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THE INFLUENCE OF THE GROUND-BASE AND OF THE HEIGHT IN CASE OF „BLOCKS OF FLATS" BUILDING TYPES ON HEAT LOSS BY DIRECT TRANSMISSION

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Abstract: *The paper presents a comparative analysis on the influence of level plan and elevation regime on the heat loss through direct transmission for flat constructions. In order to analyze the influence of level plan, the following types of buildings were considered: tower, and blade flats. The influence of elevation regime was analyzed for the same types of buildings, with height ranging from B+GF+2F up to B+GF+10F.*

Key words: *heat loss, direct transmission, flats.*

1. Introduction

Since buildings are the goods with the longest use duration, they should correspond to some demands, performance requirements determined by destination and social order.

For civilian buildings besides safety exigencies (structural resistance, stability, fire safety, exploitation security), and besides the ones referring to the protection against noise, hygiene and environment, a special place is taken by the performance exigencies concerning the energetic efficiency of buildings.

The limitation of heat loss through direct transmission by the elements of the building's envelope represents the satisfaction of one of the performance exigencies concerning the energetic efficiency of the building with an as low as possible value of global coefficient of thermal insulation.

For the new buildings, this can be made by optimizing the thermal protection, which may refer to the choice of thermal-insulating materials, to their thickness, to the constructive making-up of an element of the envelope as well as by adopting optimal solutions in order to conform the buildings horizontally and vertically.

The paper presents a comparative analysis on the influence of level plan and elevation regime on the heat loss through direct transmission for flat constructions. In order to analyze the influence of level plan, the following types of buildings were considered: tower and blade block types.

2. Materials and methods

The level dimensions of the buildings considered for the comparative

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analysis, respectively of the “Tower” block type are 21,0 m x 21,0 m (Figure 1), and of the “Blade” block type are 30,60 m x 12,60 m (Figure 2).

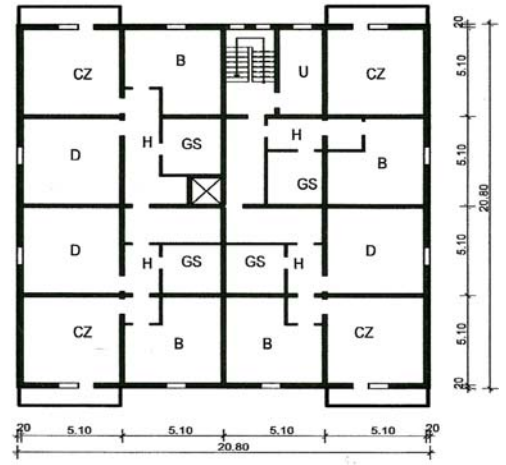

Fig. 1. *“Tower” block type*

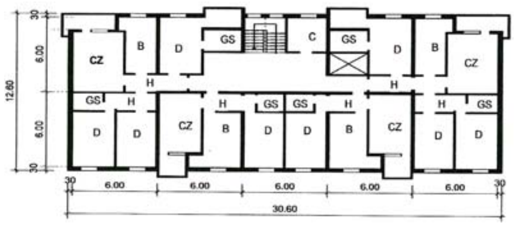

Fig. 2. *“Blade” block type*

The value of the global coefficient of thermal insulation (G), respectively, the values of its two components are determined according to the stipulations of Standard C107/1 – 2005, based on the calculations below [1]:

G = G1 + G2, [W/m3K] (1)

In the above equation, “G_1” represents the heat flux lost by direct transmission, through the envelope of the building, related to the heated volume and to the temperature gradient between the interior and exterior environment - which is also called the energetic component of the global coefficient of thermal insulation [1].

The calculation according to Standard C107/1 – 2005 is given by the following equation:

$$G_1 = \frac{\sum \left(\frac{A_j}{R'_j} \tau_j \right)}{V}, \ [\mathrm{W/m^3K}] \qquad (2)$$

The G_2 factor represents the heat loss caused by the air refreshing of inner spaces, as well as the one caused by cold air supplementary infiltrations – which is also called the quality component of the global coefficient of thermal insulation [2].

For the comparative analysis in this research paper, it is only the energetic component “G_1” that will be taken into consideration whose value will be determined on the basis of the calculation (equation 2) above and where the significance of the terms is the following:

- τ_j - Correction factor of exterior temperature;
- V - Interior heated volume of the building [m^3];
- R'_j - Specific thermal corrected resistance, average value in the construction of a building element [m^2K/W];
- A_j - Area of the building element [m^2], having the resistance R'_j.

2.1. The specific thermal corrected resistance for type of element and the correction factor for exterior temperatures

The standardized values of the thermal corrected resistances for type of element “R'_{min}” according to Disposition no. 2531 by MDRT from December 2010 [4] and of the coefficient “τ_j” according to C107/1 – 2005 [1], have the following values (Table 1).

Table 1

Type of element	R'$_{min}$ [m^2K/W]	τ_j
Exterior walls (exclusively glass surfaces)	1,80	1,0
Exterior woodwork	0,77	1,0
Terrace floor	5,00	1,0
Floor over unheated basement	2,90	0,5

2.2. Geometric characteristics of buildings, "A$_j$" and "V"

The geometric characteristics "A$_j$" and "V", calculated according to C107/3 – 2005 [2], [3] have the values in table 2.

Table 2

"Tower" block type					
Geometric characteristics	Elevation regime of the building				
	B+GF+2F	B+GF+4F	B+GF+6F	B+GF+8F	B+GF+10F
Exterior walls surface –glass area [m^2]	108,65	183,30	264,20	332,60	407,30
Exterior walls surface – opaque area [m^2]	549,80	927,70	1.299,30	1.683,40	2.061,10
Surface of floor over unheated basement [m^2]	408,00	408,00	408,00	408,00	408,00
Surface of terrace floor [m^2]	408,00	408,00	408,00	408,00	408,00
The interior heated volume of the building [m^3]	3.325,20	5.610,0	7.894,80	10.179,6	12.464,40
"Blade" block type					
Geometric characteristics	Elevation regime of the building				
	B+GF+2F	B+GF+4F	B+GF+6F	B+GF+8F	B+GF+10F
Exterior walls surface –glass area [m^2]	113,10	193,50	274,00	354,30	434,70
Exterior walls surface – opaque area [m^2]	578,0	972,50	1.367,0	1.761,50	2.155,90
Surface of floor over unheated basement [m^2]	342,00	342,00	342,00	342,00	342,00
Surface of terrace floor [m^2]	342,00	342,00	342,00	342,00	342,00
The interior heated volume of the building [m^3]	2.787,30	4.702,50	6617,70	8.532,90	10.448,10

3. The result of the calculation

The values of the energetic component "G$_1$" for the "Tower" block type and "Blade" block type determined on the basis of the equation 2 from the above calculation, as well as the differences between the two values, are highlighted in the table 3.

Table 3

Elevation regime of the building	Value of the energetic component "G$_1$" [W/m^3K]		Value of the component "G$_1$" for tower block compared to the blade block
	Tower block	Blade block	
B+GF+2F	0,18	0,2136	< cu 18,67 %
B+GF+4F	0,1614	0,1954	< cu 21,06 %
B+GF+6F	0,1541	0,1877	< cu 21,80 %
B+GF+8F	0,1492	0,1835	< cu 22,99 %
B+GF+10F	0,1465	0,1808	< cu 23,41 %

The results of the values of the energetic component "G_1" determined on the basis of the equation 1, for the two types of buildings ("Tower" block type and "Blade" block type), but having different elevation regimes, as well as the highlighting of the differences between them, are presented in the table 4.

Table 4

	"Tower" block type		"Blade" block type	
Elevation regime of the building	G_1 [W/m^{3}K]	Comparison of the value of the coefficient "G_1" for the superior floor compared to the inferior one	G_1 [W/m^{3}K]	Comparison of the value of the coefficient "G_1" – superior floor compared to the inferior one
B + GF + 2F	0,18		0,2136	
B + GF + 4 F	0,1614	< cu 11,52 %	0,1954	< cu 9,31 %
B + GF + 6 F	0,1541	< cu 4,74 %	0,1877	< cu 4,10 %
B + GF + 8 F	0,1492	< cu 3,28 %	0,1835	< cu 2,28 %
B + GF + 10 F	0,1465	< cu 1,84 %	0,1808	< cu 1,5 %

4. Conclusions

The results of the values of the energetic component "G_1" for the two types of buildings, values centralized in table 3 and table 4, lead to the following conclusions.

On the influence of the level plan on the heat loss through direct transmission through the envelope of the building, from the comparative analysis of the values of the energetic component "G_1" for the two types of buildings, centralized values in table 3, it can be noticed that heat loss through the envelope of the building is considerably lower in the case of compact building of the "Tower" type when compared to the "Blade" type.

The influence of the elevation regime on heat loss through direct loss through the envelope of the building and implicitly on the energetic efficiency of the building is highlighted by the values of the energetic component "G_1" calculated for the two types of buildings, by having different elevation regimes. From the comparative analysis of the values centralized in table 3 it is noticed that the diminution of heat loss is more significant up to an average elevation regime of GF+4F, after which the degree of diminution of heat loss „upper floor/previous floor" is more and more reduced.

On the basis of the above conclusions, the following recommendations can be formulated: in case of constructions of blocks type, the minimal recommended elevation regime is GF+4F, and as far as the level shape is concerned, buildings with a level compacted shape are recommended.

References

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2. *** C 107/3 – 2005: *Concerning the calculation of the thermal-energetic performances of the building elements of the buildings.*
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4. *** *Disposition no. 2531*, by MDRT, December 2010.