Relative brightness of facades in the L-shaped urban buildings

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Abstract. Day lighting of premises under conditions of compacted urban development is depended of brightness of the finishing material of the facades of buildings of the surrounding buildings. Measure of influence of opposing buildings on the light regime of the premises is determined by relative brightness coefficient of facade, which is the ratio of the brightness of the facade to the average brightness of the sky. Derivation of the formula for coefficient of relative brightness of the facade in L-shaped urban buildings is presented. The derivation of the formula is based on the some components. The first component is the light transmission rate component on the facade of the designed building, which takes into account the reflection of daylight from an area of the earth’s surface. The second component is a coefficient, which takes into account the increase in the light transmission rate component on the facade of the projected building. This is due to the exchange of reflected light fluxes between the facades of the buildings and the land surface, which is adjoined to the buildings. Relative brightness coefficient values are calculated depending on the building geometry and the reflective properties of the facade finishing material.

1. Introduction
Daylight is an important source of illumination in buildings and one of the factors providing comfort to residents [1,2], improving their well-being and performance [3-5]. A sufficient level of day light in the room helps to save energy on artificial lighting [6-8]. Based on these circumstances, calculation and standardization of day lighting are carried out in many countries [9-12]. Many studies are aimed at the optimal calculation of the level of day light in buildings, taking into account many factors, such as climate [7], [13-15], building orientation [13, 16, 17], the use of sunscreens devices [8, 18], window contamination [14, 18], window shape, size and composition [17, 15, [19, 20], indoor light reflection [2] Reinhart, [21-22]. In Russian normative documents the calculation of the daylight transmission rate (DTR) is carried out. The calculation takes into account a component that depends on the brightness of the facade of the opposing building. In this paper, it is proposed to consider the calculation of the component for the case of L-shaped building.

2. Methods
Each type of urban development has its own characteristic external light environment depending on the size, light characteristics, orientation and relative position of buildings. At the same time, the opposing buildings in a complex way affect the distribution of light fluxes indoors. The main parameter, which shows the effect on the distribution of light fluxes inside the building under urban conditions, is the relative brightness coefficient of the facades of the houses adjacent to and surrounding the building.
under study. According to the definition, the coefficient of relative brightness of the facade is the ratio of the brightness of the facade to the average brightness of the sky:

$$b_f = \frac{L_f}{L_{av}} = \frac{E_{sky} + E_r}{\pi L_{av}}$$  \hspace{1cm} (1)

$E_{sky}$ – direct component of daylight on the facade from the sky, lx;
$E_r$ - day light on the facade due to reflection from opposing buildings and land, lx.

When expressing $E_{sky}$ and $E_r$ through DTR:

$$E_{sky} = E_{hor} e_{sky}$$
$$E_r = E_{hor} e_r$$  \hspace{1cm} (2)

$E_{hor}$ - illumination under the open sky, lx;
$e_{sky}$, $e_r$ - accordingly, component DTR on the facade from the regions of the sky not covered by the opposing buildings and component DTR on the facade due to reflection from the opposing buildings and land.

On the other hand, horizontal illumination can be expressed in terms of the average brightness of the sky:

$$E_{hor} = L_{av} \pi$$  \hspace{1cm} (3)

Taking into account formulas (2) and (3), the relative brightness of the facade from (1) is written as:

$$b_f = \left( e_{sky} + e_r \right) \rho_f$$  \hspace{1cm} (4)

Designating the relation:

$$\left( e_{sky} + e_r \right) / e_{sky} = \eta$$

formula (4) takes the following form:

$$b_f = \rho \eta e_{sky}$$  \hspace{1cm} (5)

$\eta$ - coefficient taking into account the increase in day light on the facades of buildings due to the multiple exchange of reflected flows between the facades of buildings and a plot of land adjacent to buildings; $\rho_f$ - reflection coefficient of the finishing material of the building facade (set or known in advance).

Therefore, to calculate the relative brightness coefficient, it is necessary to have two parameters included in formula (5):
- coefficient $\eta$, which takes into account the increase in day illumination on the facades of buildings due to the multiple exchange of reflected flows between the facades of buildings and a plot of land adjacent to buildings;
- component DTR on the facade of the investigated premises not closed by opposing buildings, $e_{sky}$.

The derivation of the formula for calculating the DTR component on the facade of a separate building with an open sky taking into account the reflected component from the earth's surface is presented in the works of the authors and has the following meaning:

$$e_{ver} = \frac{3\pi + 8}{14\pi} + \frac{\rho}{2} = \frac{3\pi + 8 + 7\rho}{14\pi}$$  \hspace{1cm} (6)

$\rho$ - the reflection coefficient of the earth, in design practice is taken, as a rule, equal to 0.20.

### 2.1. The direct component of KEO in the L-shaped building on the facade of the building from part of the sky not closed by another - perpendicular building

For a specific building (Figure 1), the direct component of the geometric DTR for building 4 with point $b, e_{sky}^b$, will be equal to DTR at point $b$ with the open sky, $e_{ver}$, minus DTR at point $b$ from the part of the sky that shielded perpendicularly located building 1 of the adjacent buildings, $e^b$.

$$e_{sky}^b = e_{ver} - e^b$$  \hspace{1cm} (7)
To derive the equation of the direct component of DTR on the facade of the building under study, a shielded building perpendicular to the adjacent building 1, $e^b$, we use the formula presented in the works of the authors to calculate the day light generated by the light flux coming from the light opening onto the wall perpendicular to the wall with the window (Figure 2):

$$e^b = \sum_{i=1}^{4} (-1)^{i+1} P_i \frac{Z}{\sqrt{m_i^2 + Z^2}} \arctg \frac{n_i}{\sqrt{m_i^2 + Z^2}} + \sum_{i=5}^{6} (-1)^{i+1} P_i \frac{Z}{\sqrt{m_i^2 + Z^2}} \left(1 - \frac{\sqrt{m_i^2 + Z^2}}{\sqrt{m_i^2 + n_i^2 + Z^2}} \right)$$ (8)
where the variables (Figures 2 and 3) are presented in tabular form (table 1).

### Table 1. The variable parameters included in the formula (7).

| $i$ | 1 | 2 | 3 | 4 | 5 | 6 |
|-----|---|---|---|---|---|---|
| $p_i$ | $\frac{3}{14\pi}$ | $\frac{3}{14\pi}$ | $\frac{\rho}{2\pi}$ | $\frac{\rho}{2\pi}$ | $\frac{2}{7\pi}$ | $\frac{2}{7\pi}$ |
| $m_i$ | $S_i$ | $t$ | $S_i$ | $t$ | $S_i$ | $t$ |
| $n_i$ | $u$ | $u$ | $U$ | $U$ | $u$ | $u$ |

**Figure 3.** Scheme of the position of point $b$ with respect to the light opening. Designations: $y_0$ is the window sill height; $H$ is the building height; $S$, $t$ is the distance of the projection of point $b$ from the right and left vertical faces of the opening; $u$, $U$ is the distance of the projection of point $b$ from the upper and lower faces of the opening; $\rho$ is the reflection coefficient of the earth's surface.

In our case, $S = 0$; $y_0 = 0$; $t = L$; $u = U = \frac{H}{2}; Z = \frac{l}{2}$.

After substituting the parameters in the formula (8) we have:

$$e^b = \frac{3}{14\pi} \frac{\sqrt{u+Z^2}}{Z} \text{arctg} \frac{u}{Z} - \frac{3}{14\pi} \frac{\sqrt{Z^2+L^2}}{Z} \text{arctg} \frac{u}{Z} + \frac{\rho}{2\pi} \frac{\sqrt{u+Z^2}}{Z} \text{arctg} \frac{u}{Z} - \frac{\rho}{2\pi} \frac{\sqrt{Z^2+L^2}}{Z} \text{arctg} \frac{u}{Z} +$$

$$\frac{2}{7\pi} \frac{Z}{\sqrt{u+Z^2}} \left(1 - \frac{1}{\sqrt{u+Z^2}} - \frac{1}{\sqrt{u+Z^2}} \right)$$

We introduce the following notation:

$$a = \frac{H}{L}; b = \frac{l}{L}; c = \frac{H}{L}; k = \frac{l}{L}; y = \sqrt{1+4b^2}; z = \sqrt{1+4k^2}$$

After substitution of expressions and simplification:

$$e^b = \frac{3+7\rho}{14\pi} \left( \text{arctg} \frac{c}{Z} - \frac{1}{Z} \text{arctg} \frac{z}{Z} \right) + \frac{2}{7\pi} \left(1 + \frac{1}{\sqrt{y^2+k^2}} - \frac{1}{\sqrt{y^2+k^2}} \right)$$

We define the DTR component on the facade of building 1 at point $a$ from the part of the sky that the building 4 closes. To do this, swap $l$ and $L$ in the formula (9) and simplify:

$$e^a = \frac{3+7\rho}{14\pi} \left( \text{arctg} \frac{a}{L} - \frac{l}{\sqrt{4a^2+L^2}} \text{arctg} \frac{H}{\sqrt{4a^2+L^2}} \right) + \frac{2}{7\pi} \left(1 - \frac{l}{\sqrt{4a^2+L^2}} - \frac{l}{\sqrt{4a^2+L^2}} + \frac{1}{\sqrt{4a^2+L^2}} \right)$$

Divide and multiply the numerators and denominators by $L$ and transform:

$$e^a = \frac{3+7\rho}{14\pi} \left( \text{arctg} \frac{a}{y} \frac{H}{\sqrt{4a^2+L^2}} \right) + \frac{2}{7\pi} \left(1 - \frac{1}{\sqrt{1+a^2}} - \frac{1}{\sqrt{1+a^2}} + \frac{1}{\sqrt{4b^2+a^2+1}} \right)$$
The DTR component on the facade of building 4 at point b from that part of the sky that is closed by building 1 can be presented in a slightly different version. For this, we write formula (9) taking into account the following notation:

\[
a = \sqrt{4L^2 + l^2}; \quad b = \sqrt{H^2 + l^2}; \quad c = \sqrt{4L^2 + H^2 + l^2}
\]

(14)

In this case we get:

\[
e^b = \frac{3+7\rho}{14\pi} \left( \arctg \frac{H}{l} - \frac{l}{a} \arctg \frac{a}{l} \right) + \frac{2}{7\pi} \left( 1 - \frac{l}{a} - \frac{l}{b} + \frac{l}{c} \right)
\]

(15)

Simplify the formula by introducing the notation:

\[
A = \frac{l}{a}; \quad B = \frac{l}{b}; \quad C = \frac{l}{c}.
\]

Bring these terms to a common denominator:

\[
e^b = \frac{1}{14\pi} \left( (3 + 7\rho) \left( \arctg \frac{H}{l} - A \arctg A \right) - 4(1 - A - B + C) \right)
\]

(16)

The direct component of DTR on the facade of building 4 with a calculated point b (Figure 1) due to a portion of the sky not closed perpendicularly located building 1 according to (6), (7) and (16) will be equal to:

\[
e^b_{sky} = \frac{1}{14\pi} \left\{ (3\pi + 7\pi\rho + 8) - \left[ (3 + 7\rho) \left( \arctg \frac{H}{l} - A \arctg A \right) - 4(1 - A - B + C) \right] \right\}
\]

(17)

2.2. Coefficient \( \eta \), which takes into account the increase in daylight on the facade of building 1 due to the multiple exchange of reflected flows between the facades of buildings 1 and 4 and the land surface adjacent to the buildings

From formula (5): \( b_f = e_{sky}\eta f \) we determine the coefficient \( \eta \), which takes into account the increase in day light on the facade of building 1 due to the multiple exchange of reflected streams between the facades of buildings 1 and 4 and the site of the earth's surface adjacent to the buildings:

\[
\eta_1 = \frac{b_f}{e_{sky}\eta f} = \frac{\phi_1 f}{e_{sky}\eta f S_{E_{hor}}} = \frac{\phi_1}{H E_{sky} E_{hor}}
\]

(19)

From here

\[
\phi_1 = \eta_1 H E_{sky} E_{hor} = \eta_1 f_1
\]

(20)

where: \( f_1 = H E_{sky} E_{hor} \) - direct light flux from the sky to the facade of building 1.

In general, the luminous flux \( \phi_{1-2} \) incident from the surface \( S_1 \) to the surface \( S_2 \) (Fig. 4) can be expressed by the equality:

\[
\phi_{1-2} = u_{1-2} \phi_1
\]

(21)

where \( u_{1-2} \) is the coupling coefficient (or the irradiation coefficient) between the surfaces \( S_1 \) and \( S_2 \), which is the fraction of the total luminous flux \( \phi_1 \) emitted by the surface \( S_1 \) that hits the surface \( S_2 \).

The coupling coefficients of the faces of the parallelepiped (building facades), one of which is perpendicular to the other (Figure 4) has the form:

\[
u_{1-2} = \frac{2\pi}{\pi y} [\Phi(y_1) - \Phi(y_2) + \Phi(y_3)]
\]

(22)

where:

- \( y_1 = \arctg \frac{a}{x}; \quad y_2 = \arctg \frac{a}{\sqrt{b^2 + c^2}}; \quad y_3 = \arctg \frac{a}{c}; \quad x = \frac{a}{c}, y = \frac{b}{c} \)
- Lambert-Yamauchi function:

\[
\Phi(y_i) = \frac{1}{2} \left( \gamma_i \ln \gamma_i + \frac{1}{2} \ln \cos \gamma_i - \frac{1}{2} \ln \cos \gamma_i \ln \sin \gamma_i \right) \gamma_i^2
\]

(23)
In relation to the coupling coefficient between facades 4 and 1 the design scheme will take the form shown in Figure 5.

The coupling coefficient between the facade of building 4 and the facade of building 1 will be equal to:

\[
\phi_{4-1} = \frac{2c}{\pi} \left[ \Phi(y_3) + \Phi(y_8) - \Phi(y_4) \right]
\]  

(24)

where:

\[ y_3 = \arctg \frac{H}{L} \], \[ y_4 = \arctg \frac{H}{\sqrt{L^2 + l^2}} \], \[ y_8 = \arctg \frac{H}{l} \]; \[ c = \frac{H}{l} \].

Knowing the coupling coefficient between two surfaces, it is possible to determine the luminous flux incident from one surface to another or to determine the luminous flux incident on one surface from a system of surfaces.

Evaluation of lighting is usually done on the premises, which will have the lowest illumination. The least light in our case will be the rooms located on the ground floor in the middle of building 1 (Figure 1). Facade reflection coefficients are assumed to be the same for all buildings: \( \rho_1 = \rho_4 = \rho_f \).

Based on the assumptions made, we obtain the following system of equations:

\[
\begin{align*}
\phi_1 &= f_1 + \phi_4 \rho_4 u_{4-1} + \phi_3 \rho_3 u_{3-1} \\
\phi_4 &= f_4 + \phi_1 \rho_1 u_{1-4} + \phi_3 \rho_3 u_{3-4} \\
\phi_3 &= f_3 + \phi_1 \rho_1 u_{1-3} + \phi_4 \rho_4 u_{4-3}
\end{align*}
\]  

(25)

where:

\[ f_1 = H L e_{\text{sky}}^a E_{\text{hor}} \] - direct light flux from the sky to the facade of building 1;
\[ f_4 = H_L E_{sky}^{b} E_{hor} \] - direct light flux from the sky to the facade of building 4;
\[ f_3 = 2f_1 = 2H_L E_{sky}^{a} E_{hor} \] - the direct light flux from the sky to the piece of land between the buildings.

With sufficient accuracy for practical calculations, the following can be accepted:
\[ \phi_1 \rho_1 v_{1-3} = \phi_2 \rho_2 v_{4-3} \] (26)

Where \( v_{1-3} \) the utilization coefficient of the facade of the building 1 relative to the earth's surface (Figure 6):
\[ v_{1-3} = \frac{2}{a \pi} [\Phi(\gamma_5) + \Phi(\gamma_6) - \Phi(\gamma_7)] \] (27)

where:
\[ \gamma_5 = \arctg \frac{L}{l}; \gamma_7 = \arctg \frac{L}{\sqrt{l^2 + H^2}}; \gamma_6 = \arctg \frac{L}{H}; a = \frac{H}{L}. \]

**Figure 6.** Schemes for calculating the coupling coefficient between the facade of a building 1 and a plot of the earth's surface 3 between buildings 1, 2, 4.

\( v_{4-3} \) - coefficient utilization of the facade of the building 4 relative to the earth's surface (Figure 7):
\[ v_{4-3} = \frac{2}{c \pi} [\Phi(\gamma_1) + \Phi(\gamma_9) - \Phi(\gamma_2)] \] (28)

where:
\[ \gamma_1 = \arctg \frac{l}{L}; \gamma_2 = \arctg \frac{l}{\sqrt{L^2 + H^2}}; \gamma_9 = \arctg \frac{l}{H}; c = \frac{H}{l}. \]

**Figure 7.** Schemes for calculating the coupling coefficients between the facade of building 4 and a plot of land 3 between buildings 1, 2, 4.

In this case
\[ \phi_3 = f_3 + 2\phi_1 \rho_1 v_{1-3} \] (29)
Solving the system of equations (24) with respect to the light flux $\phi_1$ incident on the facade 1 of the building from the facade of building 4 and the site of the earth’s surface between buildings, we obtain:

$$\phi_1(1 - \rho_1^2u_{1-4}v_{1-4} - 2\rho_1^2\rho v_{4-1}v_{3-4}v_{1-3} - 2\rho_1\rho v_{1-3}v_{3-1}) = f_1 + f_4\rho v_{4-1} + f_3\rho (\rho v_{4-1}v_{3-4} + v_{3-1})$$  

(30)

Where from:

$$\phi_1 = \frac{f_1 + f_4\rho v_{4-1} + f_3\rho (\rho v_{4-1}v_{3-4} + v_{3-1})}{1 - \rho_1(\rho v_{4-1}v_{1-3} + 2\rho_1\rho v_{4-1}v_{3-4}v_{1-3} + 2\rho_1\rho v_{1-3}v_{3-1})}$$  

(31)

$$f_1 = e_{sky}^aELH; \; f_4 = e_{sky}^bELH; \; f_3 = 2e_{sky}^aELI; \; \phi_1 = f_1\eta^a$$

Divide by $f_1$:

$$\eta^a = \frac{1 + e_{sky}^a\rho v_{4-1} + 2\rho (\rho v_{4-1}v_{3-4} + v_{3-1})}{1 - \rho_1(\rho v_{4-1}v_{1-3} + 2\rho_1\rho v_{4-1}v_{3-4}v_{1-3} + 2\rho_1\rho v_{1-3}v_{3-1})}$$  

(32)

$$v_{3-4} = u_{4-3}\frac{H}{L}; \; v_{3-1} = u_{1-3}\frac{H}{L}$$

Substitute these values in (32):

$$\eta^a = \frac{1 + e_{sky}^b\rho v_{4-1} + 2\rho (\rho v_{4-1}v_{4-3}\frac{H}{L} + v_{4-1})}{1 - \rho_1(\rho v_{4-1}v_{1-3} + 2\rho_1\rho v_{4-1}v_{4-3}\frac{H}{L}v_{1-3} + 2\rho_1\rho v_{1-3}v_{4-3}\frac{H}{L})}$$  

(33)

Denote:

$$\frac{l}{L} = b; \; \frac{H}{L} = a; \; \frac{H}{l} = c$$  

(34)

Finally we get:

$$\eta^a = \frac{1 + e_{sky}^b\rho v_{4-1} + 2\rho (\rho v_{4-1}v_{4-3} + v_{4-1})}{1 - \rho_1(\rho v_{4-1}v_{1-3} + 2\rho_1\rho v_{4-1}v_{4-3}v_{1-3} + 2\rho_1\rho v_{1-3}v_{4-3}c)}$$  

(35)

3. Results and discussion

Based on formulas (5), (17), (18) and (35), the relative brightness coefficient of the facade with the L-shaped arrangement of buildings in the building is calculated for building “a” (Figure 8) and is presented in tabular form depending from the weighted average reflection coefficient of the facade and the parameters of urban buildings.

![Figure 8. L-shaped building plan.](image)
the above dependencies. The research results are supposed to be used when revising the set of rules for
weighted average reflection coefficient of the facade of the adjacent building), which is consistent with
buildings in the building for building "a".

| Weighted average facade reflection coefficient $\rho_f$ | The ratio of the length of the designed building $l$ to the length of the adjacent building $L$ | The value of the average relative brightness of the facade $b_f$ of the adjacent building with respect to the length of the adjacent building $L$ to its design height $H$ |
|------------------------------------------------------|----------------------------------------------------------------------------------|----------------------------------------------------------------------------------|
| 0.65                                                 | 2.00                                                                             | 0.25 0.30 0.33 0.36 0.38 0.39 0.40 0.41                                       |
| 0.65                                                 | 1.00                                                                             | 0.31 0.33 0.36 0.38 0.39 0.41 0.41 0.41                                       |
| 0.65                                                 | 0.50                                                                             | 0.33 0.34 0.36 0.38 0.39 0.41 0.41 0.41                                       |
| 0.65                                                 | 0.25                                                                             | 0.34 0.35 0.36 0.37 0.38 0.40 0.40 0.40                                       |
| 0.60                                                 | 2.00                                                                             | 0.27 0.30 0.33 0.35 0.36 0.37 0.38 0.38                                       |
| 0.60                                                 | 1.00                                                                             | 0.28 0.30 0.33 0.35 0.36 0.37 0.38 0.38                                       |
| 0.60                                                 | 0.50                                                                             | 0.30 0.31 0.33 0.35 0.36 0.37 0.38 0.38                                       |
| 0.60                                                 | 0.25                                                                             | 0.32 0.32 0.33 0.34 0.35 0.36 0.37 0.37                                       |
| 0.55                                                 | 2.00                                                                             | 0.25 0.27 0.30 0.32 0.33 0.34 0.34 0.34                                       |
| 0.55                                                 | 1.00                                                                             | 0.26 0.27 0.30 0.32 0.33 0.34 0.34 0.34                                       |
| 0.55                                                 | 0.50                                                                             | 0.27 0.28 0.30 0.32 0.33 0.34 0.34 0.34                                       |
| 0.55                                                 | 0.25                                                                             | 0.29 0.29 0.30 0.31 0.32 0.33 0.34 0.34                                       |
| 0.50                                                 | 2.00                                                                             | 0.22 0.24 0.27 0.28 0.29 0.30 0.31 0.31                                       |
| 0.50                                                 | 1.00                                                                             | 0.23 0.24 0.27 0.28 0.29 0.30 0.31 0.31                                       |
| 0.50                                                 | 0.50                                                                             | 0.25 0.25 0.27 0.28 0.29 0.30 0.31 0.31                                       |
| 0.50                                                 | 0.25                                                                             | 0.26 0.27 0.27 0.28 0.29 0.30 0.30 0.30                                       |
| 0.45                                                 | 2.00                                                                             | 0.19 0.21 0.24 0.25 0.26 0.27 0.27 0.27                                       |
| 0.45                                                 | 1.00                                                                             | 0.20 0.21 0.24 0.25 0.26 0.27 0.28 0.28                                       |
| 0.45                                                 | 0.50                                                                             | 0.22 0.23 0.24 0.25 0.26 0.27 0.28 0.28                                       |
| 0.45                                                 | 0.25                                                                             | 0.23 0.24 0.25 0.26 0.27 0.27 0.27 0.27                                       |
| 0.40                                                 | 2.00                                                                             | 0.17 0.18 0.21 0.22 0.23 0.24 0.24 0.24                                       |
| 0.40                                                 | 1.00                                                                             | 0.18 0.19 0.21 0.22 0.23 0.24 0.24 0.24                                       |
| 0.40                                                 | 0.50                                                                             | 0.19 0.20 0.21 0.22 0.23 0.24 0.24 0.24                                       |
| 0.40                                                 | 0.25                                                                             | 0.20 0.21 0.22 0.22 0.23 0.24 0.24 0.24                                       |
| 0.30                                                 | 2.00                                                                             | 0.12 0.13 0.15 0.16 0.17 0.18 0.18 0.18                                       |
| 0.30                                                 | 1.00                                                                             | 0.13 0.14 0.15 0.16 0.17 0.18 0.18 0.18                                       |
| 0.30                                                 | 0.50                                                                             | 0.14 0.15 0.16 0.17 0.17 0.18 0.18 0.18                                       |
| 0.30                                                 | 0.25                                                                             | 0.15 0.16 0.16 0.17 0.17 0.17 0.18 0.18                                       |
| 0.20                                                 | 2.00                                                                             | 0.09 0.10 0.11 0.11 0.11 0.11 0.12 0.12                                       |
| 0.20                                                 | 1.00                                                                             | 0.08 0.09 0.10 0.11 0.11 0.11 0.12 0.12                                       |
| 0.20                                                 | 0.50                                                                             | 0.09 0.10 0.11 0.11 0.11 0.11 0.12 0.12                                       |
| 0.20                                                 | 0.25                                                                             | 0.10 0.10 0.11 0.11 0.11 0.11 0.12 0.12                                       |

From the data of table 2 it can be seen that the relative brightness coefficient increases with decreasing ratio of the length of the designed building to the length of the adjacent building (at a fixed weighted average reflection coefficient of the facade of the adjacent building), which is consistent with the above dependencies. The research results are supposed to be used when revising the set of rules for day and artificial lighting. Studies will continue on the effect of the day light component reflected from the facades on the light conditions of the premises as applied to other urban development schemes.
4. Conclusions
So, in this paper we consider a drowning calculation of calculating the relative brightness coefficient for a L-shaped building.

The specified coefficient was calculated for various geometry of the location of buildings and various weighted average reflection coefficients of the facade of the adjacent building.

The presented method can be implemented in Russian regulatory documents on the calculation of day light.

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