multi-sectional metal-plastic structures is considered in [2, 3], but the relationship between the size or area of the WE triangular configuration and its relative area is not described there.

As is known, the area of the WE of the triangular configuration (S_{WE}) (Fig. 1) is determined by the formula

$$S_{WE} = \frac{1}{2} \cdot BC \cdot AP, \text{ m}^2. \quad (1)$$

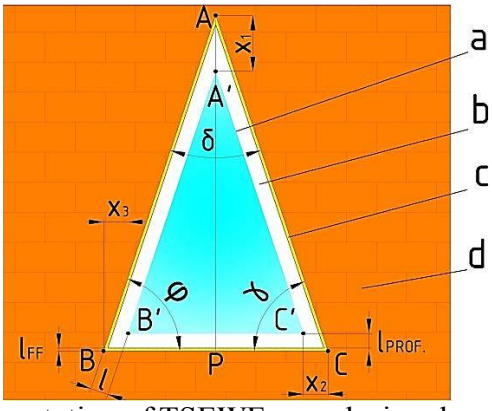

Fig. 1. Schematic representation of TSEWE: a – glazing; b – profile; c – foam filling; d – opaque building envelope

Since the window profile has the same width on all sides, the WE and glazing in the triangular configuration form similar triangles. Therefore, by similarity theorem, the size of these segments will vary in proportion to the width of the profile and a width of the foam filling. This makes it possible to determine the lengths of the segments that form the perimeter

of the glazing, at a given area of the WE and the corners at the base of a triangular WE. For any triangle of arbitrary dimensions, the angles at its vertices are determined by formulas:

$\delta = arctg\frac{BP}{AP} + arctg\frac{PC}{AP}$, deg; (2) $\gamma = arctg\frac{AP}{PC}$, deg; (3) $\varphi = arctg\frac{AP}{BP}$, deg, (4)

де BC, AP, AB і AC – base, height and side segment of the WE (Fig. 1), m;

Defined the angles at the vertices of the triangular WE can be determined:

– distance from the top of the WE (A) to the top of the glazing (A') (Fig. 1)

$$x_1 = l / \left[\sin(\delta / 2)\right], \text{ m;} \quad (5)$$

– length of the projection of the segment from the top of the WE (C) to the top of the glazing (C') on the base BC (Fig. 1)

$$x_2 = l / [tg(\gamma / 2)], \text{ m;} \quad (6)$$

– length of the projection of the segment from the top of the WE (B) to the top of the glazing (B') on the base BC (Fig. 1)

$$x_3 = l / [tg(\varphi / 2)], \text{ m;} \quad (7)$$

The width of the non-transparent part of the WE (l) occupied by the profile and the foam filling is determined, according to [2, 3], by formula:

$$l = l_{\text{PROF.}} + l_{\text{FF}}, \text{ m,} \quad (8)$$

where $l_{\text{PROF.}}$ – window profile width, m; l_{FF} – thickening of the foam filling, m [2].

The relative area of the glazing of a triangle WE $(\overline{s}_{\text{WE}})$ with a known length of the base (BC) and height (AP), window profile width and width of the foam filling is determined by the formula

$$\overline{s}_{\text{WE}} = \frac{S_{\text{GL}}}{S_{\text{WE}}} = \frac{1/2 \cdot \left(BC - x_2 - x_3\right) \cdot \left(AP - x_1 - l\right)}{1/2 \cdot BC \cdot AP}, \text{ rel.un.} \quad (9)$$

For an arbitrary triangular WE with a known area of the WE, the width of the profile and the width of the foam filling, the relative area of the glazing is determined by the formula

$$\overline{s}_{\text{WE}} = 1 - \frac{x_1 + l}{\sqrt{2 \cdot \chi \cdot S_{\text{WE}}}} - (x_2 + x_3) \cdot \frac{\sqrt{2 \cdot \chi \cdot S_{\text{WE}}} - (x_1 + l)}{2 \cdot S_{\text{WE}}}, \text{ rel.un.} \quad (10)$$

χ – the ratio of the height of the triangular WE to its base, relative units

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