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# Designing a Health Bathroom with Central Asian Bathroom Traditions (Architecture-Construction Part)

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**Abstract:** The article, examines the design of a modern energy efficient building that meets international standards.

In the section of architecture and construction, first of all, the master plan of the projected building is drawn up. Because the building building must meet the QMQ requirements. The climate of Urgut was studied and the wind directions were determined. The city of Urgut is located in the II zone. Zone II covers mountain oases, valleys, lands with good climatic conditions, beautiful flat mountains. Therefore, a design solution was developed that fully took into account the external environmental conditions (plants, gardens and orchards, ponds, calm air of mountains and valleys), and also took into account the main directions of local winds.

**Keywords:** Central Asian baths, building technologies, building technologies, district.

**Climatic and physical geological data for design.**

**For the city of Urgut:**

- Moisture zone: **dry** ;
- The temperature of the coldest day $t_t = -18\,^oS$;
- The average temperature of the coldest five days - $t_{t5} = -13\,^oC$;
- Average monthly temperature for July - $t_t^{July} = +25.5\,^oC$;
- The maximum daily amplitude of outdoor temperature fluctuations for July $A_{st} = +25.2\,^oC$;

We determine the main direction of the wind according to QMQ 2.01.01-94. We enter these values in the table below.

For the month of January

| Poles Wind Indicator | Shm. | ShmShq | Shq | JShq | J | JG' | G' | ShmG' |
|---|---|---|---|---|---|---|---|---|
| Repetition of wind direction | 3 | 1.2 | 35 | 32 | 2 | 6 | 12 | 7 |
| Wind speed m / s $^2$ | 1.3 | 1.2 | 2.5 | 2.7 | 2.2 | 4.2 | 2.9 | 2.0 |

For the month of July

| Poles Wind Indicator | Shm. | ShmShq | Shq | JShq | J | JG' | G' | ShmG' |
|---|---|---|---|---|---|---|---|---|
| Repetition of wind direction | 12 | 15 | 38 | 22 | 0 | 1 | 4 | 8 |
| Wind speed m / s $^2$ | 2.1 | 2.8 | 2.7 | 2.4 | - | 1.4 | 2 | 2 |

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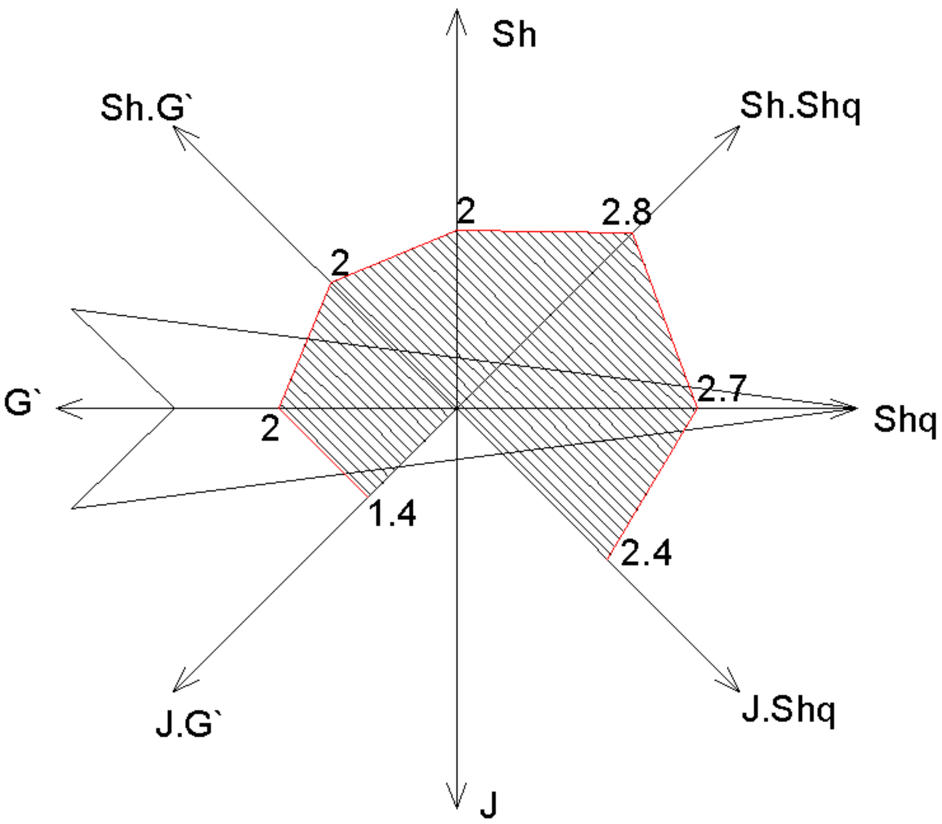
**Determining the direction of the wind**
**Wind tariff**

| City | Wind speed | | | | The highest average monthly rate for a year | | The number of dusty and rainy days in a year |
|---|---|---|---|---|---|---|---|
| | The average monthly rate in January | The highest average speed on rumbles in January | The average monthly rate in July | The lowest average speed on rumbles in July | Indicator | Moon | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Urgut | 2.9 | 3.0 | 2.5 | 0 | 3.5 | III, IV | 13 |

**Wind direction (for July)**




On the recurrence of the wind head direction.

**Dimensional planning solution of the building.**

The planned public building, ie the spa bathroom, has a rectangular appearance in the plan.

The length of our building is 30 m. side 23 m. is formed. The total height of the building is 8.7 m.

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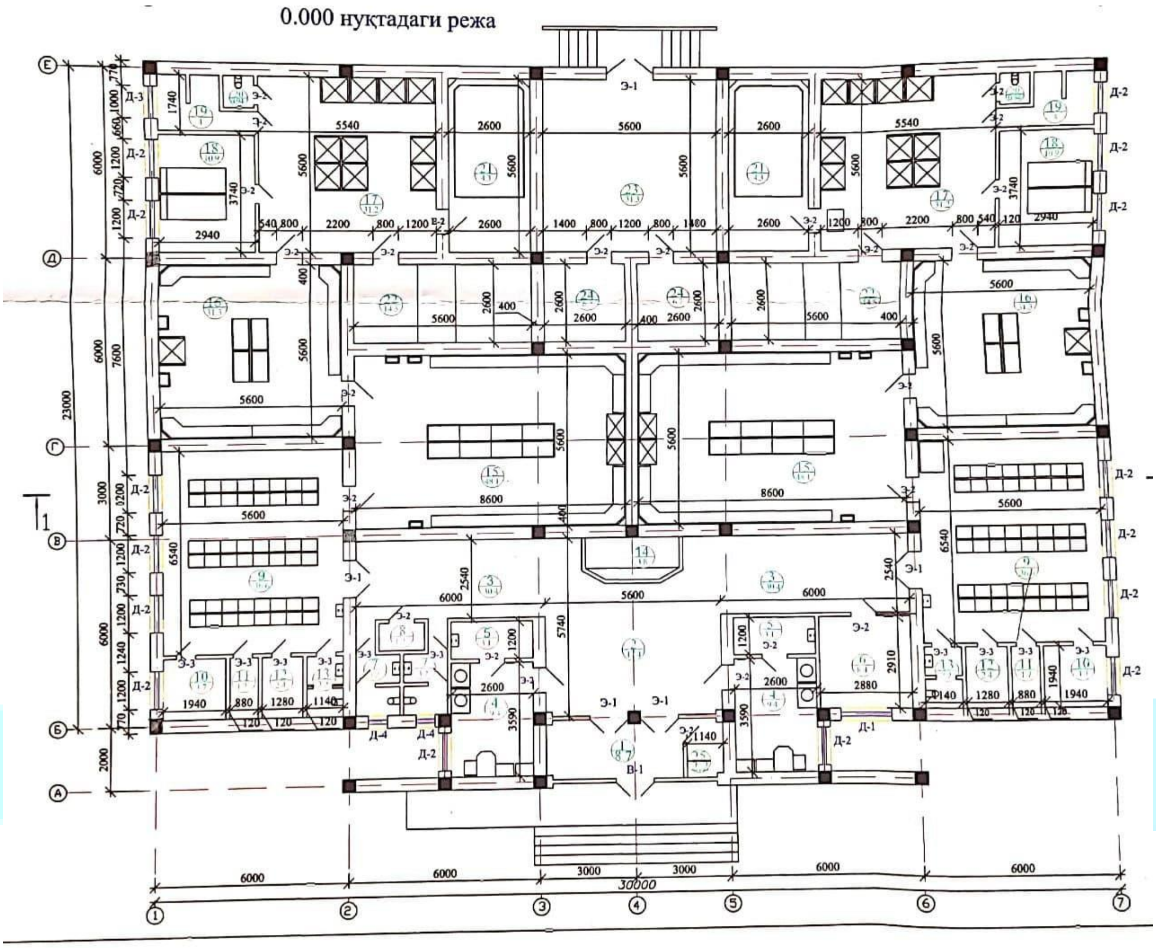


The building is domed, preserving the traditions of Central Asian architectural composition . The height of the big dome is 3 m, the width is 6.4 m, the height of the small dome is 2 m, the width is 4.6 m.

In front of the building there is a drum, a lobby, a barber shop, an administration, a cash register and other ancillary rooms. At the back of the building are toilets, a boiler room, bathrooms, a shower, a swimming pool, a steam room and other rooms.

**List of rooms**

| № | Naming | Area m $^2$ |
|---|---|---|
| 1 | Tambur | 8.7 |
| 2 | Vestibul | 17.4 |
| 3 | Corridor | 30.4 |
| 4 | Barber shop | 9.4 |
| 5 | Auxiliary room | 3.1 |
| 6 | Administration | 8.4 |
| 7 | Sanuzel | 3.2 |
| 8 | Cleaning warehouse | 1.2 |
| 9 | Dressing room | 36.6 |
| 10 | Staff service room | 3.7 |
| 11 | Clothes storage warehouse | 1.7 |

| | | |
|---|---|---|
| 12 | Cleaning equipment warehouse | 2.4 |
| 13 | Toilet | 2.2 |
| 14 | Cashier | 3.8 |
| 15 | Bathroom (hot room) | 48.1 |
| 16 | Bathroom (very hot room) | 31.3 |
| 17 | Shower room | 31.2 |
| 18 | Massage room | 10.9 |
| 19 | Hygiene room | 4 |
| 20 | Toilet | 0.94 |
| 21 | Pool | 4.3 |
| 22 | Steam room (steam room) | 14.5 |
| 23 | Boiler room | 31.3 |
| 24 | Grass room | 6.7 |
| 25 | Shop | 2.2 |

**Constructive solution of the building**

The building consists of the following structures:

**Load-bearing wall.** Serves to transfer loads from the wall to the floor. The durability, strength and superiority of a building depends in many ways on the quality of the foundation.

**Foundation.** The columnar structure is made of reinforced concrete , the width of the base is 0.80 m, the depth is -1.2 m relative to the floor. It is made under the main walls of all the columns . Concrete class B 12.5 and A II for the foundation are equipped with reinforcement types. The outer surface of the foundation is coated twice with heated bitumen mastic. Due to the fact that the city of Urgut is an earthquake zone, it is planned to lay a cement mixture of 100 grades with a thickness of 40 mm on the upper surface of the foundation. The longitudinal rods are attached with transverse rods every 400 mm. The depth of the foundation was taken as in noseismic districts. QMQ 2.01.03-96. "Construction in earthquake zones".

**Exterior walls** separate the interior artificially created environment in a building from the external environment and serve both the main compositional function of the building façade and, more often, the load-bearing function.

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The outer wall of the building is made of brick , the wall thickness is 380 mm, the dimensions are 250x120x65 mm, and the wall of this building is lined with a mixture of cement sand grade not less than M50.

**Internal walls** typically serve as load-bearing as well as barrier structures.

The inner wall of the building is made of brick , the wall thickness is 120 mm, the dimensions are 250x120x65 mm, and the wall of this building is lined with a mixture of cement sand mixture grade not less than M50.

**Curtain walls** are a thin, load-bearing, vertical internal barrier structure that can be used to separate the floors of buildings into rooms.

The curtain wall of the building is made of brick , the wall thickness is 250 mm, 0.5 rows, the dimensions are 250x120x65 mm, the walls of this building are made of a mixture of cement sand mixture grade not less than M50.

**Asphalt paving** around the building serves to keep atmospheric water out of the perimeter of the building.

Asphalt concrete pavement with a width of 1 m along the perimeter of the building will be laid with a thickness of $\delta = 85$ mm. Asphalt concrete pavement is leveled with $\delta = 95$ mm thick sheben pavement.

**The roofs are a** horizontal barrier structure at the top of the buildings. It also separates the internal environment from the external environment.

Cover constructions are extremely strong along the horizontal and vertical planes at the boundary of the compartment. Connected to vertical elements. This connection transmits horizontal forces to the vertical elements to ensure that the structures work together during the earthquake.

Covering slabs consist of prefabricated reinforced concrete slabs series 1.141.1-17S vypusk 1, brand PK8-5912-S8 , slab length L = 6 m; width V = 12 m; thickness is 220 mm and the distance to the wall is 120 mm.

**The roof covering is** the upper finish of the building and protects it from snow, rain and other adverse effects.

Roofing consists of roofing, sand-cement, 30 mm lining, thermal insulation, steam insulation and roofing tiles

**The windows** serve for natural lighting of the rooms in the building.

Window block is a standard window block made in the Republic of Uzbekistan, the material is made of wood KSI-85 / Oz series 11214-86, their brand OSP18-16v; OSP18-12v, OSP15-10v, OSP18-06v, the dimensions of the connection are height h = 1.80 m, width V = 1.6 m. structures consisting of

**Doors** are also needed to interconnect the rooms in the Building.

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Door block is a standard window block made in the Republic of Uzbekistan, the material is made of wood KSI-85 / Oz series 24698-81, connector brand DNG 21-15, DNG 21-12, DNG 20-07, DNG 30-26. The height of the doors is h = 2.10 m and the width is V = 1.2 m. and their thickness was 62 mm.

**Floors** As the bathroom of the project is a public building, the floors are made of ceramic tiles , depending on the conditions of use of the rooms and the constant humidity in the building.

**Functional processes**

Loyixalanayotgan 50 health xammombinosini appropriate to use to configure and you need to know. Therefore, we need to plan this project properly and design it not only for the bathroom, but also as an energy-efficient building with modern amenities, while preserving the Central Asian bathroom tradition.

**General plan**

The bathroom building is the main building in the master plan and is surrounded by greenery. The main building in the master plan is designed in relation to the wind roads.

In the general plan, the width of the roads is 6 m, and the corridors are 2 m. In the master plan, the maximum landscaping work was carried out.

There are parking spaces for cars. Irrigation stations have been designed around all roads and sidewalks, depending on the relief of the master plan. It collects rain and snow water and is connected to sewage networks. The master plan includes landscaping in front of the main building and a fountain.

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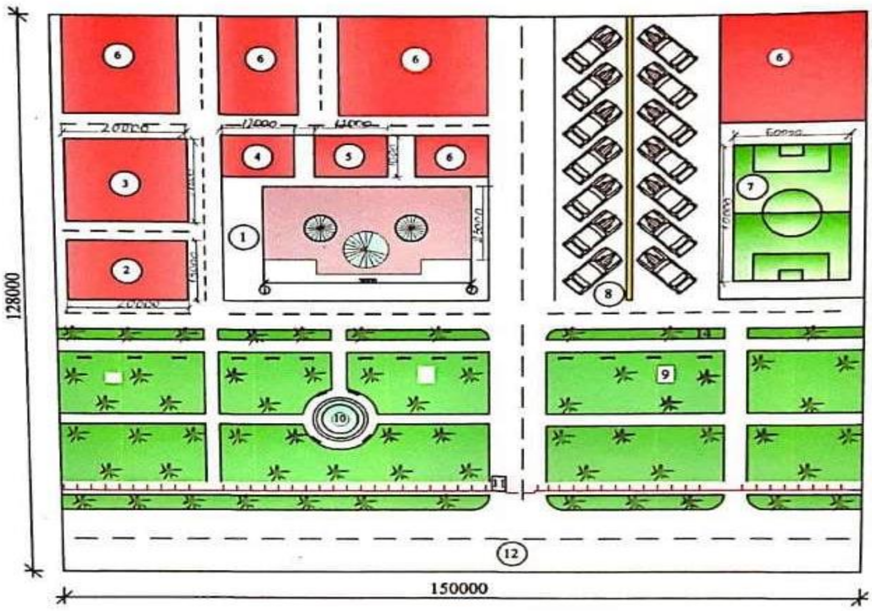
**General plan M 1:500**




**List of buildings and structures**

| № | Naming | Area $m^2$ |
|---|---|---|
| 1 | The building under construction | 713 |
| 2 | Cafe | 308 |
| 3 | Shopping center | 428 |
| 4 | Bookstore | 129 |
| 5 | Computer services | 129 |
| 6 | Existing buildings | 2210 |
| 7 | Sports field | 1066 |
| 8 | Car accommodation | 1975 |
| 9 | Greenery | 4443 |
| 10 | Musical fountain | 50 |
| 11 | Checkpoint | 9 |
| 12 | Roads and sidewalks | 6436 |

**Technical and economic indicators**

| № | Naming | Area | 100% |
|---|---|---|---|
| 1 | Common area | 19200 | 100% |
| 2 | Construction site | 713 | 3% |
| 3 | The area of greenery | 4443 | 23% |
| 4 | Road and sidewalk area | 6436 | 33% |

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**Thermophysical calculation of a solid brick wall.**

We calculate the data required for thermophysical calculations.

1. Construction area on assignment - Urgut.
2. Located in the dry zone on humidity according to Annex 6.
3. In Annex 6, we consider the following information in terms of the calculated temperature of the outside air $t_{H}$:

- the average temperature of the coldest days is 0.98 $t_{H}^{1} = -18\ ^{0}C$;
- the average temperature of the coldest days is 0.92 $t_{H}^{1} = -15\ ^{0}C$;

The provision of the cold ordained five days average 0.92 $t_{H}^{5} = -14\ ^{0}C$ -tempered ;

- the average temperature of the coldest three days with a supply of 0.92 $t_{H}^{3}$ ,, we determine using the following formula:

$$t_{H}^{3} = \frac{t_{H}^{1} + t_{H}^{5}}{2} = \frac{-18-15}{2} = -16{,}5\ ^{0}C$$

- average temperature in July $t_{H} = +25.9\ ^{0}C$;

4. From Annex 6, we determine the maximum amplitude of diurnal fluctuations of the outside air temperature in July $A_{t_{H}} = +25.2\ ^{0}C$ .
5. Construction walls to guide application of 6- west vertical to the surface of the ordinary and average solar radiation to determine:

$J_{макс} = 740\ ^{BT}/_{м^2}$;  $J_{cp} = 169\ ^{BT}/_{м^2}$

6. 6-app Rumbo q aytalanishi more than 16% of urban property, the average speed for the month of July the minimum shouting-Matin determine: $\upsilon = 2.4\ ^{м}/_{сек}$
7. Set Design perceived living room facing the BBC in accordance with the application for the project room, 1 h air- report Tempur-raturasi and relative humidity to determine: $t_{B} = 18\ ^{0}C$ ; $\varphi_{B} = 55\%$
8. Based on the detected $t_{B} = 18\ ^{0}C$ and $\varphi_{B} = 55\%$ values, we determine the humidity regime of the room from Appendix 2 : Moderate.
9. Given the mode of moderate humidity and the fact that the room is located in a dry zone, we determine the operating conditions of the barrier structure from the appendix: A.
10. The wall is plastered both inside and out with a 15 mm thick lime sand mixture (see Figure 1), the bulk density of the mixture

$\gamma_{0} = 1600\ ^{кг}/_{м^3}$.

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The wall panel thickness (380 mm) is dialed as a whole, the volume weight of the panel $\gamma_0 = 1400\, ^{кг}/_{м^3}$ ,, depending on the operating conditions of the structures from Annex 9, we determine the coefficient of thermal conductivity for each material :

$\lambda_1 = \lambda_3 = 0.7\, ^{\text{BT}}/_{(м.^0C)}$ - for a layer of plaster ;

$\lambda_2 = 0.58\, ^{\text{BT}}/_{(м.^0C)}$ - for sought-after bricks

Determine the coefficient of heat absorption:

$S_1 = S_3 = 8.69\, ^{\text{BT}}/_{(м^2.^0C)}$ - for plaster layer ;

$S_2 = 8.08\, ^{\text{BT}}/_{(м^2.^0C)}$ - for picked bricks .

**11.** According to the function of the room and the type of construction , we determine the normative difference in temperature from Annex 7 : $\Delta t^{\text{H}} = 6\ ^0C$

**12.** Depending on the type of barrier structure and the nature of its surfaces, we determine the heat transfer coefficient of the inner and outer surfaces in Annex 4 and the heat transfer coefficient of the outer surfaces in Annex 5 : $\alpha_{\text{B}} = 8{,}7\, ^{\text{BT}}/_{(м^2.^0C)}$ and $\alpha_{\text{H}} = 23\, ^{\text{BT}}/_{(м^2.^0C)}$

**13.** Depending on the type of barrier structure, we determine the coefficient from Annex 7, which takes into account the position of the outer surface relative to the outside air : $n = 1$.

**14. From Annex** 9, we determine the coefficient of absorption of solar radiation by the outer surface material of the barrier structure : $\rho = 0{,}7$

**Thermophysical calculation for winter conditions**

**1. Since the** brick wall is a homogeneous structure , using the collected data, we determine the total resistance of the structure to thermal fire using the following formula obtained on the basis of formula (3.1) :

$$R_0 = R_{\text{B}} + R_{\text{K}} + R_{\text{H}} = \frac{1}{\alpha_B} + \frac{\delta_1}{\lambda_1} + \frac{\delta_2}{\lambda_2} + \frac{\delta_3}{\lambda_3} + \frac{1}{\alpha_{\text{H}}} = \frac{1}{8{,}7} + \frac{0{,}015}{0.7} + \frac{0{,}38}{0.58} + \frac{0{,}015}{0.7} + \frac{1}{23} = 1.24\ (м^2 \cdot {}^\circ C/\text{BT}).$$

**2. Determine the** thermal inertia of the structure using the following formula obtained on the basis of formula (3.2) :

$$D = \frac{\delta_1}{\lambda_1} \cdot S_1 + \frac{\delta_2}{\lambda_2} \cdot S_2 + \frac{\delta_3}{\lambda_3} S_3 = \frac{0{,}015}{0.7} \cdot 8.69 + \frac{0{,}38}{0.58} \cdot 8.08 + \frac{0{,}015}{0.7} \cdot 8.69 = 5.67$$

**3. Since** 4> D = 5.67, we assume that the calculated temperature of the external h avo is defined in point 2.1 according to the $t_{\text{H}}^{3} = -18\ ^0C$ instructions.

**4. Using the** following formula (1.13) we determine the required value of resistance to heat transfer for the structure :

$$R_{\text{O}}^{\text{TP}} = \frac{(t_{\text{B}} - t_{\text{H}}) \cdot n}{\Delta t^{\text{H}} \cdot \alpha_{\text{B}}} = \frac{(18+12) \cdot 1}{6 \cdot 8{,}7} = 0{,}27\ м^2 \cdot {}^\circ C / \text{BT}$$

**5.** $R_0 \geq R_{\text{O}}^{\text{TP}}$ Check the fulfillment of the condition:

$R_0 = 1.24 > R_{\text{O}}^{\text{TP}} = 0{,}27\ м^2 \cdot {}^\circ C / \text{BT}$

since the condition is met, i.e. the overall resistance of the structure to heat transfer is sufficient, we proceed to check the thermal predominance of the structure .

**6. For the** wall, D = 5,362> 4, in which case the thermal predominance of the structure may not be calculated . But in order to study the calculation, we calculate the thermal predominance of the structure .

**Thermophysical calculation for summer conditions**

**1.** Determine the thermal inertia of the structural layers according to the above formula (31) :

$D_1 = \frac{\delta_1}{\lambda_1} \cdot S_1 = \frac{0{,}015}{0{,}7} \cdot 8{,}69 = 0{,}186$ at the first layer: ;

$D_2 = \frac{\delta_2}{\lambda_2} \cdot S_2 = \frac{0{,}38}{0{,}7} \cdot 8.08 = 4.38$ - two layers: ;

$D_3 = D_1 = 0{,}186$ -for the third layer : .

In accordance with the values of, we determine the heat absorption coefficients of the outer surfaces of the layers:

- for the first layer: $D_1 = 0{,}186 < 1$ so we $Y_1$ determine the value of using the following formula:

$$Y_{1,} = \frac{R_1 \cdot S_1^2 + \alpha_{\text{B}}}{1 + R_1 \cdot \alpha_{\text{B}}} = \frac{\frac{0{,}015}{0{,}7} \cdot 8{,}69^2 + 8{,}7}{1 + \frac{0{,}015}{0{,}7} \cdot 8{,}7} = 8{,}67\ \text{BT}/м^2 \cdot {}^\circ C;$$

- for the second layer: $D_2$ =4,38>1, so the heat absorption coefficient of the outer surface is equal to the heat absorption coefficient of the material $Y_2$ , i $S_2$ г
- for the third layer: $D_3 = 0{,}186 < 1$ determine the heat absorption coefficient of the surface using the following formula:

$$Y_3 = \frac{R_3 \cdot S_3^2 + Y_2}{1 + R_1 \cdot Y_2} = \frac{\frac{0{,}015}{0{,}7} \cdot 8{,}69^2 + 8.08}{1 + \frac{0{,}015}{0{,}7} \cdot 8.08} = 8.29\ \text{BT}/м^2 \cdot {}^\circ C;$$

**2.** Using the following formula, we determine the coefficient of external surface heat transfer for summer conditions :

$$\alpha_{\text{Н}} = 1{,}16 \cdot (5 + 10 \cdot \sqrt{\upsilon}) = 1{,}16(5 + 10\sqrt{2.4}) = 23.77 \ \text{ВТ}/м^2 \cdot {}^{\circ}C.$$

**3.** Using the following formula obtained on the basis of the formula (1.23), we determine the extinction of the amplitude of tempera-changes in the design transition:

$$\nu = 0{,}9e^{\frac{D}{\sqrt{2}}} \cdot \frac{(S_1 + \alpha_{\text{В}}) \cdot (S_2 + Y_1) \cdots (S_n + Y_{n-1})(\alpha_{\text{Н}} + Y_n)}{(S_1 + Y_1)(S_2 + Y_2) \cdots (S_n + Y_n)\alpha_{\text{Н}}} =$$

$$= 0{,}9e^{\frac{5{,}362}{\sqrt{2}}} \cdot \frac{(8{,}69 + 8{,}7)(8.08 + 8{,}67)(8{,}69 + 8.08)(28.4 + 7{,}84)}{(8{,}69 + 8.67)(8.08 + 8.08)(8{,}69 + 7{,}84) \cdot 28{,}4} =$$

$$= 0{,}9 \cdot e^{3{,}725} \frac{17{,}39 \cdot 17{,}75 \cdot 17{,}77 \cdot 36{,}24}{17{,}36 \cdot 18{,}16 \cdot 16{,}53 \cdot 28{,}4} = 48.5$$

**4.** We determine the calculated amplitude of changes in outside air temperature using the following formula:

**5.** $A_{t_{\text{Н}}}^{расч} = 0{,}5A_{t_{\text{Н}}} + \frac{\rho(J_{макс} - J_{ср})}{\alpha_{\text{Н}}} = 0{,}5 \cdot 27{,}6 + \frac{0{,}7(740 - 169)}{23.77} = 44.92 \ {}^{0}C$

We determine the amplitude of temperature changes on the inner surface of the barrier structure using the following formula:

$$A_{\tau_{\text{В}}} = \frac{A_{t_{\text{Н}}}^{расч}}{\nu} = \frac{44.92}{50} = 0.898 \ {}^{0}C$$

**6.** Using the following formula, we determine the required value of this amplitude :

$$A_{\tau_{\text{В}}}^{\text{ТР}} = 2{,}5 - 0{,}1(t_{\text{Н}} - 21) = 2{,}5 - 0{,}1(25.2 - 21) = 10.08 \ {}^{0}C$$

where $t_{\text{Н}}$ - the average temperature in July is ° C.

**7.** $A_{\tau_{\text{В}}} \le A_{\tau_{\text{В}}}^{\text{ТР}}$ Check the fulfillment of the condition :

$$A_{\tau_{\text{В}}} = 0{,}898 < A_{\tau_{\text{В}}}^{\text{ТР}} = 10.08$$

the condition is met, which means that the thermal predominance of the barrier structure is sufficient.

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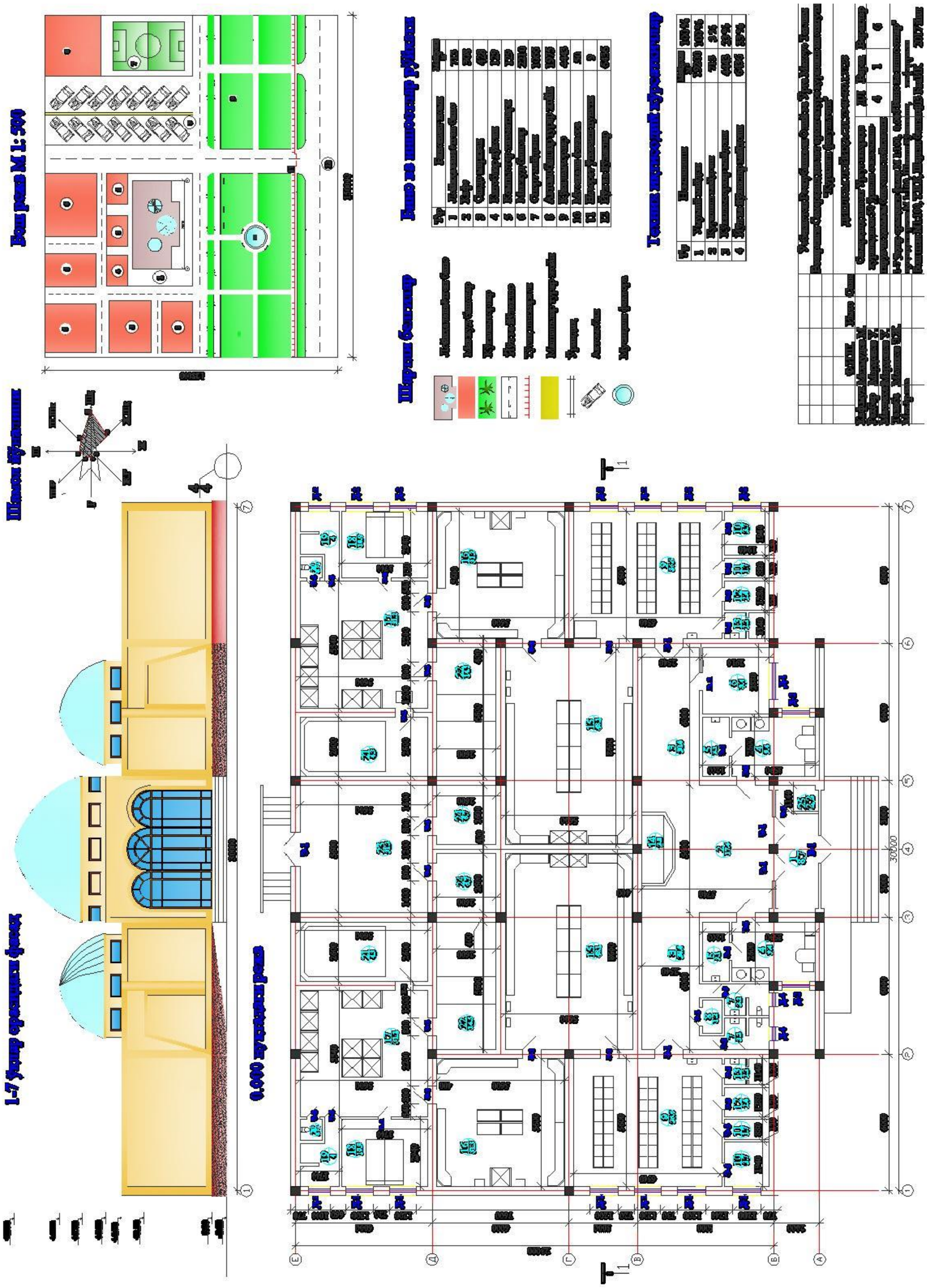

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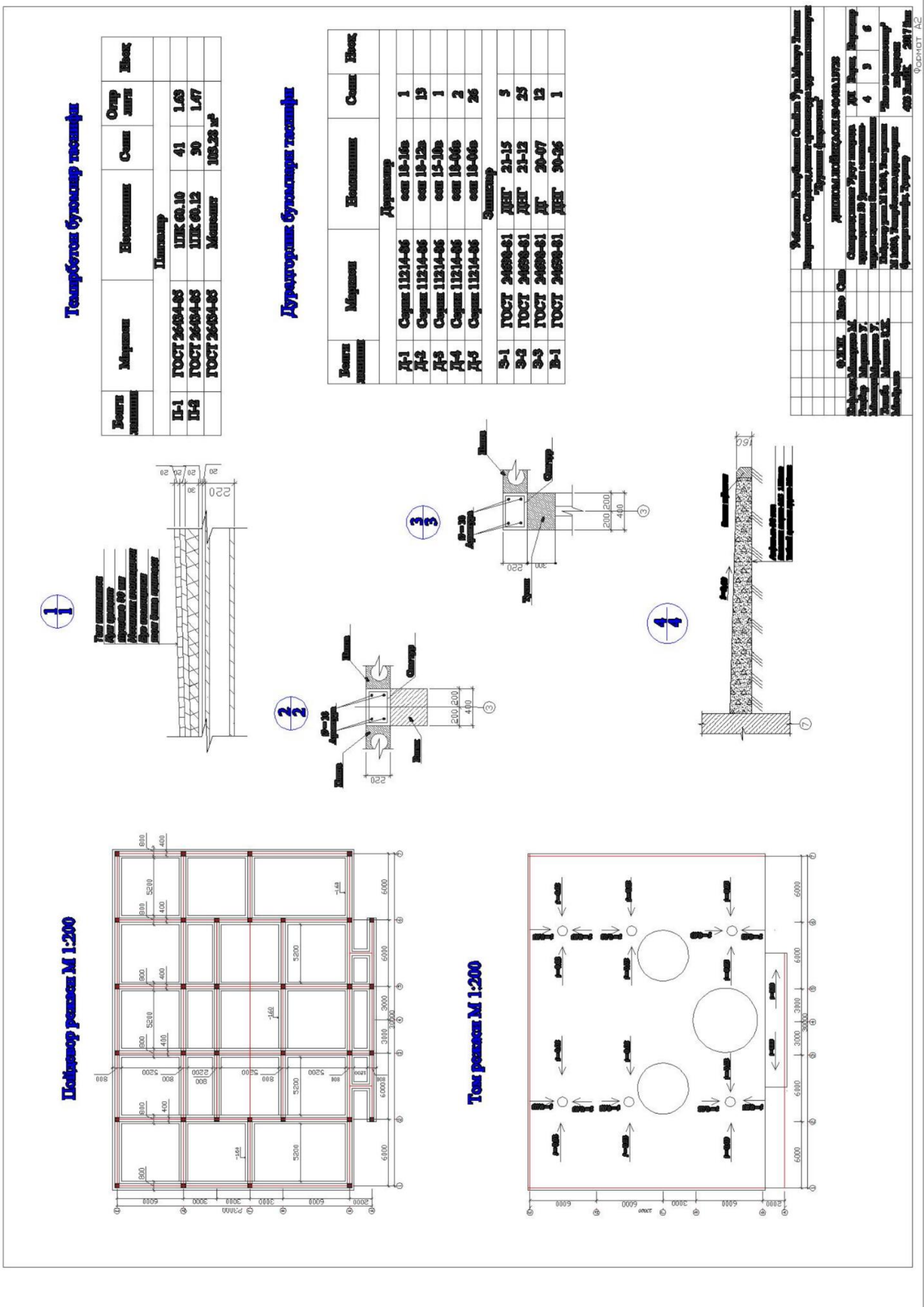

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