MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE
NATIONAL AVIATION UNIVERSITY
FACULTY OF ARCHITECTURE, CIVIL ENGINEERING AND DESIGN
COMPUTER TECHNOLOGIES OF AIRPORT CONSTRUCTION AND
RECONSTRUCTION DEPARTMENT

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Performed by: student of group ЦБ – 406 Ба, Elkodousy Abdalla

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Kyiv 2022

МІНІСТЕРСТВО ОСВІТИ І НАУКИ УКРАЇНИ
НАЦІОНАЛЬНИЙ АВІАЦІЙНИЙ УНІВЕРСИТЕТ
ФАКУЛЬТЕТ АРХІТЕКТУРИ, БУДІВНИЦТВА ТА ДИЗАЙНУ
КАФЕДРА КОМП'ЮТЕРНИХ ТЕХНОЛОГІЙ БУДІВНИЦТВА ТА РЕКОНСТРУКЦІЇ АЕРОПОРТІВ

ДОПУСТИТИ ДО ЗАХИСТУ
Завідувач випускової кафедри
_____ О.І. Лапенко
«_7_» ____06____ 2022 р.

ДИПЛОМНА РОБОТА

(ПОЯСНЮВАЛЬНА ЗАПИСКА)

ВИПУСКНИКА ОСВІТНЬОГО СТУПЕНЯ БАКАЛАВР

ЗА СПЕЦІАЛЬНІСТЮ 192 «БУДІВНИЦТВО ТА ЦИВІЛЬНА ІНЖЕНЕРІЯ»
ОСВІТНЬО-ПРОФЕСІЙНА ПРОГРАМА
«ПРОМИСЛОВЕ І ЦИВІЛЬНЕ БУДІВНИЦТВО»

Тема: **«Офісна споруда в м. Ізюм Харківської області»**

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Київ 2022

НАЦІОНАЛЬНИЙ АВІАЦІЙНИЙ УНІВЕРСИТЕТ
Факультет архітектури, будівництва та дизайну
Кафедра комп'ютерних технологій будівництва та реконструкції аеропортів
Спеціальність: 192 «Будівництво та цивільна інженерія»
Освітньо-професійна програма: «Промислове і цивільне будівництво»

ЗАТВЕРДЖУЮ
Завідувач кафедри
_____ О.І. Лапенко
«13» 04 2022 р.

ЗАВДАННЯ
на виконання дипломної роботи

Елькодусі Абдалла Айман Абдельмонем
(П.І.Б. випускника)

1. Тема роботи «Офісна споруда в м. Ізюм Харківської області»
затверджена наказом ректора від «13» квітня 2022р. № 379/ст.

2. Термін виконання роботи: з «23» травня 2022р. по «19» червня 2022р.

3. Вихідні дані роботи: офісна будівля різної поверховості з цегли та збірними залізобетонними плитами перекриття, навантаження відповідно до ДБН В.1.2-2:2006 «Навантаження та впливи».

4. Зміст пояснювальної записки:
Вступ, аналітичний огляд, архітектурно-планувальна частина, розрахунково-конструктивна частина, технологічно-організаційна частина, висновки, список використаних джерел.

5. Перелік обов'язкового ілюстративного матеріалу: таблиці, рисунки, діаграми, графіки не менше 4-х креслень та 4-х слайдів:
-фасади, план типового поверху, експлікації

- креслення конструкції, специфікації елементів

-технологічно-організаційні схеми виконання основних будівельних процесів

6. Календарний план-графік

№ з/п	Завдання	Термін виконання	Підпис керівника
1.	Аналітичний огляд	13.05.22-14.05.22	
2.	Архітектурно-будівельний розділ	16.05.22-20.05.22	
3.	Розрахунково-конструктивний розділ	23.05.22-02.06.22	
4.	Технологічно-організаційна частина	03.06.22-04.06.22	
5.	Вступ. Висновки. Список використаних джерел.	06.06.22-07.06.22	
6.	Підготовка доповіді та презентації	08.06.22-11.06.22	

8. Дата видачі завдання: «13» травня 2022 р.

Керівник дипломної роботи: _____ Гасій Г.М.

Завдання прийняв до виконання: _____ Елькодусі Абдалла

CONTENTS

INTRODUCTION

Office construction is one of the most promising areas in commercial construction. The design and construction of office buildings have their characteristics and differences.

As a rule, there are increased requirements for security, planning, external and internal design, as well as the quality of engineering systems of office buildings.

Moreover, whether it is large office buildings or mobile mini-offices – all of them must meet the specified requirements.

The main requirements of investors for office buildings are the price (the lower it is, the faster the investment will pay off) and construction time. Investors are not interested in waiting months and years for the completion of construction. For this reason, the construction of office buildings using frame technology and modular construction technology is so popular.

Recently, modular offices are gaining more and more popularity. And there are several reasons for this:

- construction terms. Manufacturing and installation of the building will take from one week to a month, depending on the size of the office building;
- construction price. The cost of building modular offices is several times lower than the cost of building a capital building. At the same time, modular offices are not inferior to capital buildings in terms of convenience and functionality.

Office centers are intended for the gathering and long stay of people in them, there are certain requirements for them and therefore they are built following state standards and norms, equipped with the required security systems. The design is carried out in such a way that the arrangement of offices in the future complies with the rules for labor protection and legislative requirements. It is necessary to pay special attention to the choice of the developer - the reliability of the future premises depends on this.

CHAPTER 1. ANALYTICAL REVIEW

In current times, due to socio-economic growth, the emergence of new technologies, materials, construction, and design of interior office space has undergone rapid and qualitative changes. Today's view of office interior design is radically different from the past. A modern office is a business tool that consists of the company's marketing plan, maintaining its image, and the corresponding corporate culture (for example, a small-town office, a «cooperative society», etc.). Thus, an urgent problem of up-to-date architectural practice is a systematic scientific approach to determining the features of office space design, taking into account functional planning, socio-psychological, ergonomic, and other significant requirements [12, 13, 15].

The learning of technical sources revealed the lack of current systematic studies on this problem. Publications [16, 17, 18,] devoted to the design of exclusive buildings and management complexes, as well as publications [15, 16,], which study numerous features of the design of office and office buildings, assist to discover this issue. In the previous author's article on this topic, the peculiarities of the architectural and planning organization of office space were considered [14, 15].

The architectural and planning organization of the inner space of the office building covers some features, patterns, and practices and is the most important task, which aims to ensure the comfort of staff. The separation of inner office space is considered a planning necessity in the coordinated functioning of all components. Hence the diversity of planning and spatial structures, express a clear system of different relationships between elements and guarantee the invariance of the spatial planning organization.

Techniques for organizing the interior of the office at the level of typical floors depend on the nature of the company and the system of staffing. Based on the analysis, we can distinguish three basic types of spatial conditions: closed –

for individual activities; open – for teamwork; mixed – for group work. These types, focused on the implementation of a given scheme of the team, will determine the three basic techniques of architectural and planning organization of internal office space:

1) Office of rigid type determines the clarity of spatial solutions, individual comfort conditions, and convenience of organizing evacuation routes;

2) Office of flexible type consists of large spaces designed for a significant number of people, characterized by the most efficient use of workspace, flexible planning, and a high degree of transparency of work processes;

3) Office of mixed type proves a combination of first and second techniques, provides high-quality compromise flexibility and the necessary insulation of workplaces, and has a dynamic and clear spatial organization.

Each of these techniques of architectural and planning organization of office space, in turn, identified many subtypes.

The office of rigid type has partitioned into cellular and corridor. Here, the cell type demonstrates linear compositions of rooms or rooms designed using the module. Offices are often the same size and are designed for 1-3 people. This determines the uniformity and simplicity of the division of the interior space, where the corridor acts as a functionally unifying element [15, 18]. This traditional office scheme, which creates an atmosphere of solitude and tranquility, is suitable for companies divided into departments consisting of a small number of people.

Corridor type involves the organization of premises of heterogeneous functional composition, including premises for collective and special functions. There are two types of offices. The first is an office for one person, characterized by increased loneliness of the employee and the inability to work in a team, as well as static composition and lack of flexibility; which became widespread in Western Europe. The second type includes offices designed to accommodate three or more employees.

Here, the corridor acts as a coordinating element that provides a high level of isolation of working groups and at the same time provides an opportunity to perform additional functions [13, 14]. The office-based on flexible planning can be divided into the landscape, boxing, and open types. This space can be undivided or divided into working zones using transforming partitions. It is proposed called flexible planning, in which the main horizontal pedestrian connections, workplaces, and areas can change significantly depending on functional processes and only partially dependent on the location of vertical communication nodes. This technique is used mainly in organizations and corporations that are developing dynamically.

According to research by psychologists, people with different psycho types need the excellent organization of the workspace. Thus, introverts need silence and isolation for comfortable work, and extroverts need communication. This factor affects the results of work, and hence the success of the company. The solution to this problem is the emergence of a mixed type of organization of the interior space of office buildings, which has become popular in Western Europe. In the office, decided based on mixed planning, we can distinguish between combined, modular types and type «pool».

Thus, office work, in general, can be divided into two categories: concentration and communication. The main difficulty in designing office space is finding a balance between these two activities.

The most versatile and promising today is the architectural and planning organization of office space based on mixed types, which realizes the possibility of combining the positive qualities of offices with rigid and flexible types, as well as provides a variety of creative perspectives for architects and designers. Today, an open office is used in cases of equal status of workers, which are united by an intensive scheme of interaction.

The brutal office is used to a limited extent compared to the previous two, but there are and will be processed that require such an organization.

CHAPTER 2. ARCHITECTURAL DESIGN

2.1. Master plan of the site

The building of the Office center was designed in Izyum city of Kharkiv region. The plot area is 1.1 hectares. The designed building is located taking into account the prevailing winds. The orientation of the main premises of the building relative to the cardinal points is such that the most favorable conditions for ventilation and insolation are provided. The relief of the site is calm with a slight slope to the southwest. There is the wind direction repeatability in table 2.1.

Table 2.1

Wind direction repeatability

Month	North	Northeast	East	Southeast	South	Southwest	West	Northwest
January	14	16	16	11	15	15	9	7
July	20	19	7	6	10	9	9	16

When designing the master plan, the placement of buildings was carried out following the instructions of the technical design standards and chapters of ДБН Б.2.2-12:2019 «Planning and Building of Territories» [8], and fire and sanitary breaks to other buildings were observed. The interval of minimum breaks is maintained.

To ensure the improvement and landscaping of the territory, recreation areas, lawns, and green spaces are provided.

Green spaces are of great importance in the fight against urban noise, to protect against smoke and gases. Green spaces can significantly reduce the force

of the wind. The shade given by trees protects well from excess solar energy. Green spaces have a significant impact on air temperature.

The architectural and planning significance of green spaces is very large and diverse. Vegetation has a huge variety of shapes, colors, and textures.

To transform and use the relief to the requirements of planning, development, and improvement, a high-rise organization is carried out, i.e., vertical planning of territories.

With the vertical planning of territories, the following main tasks are solved:

– creation of a relief conducive to the placement and construction of buildings and structures;

– ensuring normal longitudinal slopes of streets and roads for convenient and safe traffic and pedestrians;

– device for surface water drainage with the help of drainage communications.

Platforms and driveways are designed with asphalt pavement.

2.2. Details of the functional process

The office building is designed to perform all types of office operations with individuals and legal entities. On the ground floor, there are night ATMs, operating rooms, storerooms, security rooms, a buffet, and service rooms.

On the second and third floors are located: business rooms and offices. Office hours are one-shift. The approximate staff of service personnel is 20 – 40 people.

The building has a complex shape, has a central entrance for visitors, and service for staff and security services.

2.3. Space planning

The office building has a complex shape in plan. Dimensions in axes 30×18.6 m. The building is three-storied, according to the degree of durability 2, according to the degree of fire resistance 2, building class 2, responsibility class cc1. There are the technical and economic indicators of the building in table 2.2.

Table 2.2

Technical and economic indicators of the building

№	Indicator	Unit of measurement	Quantity
1	Total area	м^2	1419.9
2	Working area	м^2	982.5
3	Auxiliary area	м^2	187.8
4	Utility area	м^2	249.6
5	Building height	м	14
6	Construction volume of the building	м^3	19878.6
7	Area utilization factor	%	69.2

2.4. Thermal engineering characteristics of external enclosing structures

The project provides for effective enclosing structures. External complex walls are insulated with rigid mineral wool boards with heat transfer resistance Ro=2.3 m²·°C/W. The covering above the upper floor is insulated with slab foam concrete γ=400 kg/m³ 250 mm thick, providing R = 2.6 m²·C/W. Filling stained-glass windows with the use of sealed double-glazed windows with Ro>0.5 m²·°C/W. The filling of window openings is provided by window blocks

with triple glazing in wooden separate-paired bindings providing Ro=0.6 m²·°C/W. Characteristics:

- Temperatures: coldest day (0.98): –32 °C;
- Coldest day (0.92): –29 °C;
- Highest cold five (0.92): –25 °C;
- Indoor air: 18 °C;
- Normal temperature difference: 7 °C;
- Heat transfer coefficient of the internal surface: 8.8 W/m²·°C;
- Heat transfer coefficient of the external surface: 23 W/m²·°C;
- Coefficient depending on the position of the outdoor surface: 1;
- Composition of the construction (in order, starting from interior surface to exterior): layer thickness – 0.51 m, 0.05 m, 0.03 m; calculated coefficient of thermal conductivity – 0.70 W/m·°C, 0.04 W/m·°C, 0.77 W/m·°C.

2.5. Characteristics of the main structural elements

Base and foundations.

Dusty sands were taken as the base. Groundwater is absent. The foundations are accepted as tape following ДСТУ Б В.2.6-109:2010 [3]. The depth of foundations is 2.5 meters. Horizontal waterproofing is designed from two layers of roofing felts on bituminous mastic.

Walls and partitions.

External and internal walls – brickwork from clay solid brick grade М-100 of plastic molding following ДСТУ Б В.2.7-61:2008 [1] on cement-sand mortar

grade M-75. Insulation – rigid mineral wool board γ=70 kg/m³. The partitions are made of solid clay bricks of the M-100 brand; 120 mm thick.

Exterior finish – textured plaster, interior – cement-sand mortar plaster.

Overlapping and roofing.

Floor slabs are prefabricated multi-hollow reinforced concrete 220 mm thick according to series 1.041.1.

The gap between the floor slabs is monolithic with cement-sand mortar M-100.

There is a specification of floor slabs and coatings in table 2.3.

Table 2.3

Specification of floor slabs and coatings

Position	Designation	Name	Quantity, pcs.	Weight, tons
1	1.041.1 – 2, В. 3	ПК63.12 – 2	43	2.25
2	1.041.1 – 2, В. 3	ПК30.18 – 1	18	1.48
3	1.041.1 – 2, В. 3	ПК60.15 – 2	7	2.75
4	1.041.1 – 2, В. 3	ПК60.12 – 1	9	2.25
5	1.041.1 – 2, В. 3	ПК90.15 – 1	18	4.45
6	1.041.1 – 2, В. 3	ПК90.12 – 2	36	3.75

Stairs.

In the building being designed, the stairs are prefabricated reinforced concrete, consisting of marches with two half-platforms.

The railing of the march is made of metal sections 0.9 m high with wooden handrails. The march fencing is attached to the embedded details of the march from the side by welding.

Roofing

The roof of the building is designed combined, not ventilated, with a slope of 2 %. Roof structure: coating slabs are coated with a vapor barrier (hot bitumen coating twice), then insulation from foam concrete slabs is laid.

The insulation is leveled with a cement-sand screed 20 mm thick, and then 4-layer roofing felt carpet is glued on bituminous mastic.

In places where the roof adjoins the parapet, fillets are made from a cement-sand mortar to smoothly place the rolled carpet on the parapet wall to a height of 0.25 m. The parapet wall is covered with galvanized steel roofing from above.

The rolled carpet of the parapet wall consists of three additional layers of roofing material on bituminous mastic.

Drainage from the roof is adopted as an organized internal one according to the envelope scheme.

Lintels.

The prefabricated reinforced concrete lintels are used.

Floors.

The following types of floors are designed in the building: ceramic ДСТУ Б В.2.7-282:2011 [2], concrete, and linoleum.

Aerated concrete was adopted as a heater under the floors of the 1st floor.

Doors and windows.

External and internal the door blocks are made of metal-plastic and anodized aluminum. Fire and entrance doors must be equipped with a device for self-closing (pneumatic devices).

Windows and doors are used following [4].

There is the specification of elements for filling window openings in table 2.4.

The glazing of separate partitions between open spaces is made of transparent glass, starting from the glass surface. The height of the partitions from the floor is 2.4 m.

Table 2.4

Specification of elements for filling window openings

Mark	Designation	Name	Quantity			
			1 floor	2 floor	3 floor	Total
O1	Individual	Window block OPC 18-18. Opening 1815×1815	11	16	10	37
O2	Individual	Window block OPC 1518. Opening 1515×1815	2	2	2	6
O3	Individual	Window block OPC 12-18. Opening 1215×1815	4	4	4	12
O4	Individual	Window block OPC 18-12. Opening 1815×1215	6	–	–	6
O5	Individual	Window block OPC 12-12. Opening 1215×1215	3	–	–	3
O6	Individual	Window block OPC 18-09. Opening 1815×915	2	–	–	2

The glazing of partitions of the vestibule-gateway, dividing partitions between the cabins of the rooms of the open space and the halls for individuals and legal entities is made of display glass to the full height.

Exterior and interior decoration.

The outer finish of the building under the «fur coat» with the use of marble chips according to the technology of TM «Ceresit».

The internal working premises are covered with wallpaper, and the corridors and halls are covered with mineral plaster. In the buffet, within the height of the kitchen equipment, as well as the walls of the toilets to a height of 1.8 m, are tiled.

The ceilings of the bathrooms and the buffet are painted with moisture-resistant paints in light colors. Window frames, door leaves, and door blocks are painted with Penatex lacquer 2 times.

At the request of the customer, changes in the interior decoration are possible.

2.6. Engineering equipment and networks

Heating.

The heating system is adopted as a single-pipe dead-end, an independent branch from the control unit. The heat carrier is water with parameters of 95 – 75 °C. The main pipelines are laid near the floor and partially, in underground channels with a laying of 0.002. Pipelines are laid in underground channels, insulated with semi-cylinders of mineral wool on a synthetic binder, followed by wrapping. As heating devices, radiators «M 140-AO» are adopted.

Removal of air from the system is carried out through air cocks designed by Mayevsky, and installed in the upper radiator devices.

Ventilation and air conditioning.

Provides natural ventilation through channels and supply and exhaust with mechanical stimulation. Air conditioning from split systems.

Water supply.

The water supply of the building is provided by external water supply networks. The input is designed from cast-iron pressure pipes d 65 mm, laid at a depth of 0.5 m below the depth of soil freezing. The inner part is mounted from galvanized steel water and gas pipes. Hot water supply – local is provided from domestic electric water heaters.

The input of hot and circulation pipelines into the building is laid together with heating pipes in the heating network channel. The main pipelines of cold and hot water supply are laid in channels under the floors. Estimated water flow

rates and required pressures are determined following ДБН В.2.5-64-2012 [7]. The main pipelines of the cold water supply are isolated from condensate.

Sewerage.

Drainage of domestic wastewater from the building is carried out by outlets Ø100 mm. to the external sewerage network. The internal network is laid from cast-iron sewer pipes. The ventilation of the network is carried out through risers, brought out above the roof by 0.5 m.

Power supply.

The project is designed for voltage 380/220V with a solidly grounded transformer neutral.

According to the degree of reliability of the power supply, the object belongs to category II, except for emergency lighting, electrical receivers of fire-fighting devices, and computer equipment belonging to a special category.

The power supply of the facility is provided from the designed transformer substation via two mutually redundant cable lines.

For consumers of a special category and a part of consumers of category I, it is planned to install an autonomous power source (DES).

The following types of lighting are provided:

– working;

– emergency (evacuation);

– repair (36 V).

Luminaires with fluorescent lamps in the main rooms and with incandescent lamps in auxiliary rooms are accepted as light sources.

Entrance lighting is controlled by switches from the interior rooms (vestibules).

Connection of computers is provided through blocks of socket outlets with a grounding contact. Provides for automatic shutdown of ventilation and air conditioning systems in case of fire.

The server and computer equipment of the server room must be connected to an external ground loop with a grounding device resistance of no more than 2 ohms.

All metal non-current-carrying parts of electrical equipment are subject to grounding.

As zero protective conductors, special protective conductors are used, laid from distribution boards together with phase ones.

CHAPTER 3. STRUCTURAL DESIGN

3.1. Initial data for multi-hollow slab calculation

The panel is manufactured according to the flow-assembly technology with electrothermal tension of the reinforcement on the stops and heat and moisture treatment. Load safety factor $\gamma_f = 1.2$. According to the degree of responsibility, the building belongs to the 1st class. Reliability factor for the purpose $\gamma_n = 1$.

Characteristics:

– concrete heavy class – C16/20;

– longitudinal reinforcement class – A600;

– transverse reinforcement and welded mesh – B500.

Design characteristics of materials are accepted following [11].

3.2. Constructive solution

The geometric dimensions of the multi-hollow prestressed roof panel:

– length – 5980 mm;

– width – 1190 mm;

– depth – 220 mm.

An estimated span of the panel when supported is $120\ mm$. $l_0 = 5980 - 4/3\ 120 = 5820\ mm$.

3.3. Determination of loads and forces

We calculate the loads for 1 m of the length of the panel with a width of $1200\ mm$.

When calculating, we take into account the reliability coefficient for the intended purpose $\gamma_n = 0.95$.

We summarize the calculation in Table 3.1.

Table 3.1

Calculation of loads on the floor slab

№	Type of load	Normative load, kN/m	Load safety factors, γ_a	Design load, kN/m
Permanent load:				
1	The floor is made of ceramic tiles $\gamma = 18$ кН$/m^3$, $\delta = 0{,}02\ m$	0.36	1.2	0.43
2	Cement-sand mortar screed M50, $\gamma = 23\ kN/m^3, \delta = 0{,}02\ m.$	0.46	1.3	0.6
3	Cement-sand mortar screed M50, $\gamma = 23\ kN/m^3, \delta = 0{,}005\ m.$	0.12	1.3	0,15
4	Coating plate $\gamma = 25\ kN/m^3, \delta = \ 0{,}22\ m$	2.1	1.1	2,31
Total:		3.04	–	3.49
Temporary load:				
1	Long	1	1,2	1,2
2	Short-term	1	1,2	1,2
Total:		2	–	2,4
Full load:		5.04	–	5.89

Estimated loads per 1 m of panel length.

Full design load: $q = 5.89 \times 1.2 \ = \ 7.07\ (kN/m)$

Full standard load: $q_2 = \ 5.04 \times 1.2 \ = \ 6.05\ (kN/m)$

Normative continuous load: $q_3 = \ (3.04 + 3.49) \times 1.2 \ = \ 7.83\ (kN/m)$

Design bending moment from full design load:

$$M = q \times l^2/8 = 30.1\ kNm, \quad (3.1)$$

Calculation of forces from the standard load. Design bending moment from full standard load following formula (3.1) is $25.6\ kN/m$.

The continuous load moment following formula (3.1) is $33.2\ kN/m$

The shear force from design load:

$$Q = q \times l/2 = 7.07 \times 5.82/2 = 20.7\ kNm, \quad (3.2)$$

The shear force from full standard load following formula (3.2) is $17.6\ kN$.

3.4. Calculation of the strength of a normal section

To calculate a multi-hollow panel, the cross-section is reduced to an equivalent I −section with a height $h = 220\ mm$, a flange width $bf' = 1190\ mm$, a rib width $b = 195\ mm$ and a compressed flange thickness $hf' = 30\ mm$.

We replace the areas of round voids with rectangles of the same area and the same moment of inertia.

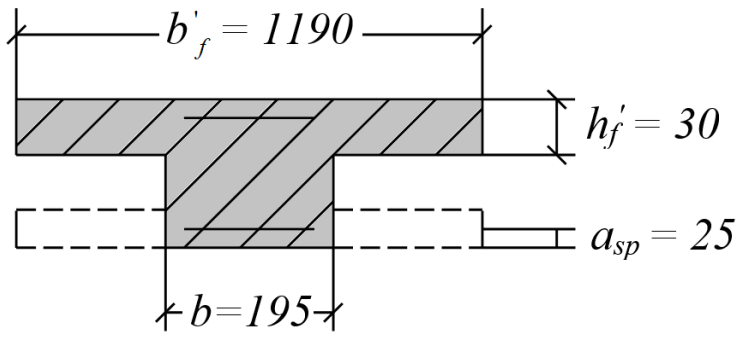

Fig. 3.1. The normal section of the structure

The initial prestress of the reinforcement transferred to the pallet is taken: $\sigma_{sp} = 0.75 \times 590 = 443\ MPa$.

We assign $a_{sp} = 2.5\ cm$, then the working height of the section is:

$$h_0 = h - a_{sp} = 22 - 2{,}5 = 19{,}5\ cm. \quad (3.3)$$

Now we sequentially calculate:

$\omega = 0{,}85 - 0{,}008 \times 10{,}35 = 0{,}767$

$\Delta\sigma_{sp} = 1500 \times (443/510) - 1200 = 103\ MPa$

$\sigma_{sr} = 510 + 400 - 443 - 103 = 364\ MPa$

$\xi_R = 0.628$

$A_r = 0.628 - (1 - 0.5\ 0.628) = 0.431$

Since $M_f = 10.35 \times 119\ 3 \times (19.5 - 0.5\ 3) \times 100 = 6651000\ N/cm = 66.51\ kN/m > 33.2\ kN/m$, then the neutral axis passes within the flange and the section is calculated as a rectangular width: $b = b_f' = 119\ cm$.

We determine the cross-sectional area of the reinforcement by the formula:

$$A_0 = \frac{M}{b_f' \times h_0 \times f_{cd}} = 0.0711 < A_r = 0.431, \quad (3.4)$$

according to the table, we find $\xi = 0.074$ and $\nu = 0.963$.

The required cross-sectional area of the longitudinal reinforcement is $A_s = 3.73\ cm^3$.

We accept 6Ø10 with $A_{s,fact} = 3.93\ cm^2 > A_s = 3.73\ cm^2$.

3.5. Strength calculation of sections inclined to the longitudinal axis

Suppose that on the support sections of the panel 1.2 m long on each side we put 4 frames (h=4) with transverse rods with a diameter of 4 mm, installed at a distance from each other S=10 cm.

Then $\alpha = E_s/E_B = 7.08$, $\mu_\omega = A_{s\omega}/b_s = 0.0026$, $\varphi_{\omega 1} = 1 + 5\alpha\mu_\omega = 1.09$, $\varphi_{B1} = 1 + \beta f_{cd} = 0.9$.

Since the condition is met $Q = 17.6\ kN < 0.3\varphi_{\omega 1}\varphi_{B1} f_{cd} b h_0 = 115.82\ kN$, then the accepted dimensions of the section are sufficient.

To check the conditions, we determine by the formula $Q = 17.6\ kN < \varphi_{b3} f_{ctk} b h_0 (1 + \varphi_f + \varphi_n) = 25.69\ kN$.

The conditions are met, so the calculation of transverse reinforcement is not performed.

3.6. Calculation based on the formation of cracks normal to the longitudinal axis of the panel

The maximum stress in the compressed zone:

$$\sigma_b = M_n y / I_{red} + P_2 / A_{red} - P_2 e_{op} y / I_{red} = \\ = 2560000 \times (22 - 3.6)/(86814 \times 100) + \\ +134799/(1438.39 \times 100) - \\ -134799 \times 1.1 \times 18.4/(86814 \times 100) = 6.03\ MPa \quad (3.5)$$

Coefficient $\varphi = 1.6 - 6.03/15 = 1.2 > 1$ then accept $\varphi = 1$ and distance $r = 24115/1458.39 = 16.5\ cm$.

The moment of crack formation $M_{crc} = 1.4 \times 36174 + 0.9 \times 134799 \times (1.1 + 16.5) = 20.9\ kNm < 25.6\ kNm$.

In the section normal to the longitudinal axis of the element, cracks are formed, so it is necessary to calculate their opening.

We determine the crack opening width from the short-term action of the entire standard load.

Sequentially calculate the values $\mu = A_s/bh_0 = 0.007 < 0.02$, $\varphi_f = 0.6$, $\lambda = 0.6 \times (1 - 4.1/(2 \times 19.5)) = 0.5$.

Then $M_{tot} = 25.6\ kNm$,

and $\sigma = 2560000/(31 \times 19.5^2 \times 15 \times 100) = 0.15\ MPa$.

Compression force, taking into account the accuracy factor $\gamma_{sp} = 0.86$;

$P_2 = 0.9 \times 134799 = 115927\ N = 115.9\ kN$, applied at the center of gravity of the reinforcement section. Center of longitudinal force $N_{tot} = P_2$ relative

to the center of the section under full load: $e_{s,tot} = M_{tot} / N_{tot} = 2560000 / 115927 = 22{,}2\ cm.$

Relative height of the compressed zone $\xi = 0.4 < 1.$

Voltage increment in design reinforcement under the action of the entire load $\sigma_s = 90.5\ MPa.$

Inner pair distance $Z = 16.88\ cm.$

The average value of reinforcement diameter $d \approx 10\ mm.$

The desired width of the short-term crack opening at the reinforcement level, at $\sigma = 1;\ \eta = 1$, then $a_{crc} = 0.06\ mm < 0.44\ mm.$

CHAPTER 4. TECHNOLOGY OF CONSTRUCTION

4.1. Construction technology

4.1.1. Excavation.

During the construction of the building, as well as the planning and landscaping of the territory, the soil is processed. The specialized earthworks flow includes the following private flows:

- cutting of the vegetative soil layer from the planned area, which is carried out by a bulldozer of the DZ-101A brand. The soil is transported to a distance of up to 20 km by dump trucks for the reclamation of agricultural land;
- vertical planning is carried out to ensure the drainage of water from the construction site with a slope of 5% toward natural drainage. The layout is carried out according to the balance of earthen masses by the bulldozer DZ-101A;
- development of pits is carried out by a single-bucket excavator EO-2621 with a capacity of 96 kW / h. The excavator is equipped with a straight shovel;
- manual refinement is carried out by cleaning the bottom of the pit to the design mark with shovels.

It is allowed to start earthworks only at the end of the preparatory work. Dump trucks deliver sand and arrange sand preparation for foundations.

4.1.2. Underground device.

Before foundation installation, the following work must be completed:

– the conformity of the actual marks of the bottom of the pit was checked;

– the basis under the bases is verified and leveled;

– the conformity of the actual marks of the bottom of the base with the design ones was checked;

– the quality of the foundation soil and its compliance with the design data were checked;

– rendered axial risks on concrete preparation.

The installation of monolithic foundations shall be carried out according to working drawings in compliance with ДБН А.3.2-2-2009 [9].

After the installation of foundations, and their waterproofing, the excavation is backfilled and the soil is compacted. The filled soil is compacted with pneumatic rammers. Installation of prefabricated reinforced concrete elements is carried out using a crane MKG-40.

The installation of blocks should begin with the installation of lighthouse blocks (corner and intermediate). When laying out the installation sites for blocks of subsequent rows, apply drawings of the axes of vertical seams to the side surface of the block.

Before mounting the blocks of the second row, cut or bend the mounting loops of the previous row, then make a bed from the solution. Drive two beacons and two wedges into the bed under each block. Beacons are installed near the outer face of the block at a distance of 8–10 cm from the side face. Lay the wedges under the inner edge to provide a slight inclination of the block outward. Remove wedges 1–2 days after block installation.

During installation, control the position of the block in the longitudinal direction according to the risks of the axes of the vertical seams and the size of the mounting gap between the installed and installed blocks, in the transverse direction – along the edge of the blocks of the lower row.

The correctness of the installation of the top of the block is checked by mooring and sighting on previously installed blocks. If the deviation of the top of the block from the design position exceeds 5 mm, the block should be lifted, set aside, cleared of the mortar, and the mortar bed should be re-arranged, replacing the beacons with thicker or thinner ones, and the block should be installed again. Check the horizontality of the top of the block in the longitudinal direction by the rule with a level and sighting on previously installed blocks.

After installing the block, the vertical grooves and the seams between the blocks are filled with mortar, which is fed from the box to the groove in a bucket with a spout or thrown into the groove with a mortar shovel or trowel in layers of about 0.3 m. As the groove is filled, the solution is compacted with a bayonet.

To protect the foundations from moisture, horizontal and vertical waterproofing is installed. The foundation structures are subject to delivery according to the act before the start of work on the construction of the above-ground part of the building.

4.1.3. Development of a technological map for the device of the above-ground part.

The supply and installation of elements of the above-ground part are carried out with the help of a crane MKG-40. We proceed to the construction of the above-ground part only after an instrumental verification of compliance with the design of the position of the foundations.

The slinging of the elements and their supply to the place should be carried out only in the position corresponding to the design one.

Scope of the technological map.

This technological map has been developed for the device of the above-ground part of the building. The building is divided into two sections and the construction is carried out sequentially, i.e. first, a building is erected on the first capture, then on the second.

Construction on the first and second grips is similar. The erection of walls from ceramic bricks and partitions are made of ceramic bricks. Slabs of 1.5×6, and 1.2×6 are laid on top.

Justification of the adopted installation method.

In this technological map, a sequential mounting method is adopted. With this method, all structures are mounted in a certain order: columns, crossbars, and slabs. This method allows the standard setting of concrete, which affects the strength of the structure and quality.

In the direction of the development of the installation process, we accept the installation of structures around the perimeter of the building with external penetration of the crane.

4.1.4. Choice of mounting mechanism.

The initial data for the selection are the dimensions, space-planning solutions, parameters and working positions of the mounted loads, the method and technology of installation, and the conditions for the production of work.

For the installation of structures of the designed building, we accept a tower crane. The crane stops are determined by taking into account the maximum reach of the boom and taking into account the load capacity at this reach.

Carrying capacity.

$$Q_{cc} = m_{\text{e}} + m_s = 4.5 + 0.02 = 4.52\ t, \qquad (4.1)$$

m_{e} – the mass of the lifting element;

m_s – the weight of the sling

According to the height of the hook.

$$H_H = h_0 + h_1 + h_{\text{e}} + h_s = 13.8 + 1.0 + 0.2 + 5.0 = 19\ m, \qquad (4.2)$$

$h_0 = 13.0 - 2.2 = 10.8\,m$ – the height of the mon. buildings from the base of the crane;

$h_1 = 1.0\,m$ – the distance from the top of the building to the bottom of the load;

$h_e = 0.2\,m$ – the height of the mounted element;

$h_s = 5.0\,m$ – the height of the lifting devices.

We accept jib crane MKG-40 with the length of the boom of $30\,m$.

4.1.5. Description of technological processes.

Before the commencement of work on the construction of the above-ground part of the buildings, the following work must be completed:

- prepared inventory and fixtures;
- planned areas for storing bricks and prefabricated structures on the 1st floor;
- checked the marks of the bases for brickwork.

The brickwork of walls and partitions.

When laying brick walls up to 4 meters, scaffolds are used. Dimensions of ceramic bricks 250×120×65 mm. The workplace includes three zones: a work zone, a storage zone, and a transport zone. The working area has a size of at least 0.60 – 0.70 m, the storage area is 1.00 – 1.60 m, and the free area is 0.30 – 0.90 m.

The average thickness of horizontal joints should be 12 mm, and vertical 10 mm. Bricklayers use instrumentation.

Produce brickwork of walls following working drawings and in compliance with the requirements of [6, 9, 10]

Organization of labor of masons.

The main method of the organizational process in brickwork is flow-ring.

In the link, duties are distributed in such a way that all masons are equally loaded and perform work operations in terms of complexity corresponding to their category. A high-ranking bricklayer sets, rows, lays verst rows and checks the correctness of the laid out sections. Henchmen serve bricks and spread mortar

The labor productivity of a bricklayer is also influenced by the organization of the workplace. Following the organization of the workplace, it should be in the service of a crane. In this case, three zones should be distinguished: a working zone of 0.6–0.7 m wide, a material zone of 0.65–1 m, and a transport zone of 0.8–1.25 m. The total width of the mason's workplace reaches 2.5 m. The brick is placed along the front of the work, alternating with the solution. When laying walls with openings, the brick should be placed opposite the walls and the mortar - opposite the openings.

The supply of bricks at the workplace should be 2–4 hours required, the mortar is supplied to the scaffold before the start of laying. In the future, the material is supplied as it is spent. In the warm season, the amount of solution is 40–45 minutes of work. The operating load on the scaffold must not exceed 250 kg/m².

Installation of landings and marches.

Sling flights of stairs with a four-branch sling. Stair flights and landings are mounted similar to slab elements of floors of multi-story buildings. The difference lies in the fact that they are raised in an inclined position and the slope at the same time slightly exceeds their slope in the design position. This is necessary to first support the lower end of the march on the landing and then lower the upper end onto the support. Before laying the march with a template, they check the correctness of laying the sites.

Installation of roof and ceiling structures. Plate installation process.

– cleaning of coating plates and embedded parts from dirt;

– checking the correct location of embedded parts and dimensions of the slab;

– slinging plate;

– lifting, setting, and alignment;

– slinging.

Installation of plates is carried out by a link of assemblers consisting of five people.

Installation work is carried out by a jib crane from on-site storage. Plates are stored in stacks. The first slab is laid on a lining of 70×70 timber, and the subsequent ones are on a lining of 50×50 mm timber. The height of the stacks is not more than 2.4 m (six slabs are stacked in stacks).

When laying the floor slabs, care should be taken to ensure that the bearing structures are carefully supported and that the bearing area meets the requirements of the project. The slabs are mounted using special traverses, built at the required number of points specified in the project. During laying, it is necessary to provide a gap between the plates and install each subsequent one after welding the previous one to the embedded parts of the crossbar.

Scope of work:

– preparation of a bed from a ready-made solution;

– laying slabs of panels with a crane;

– alignment and correction of the position of plates or panels;

– fastening plates or panels with anchors to each other.

Quality control of brickwork.

The quality of brickwork must meet the requirements of national codes. Quality control must be carried out in the course of laying and, if necessary, acceptance of hidden work with the preparation of acts.

Acceptance of finished masonry structures must be accompanied by a check:

- the correctness of dressing, the thickness of the filling of the seams, as well as the verticality, horizontality, and straightness of the surfaces and knots of the masonry;
- the presence and correct installation of embedded parts, connections, acts, and anchors;
- the quality of the surfaces of the facade non-plastered brick walls, and compliance with the required dressing and jointing.

Deviations in the dimensions of stone structures from the design ones should not exceed the allowable deviations given in this technological map.

There are tolerance and deviations in the assembly of prefabricated structures in table 4.1.

During the installation process, operational quality control of work is carried out. The main criteria for the quality of installation work: are the accuracy of the installation of elements and the thoroughness of the permanent fastening of the joints. Upon completion of the brickwork, an acceptance control is carried out. It is carried out by separate sections of the building during the acceptance of work by foremen and foremen, as well as in general for the facility upon its delivery. Upon delivery of completed stone structures, an act of acceptance of stonework is drawn up. Working drawings of structures, work production logs, and acceptance certificates for hidden works are attached to the acceptance certificate.

Quality control of installation works.

When installing reinforced concrete structures, it is necessary to comply with the requirements of national codes. The quality control of the installation is carried out from the moment the structures arrive at the construction site, the object is subjected to incoming control by external inspection. If deviations from

the project exceed the allowable national codes, then they make a complaint and, together with the rejected products, are sent to the manufacturer.

Table 4.1

Tolerances and deviations in the assembly of prefabricated structures

№	Parameter	The value of permissible deviations, mm
1	Irregularities on the vertical surface are allowed when applying a 2-meter rail not plastered not plastered plastered	 ±5 ±10
2	Rows of masonry from the horizontal to 10 meters in length	±15
3	Surfaces and angles of masonry from the vertical to the 1st floor	±10
4	By offset of the axes of adjacent window openings	±20
5	By the width of the openings.	±15
6	By cut marks	±15
7	According to the width of the piers	±15
8	By displacement of the axes of the structure	±10
9	By masonry thickness	+10

Tolerances and deviations in the assembly of prefabricated structures: the offset in terms of pavement slabs relative to their design position is ±13 mm.

During the installation process, operational quality control of work is carried out. The main criteria for the quality of installation work: are the accuracy of the installation of elements and the thoroughness of the permanent fastening of the joints. Upon completion of the installation of structures, an acceptance control is carried out. It is carried out by separate sections of the building during the acceptance of work by foremen and foremen, as well as in

general for the facility upon its delivery. Upon delivery of the mounted object, an act of acceptance of installation work is drawn up. The acceptance certificate is accompanied by working drawings of structures, work logs, acceptance certificates for hidden work, documents of laboratory analysis, and tests when monolithic joints.

Safety requirements in the production of brickwork.

When performing work on the construction of brick walls, it is necessary to comply with the requirements of [9].

When erecting walls, it is necessary to check the condition of the sub-bridges and scaffolding daily, not allowing them to be loaded more than is established by the project. Packages with bricks or small blocks and boxes of mortar should be placed following the accepted organization of the workplace and provide free passage. The initial level of masonry should rise 150 mm above the surface of the scaffold flooring and inter-floor overlapping. Laying while on the wall and walking on the wall should not be allowed.

It is impossible to lay walls to a height of more than two floors without installing an inter-floor overlap or laying temporary flooring.

The walls of buildings up to 8 m high can be laid out without protective peaks, provided that a fence is installed around the building at a distance of at least 1.5 m from the wall of sheds above the entrances.

Scaffolding and scaffolding are fenced with railings at least 1.0 m high, which must have a handrail on top, one intermediate horizontal element and a board at least 150 mm high. Window and door openings that are not filled with blocks must have a temporary fence.

When supplying materials during the masonry process, it is necessary to check the condition of slings, pallets, and other gripping devices. Workers should not be under the boom of a crane with a load.

Safety requirements in the production of installation work.

When performing work, it is necessary to be guided by [9]. On the site (grip) where installation work is being carried out, other work is not allowed.

Installation work is allowed for persons not younger than 18 years old, trained in special. program and have a certificate for the right to carry out these works, undergoing a medical examination and appropriate safety briefing. To prevent workers from falling from a height, inventory scaffolding or temporary flooring with fencing of the workplace should be installed when it is located above 1 m from the floor level. Workers employed at the installation are provided with overalls, footwear, and helmets. Hazardous areas must be identified and fenced off at the construction site.

With free mounting, the raised elements must be supported by swinging with flexible braces. Mounted elements are unstrapped only after secure fastening. Lifting machines and mounting devices must undergo technical inspection before they can be used.

4.1.6. Roofing.

Roofing is carried out in the following technological sequence: installation of roof structures, installation of purlins, laying of metal tiles

The supply of materials and the lifting of people are carried out using the TP-2 hoist.

4.1.7. Finishing works.

Exterior finish

The outer surfaces of the walls from the 0.000 mark are plastered with materials according to the Ceresit exterior finishing system. The porches of the building are made of monolithic concrete with stuffed concrete steps. The covering of the platform of the porch of the main entrance is made of granite slabs measuring $500 \times 500 \times 20\ mm.$

Interior decoration.

When finishing the room, improved coloring is used. The roughness is smoothed out, and all permissible surface cracks are embroidered and sealed with putty. Before starting painting work on the premises, it is necessary to complete all construction work (except for the installation of clean floors).

Painting surfaces with water-based compositions is carried out with rollers. Painting is done in thin layers several times after the previous layer has completely dried.

Painting is carried out using a painting station SO–114 with a productivity of 500 m²/h when applying water compositions.

Before plastering, the surface is cleaned and notched over the entire plane. Multi-layer plaster is made of three separately applied layers of spray, primer, and topcoat. Each subsequent layer is applied only after leveling and setting the previous one. The solution is leveled along the lighthouse rails manually by the rule. Grouting is done by hand. Plastering work is carried out mechanized, using the SO–115 plastering station.

The facing of the surface begins with its marking and hanging with a plumb line to determine their deviation from the vertical and horizontal. They install rails of nails along which the surface is finally leveled, then, after 1.50 m from each other, lighthouse tiles are installed, then the upper lighthouse tiles are also fixed by weight. Facing begins with the first lower beacon row, which is installed on a horizontal rail, aligned to the level. Facing is carried out from the bottom up with the observance of vertical and horizontal rows.

4.1.8. Floor arrangement.

The complex process consists of the following operations: foundation arrangement, underlayment, screed, waterproofing layer, and concrete cover. A flow-complex method of laying each type of floor is used. The link of workers performs the whole complex of works on the device of the floor on the grip and

only then moves on to the next one. The structure of the link includes concrete workers and carpenters.

Concrete and mosaic coatings are made from concrete mixtures on Portland cement M 400. Crushed stone of $5…15\ mm$ sizes from rocks are used as a coarse aggregate, river sand serves as a fine aggregate. Monolithic concrete floors are made in one layer with a thickness of $25…50\ mm$, and mosaic in two layers: the lower layer of the solution is $15…20\ mm$, and the upper one is $25…30\ mm$. Immediately before laying the coating material, the surface is abundantly moistened and primed with cement laitance. To obtain a mosaic coating on the underlying layer, veins of glass, brass, and aluminum are preliminarily exposed.

Ceramic tiles measuring $300 \times 300\ mm$ are laid on a cement-sand mortar screed $10 - 20\ mm$ thick. After preparing the base, they begin marking and installing beacons. After laying the frieze row and installing the lighthouse rows, the rest of the tile is laid from the tiles. The finished floor of ceramic tiles must be even and horizontal.

Linoleum floors are performed on cement-sand screeds with a finishing finish with leveling compounds. Before laying the floors, linoleum is kept indoors at an air temperature of at least 15 ℃ for 2 days. Linoleum is glued to the base with TM «Master» glue, which is applied in a continuous layer with a plastic spatula $1\ mm$ thick. Cutting and gluing are performed no earlier than 2–3 days after the panels are pasted. The gaps between walls and linoleum should not exceed $10\ mm$. After laying linoleum, wooden or plastic skirting boards are installed. Skirting boards are attached to the wall with nails.

The parquet flooring is made up of separate planks (riveting), which have a groove and a ridge on the side and end edges. Piece parquet planks are made of 20 mm thick pine and larch wood. The humidity of the rivets should be within 6 … 10 %. Planks of parquet should not have cracks or chips. Parquet planks are laid on a layer of mastic.

4.2. Organization of construction production

4.2.1. Conditions for the organization and implementation of construction, characteristics of the construction site, and the designed building.

The building of Office center is being built in Izyum city of the Kharkiv region. The construction area, to its remoteness from the bases of the construction industry, is connected by a network of city roads, which ensures uninterrupted delivery of materials in a two-shift operation.

Water supply from the existing city water supply network. Electricity supply – from the city network.

Construction is carried out by contract. The general contractor leads the construction and is responsible to the customer not only for the scope of his work but also for the work of the subcontractor performing special work.

Before the start of construction, the construction site was prepared for construction. The layout of the construction site has been made, and trees and shrubs have been uprooted and, if possible, replanted.

Access roads are arranged, because. the structure is being built as part of a complex of structures. Sites for the storage of materials and structures have been identified.

The supply of the construction site with the necessary materials is carried out by road transport at a distance not exceeding 50 km.

The construction is carried out in the developed area, the builders live in the city. Water and electricity are supplied from city communications. Communications are provided: water supply, sewerage, heating system. The site is fenced and safety signs are installed. At night, it is illuminated.

4.2.2. Normative duration of construction.

Following ДСТУ Б А.3.1-22:2013 «Determination of the duration of construction» [5], the standard construction period is 15 months, including the preparatory period of 1 month. The start of construction is on April 1, 2023.

4.2.3. The need for material and technical resources.

There is the statement of the need for construction machines, mechanisms, and small-scale mechanization in table 4.2.

4.2.4. Work methods.

The layout of the construction site is carried out by a bulldozer DZ-101A with power up to 96 kW with soil movement up to 10 m.

The excavation of the pit is carried out by an EO-2621 excavator equipped with a backhoe with a bucket volume of 0.5 m³. Soil cleaning for foundations is carried out manually up to 2 m deep without fixing slopes.

Installation of foundation slabs and blocks is carried out using a crane MKG-40.

Backfilling of soil in the sinuses of foundations using a bulldozer. Soil compaction is carried out by pneumatic rammers TR-1 without watering in one pass. Soil compaction - using a smooth self-propelled roller 1U-89.

Installation of the elements of the building frame and the supply of materials is carried out using a crane MKG-40. The waterproofing device from a cement-sand mortar 1: 2 with a thickness of 20 mm is carried out manually.

Painting with water-based compositions is carried out using the SO-115 painting station with a capacity of $500\,m^2/h$ when applying aqueous compositions.

Table 4.2

Statement of the need for construction machines, mechanisms, and small-scale mechanization

№	Machines and mechanisms	Model	Qty, pcs.	Carrying capacity, t	Power, kWt
1	2	3	4	5	6
1	Bulldozer	DZ-101	1	–	96
2	Excavator	E0-2621	1	–	–
3	Crawler crane	MKG-40	1	10	–
4	Truck	ZIL 130	2	5	–
5	dump truck	ZIL 15021	2	5	–
6	General-purpose semi-trailer	MAZ 35224	1	10	–
7	Road roller	DU 89	1	–	–
8	Pneumatic rammer	TR-1	1	–	12
9	Welding machine	STN-350	2	–	30
10	Lift	TP-2	1	–	7
11	Rewinding machine	SO-98	1	–	40
12	Compressor	SO-7	1	–	4
13	plastering station	S-327	1	–	10
14	sticker machine	SO-99	1	–	1.1
15	Anti-corrosion unit	UPAG-1	1	–	0.4
16	Painting station	SO-115	1	–	40

Plastering of walls and partitions is carried out using the C-327 plastering station with a capacity of $2-4\,m^3/h$. Wall cladding with ceramic tiles, as well as the installation of clean floors, is carried out manually.

The compaction of the crushed stone base under the blind area, as well as the installation of the asphalt concrete pavement, are carried out by the DC-87 skating rink.

The work is carried out by appointment. Installation of the building frame and finishing work is carried out according to the grips, earthwork, and roofing – with a breakdown along the length of the building. Works are carried out with the maximum combination in time.

To display the process of project implementation and construction management, a construction schedule is used, which allows you to:

- display the structure of the project and establish the relationship of individual sections;
- draw up a reasonable plan for the implementation of the project, since when building a network model, the experience and knowledge of specialists directly involved in solving problems are used;
- predict critical work and focus management attention on their implementation;
- more efficient use of resources;
- apply for information processing computers;
- to carry out continuous planning of work by adjusting plans, taking into account the changes that have arisen;
- take a new approach to reporting on construction.

4.2.5. Placement of temporary objects at the construction site.

The building master plan is developed at the stage of erection of the above-ground part of the building. Temporary administrative buildings, a temporary water supply network, and a transformer substation of the required capacity are provided at the construction site, and the number of lamps required for security

lighting has been calculated. The construction master plan was developed to address the issues of rational use of the construction site, location of production facilities, placement of storage facilities, administrative and amenity premises, establishing the location and length, temporary roads, water supply networks, sewerage, power supply, and other communications.

Delivery of materials and structures to the construction site is carried out by the road, for which temporary roads with a radius of curvature of 12 m are provided, the width of the roads is 4.5 m, and the surface is unpaved. Temporary intra-construction roads are designed along the routes of permanent roads in a circular pattern.

The crane service area is determined by the maximum required hook reach and the maximum working section of the crane runway, the danger zone is equal to the maximum crane hook reach plus 5 m, with a load drop height of up to 20 m.

When locating sanitary and administrative buildings, it is necessary to ensure the safety and convenience of approaches to them, not interfere with construction throughout the entire period, and ensure maximum blocking of buildings among themselves.

Household and administrative buildings should be at least 50 m away from objects emitting dust and harmful gases and located to them on the windward side of the prevailing winds. The distance from drinking installations to workplaces should not exceed 75 m, and from food points – 600 m. Restrooms should be located so that the distance from the most remote workplace does not exceed 200 m.

Open areas for storage of building materials and structures are located near the facility under construction and in the area of the assembly crane. There is also a closed material warehouse and sheds. The placement of warehouses on the construction master plan is linked to the availability of access roads and entrances. The warehouses are provided with free access for vehicles and electric lighting lines. Warehouses must be 1.5 m from the edge of the road.

CONCLUSIONS

In this work was designed Office center in Izyum city of Kharkiv region.

The first part of this thesis describes the analytical review.

The second part of this thesis describes the Architectural solution of the Office center. The building of the Office center was designed in Izyum city of Kharkiv region. The plot area is 1.1 hectares. The designed building is located taking into account the prevailing winds.

The orientation of the main premises of the building relative to the cardinal points is such that the most favorable conditions for ventilation and insolation are provided. The relief of the site is calm with a slight slope to the southwest.

To ensure the improvement and landscaping of the territory, recreation areas, lawns, and green spaces are provided.

Green spaces are of great importance in the fight against urban noise, to protect against smoke and gases. Green spaces can significantly reduce the force of the wind. The shade given by trees protects well from excess solar energy. Green spaces have a significant impact on air temperature.

The architectural and planning significance of green spaces is very large and diverse. Vegetation has a huge variety of shapes, colors, and textures.

To transform and use the relief to the requirements of planning, development, and improvement, a high-rise organization is carried out, i.e., vertical planning of territories.

The office building is designed to perform all types of office operations with individuals and legal entities. On the ground floor, there are night ATMs, operating rooms, storerooms, security rooms, a buffet, and service rooms.

On the second and third floors are located: business rooms and offices. Office hours are one-shift. The approximate staff of service personnel is 20 – 40 people.

The building has a complex shape, has a central entrance for visitors, and service for staff and security services.

The foundations are accepted as tape following ДСТУ Б В. 2.6 – 109: 2010. The depth of foundations is 2.5 meters. Horizontal waterproofing is designed from two layers of roofing felts on bituminous mastic.

External and internal walls – brickwork from clay solid brick grade М – 100 of plastic molding following ДСТУ Б В. 2.7 – 61: 2008 on cement-sand mortar grade М – 75. Insulation – rigid mineral wool board $\gamma = 70\ kg/m^3$. The partitions are made of solid clay bricks of the М – 100 brand; 120 mm thick.

Exterior finish – textured plaster, interior – cement-sand mortar plaster.

Floor slabs are prefabricated multi-hollow reinforced concrete 220 mm thick according to series 1.041.1. The gap between the floor slabs is monolithic with cement-sand mortar М – 100.

In the building was designed, the stairs are prefabricated reinforced concrete, consisting of marches with two half-platforms.

The railing of the march is made of metal sections 0.9 m high with wooden handrails. The march fencing is attached to the embedded details of the march from the side by welding.

The roof of the building is designed combined, not ventilated, with a slope of 2 %. Roof structure: coating slabs are coated with a vapor barrier (hot bitumen coating twice), then insulation from foam concrete slabs is laid.

In places where the roof adjoins the parapet, fillets are made from a cement-sand mortar to smoothly place the rolled carpet on the parapet wall to a height of 0.25 m. The parapet wall is covered with galvanized steel roofing from above.

The ceilings of the bathrooms and the buffet are painted with moisture-resistant paints in light colors. Window frames, door leaves, and door blocks are painted with Penatex lacquer 2 times.

The third part describes the multi-hollow slab calculation. Determination of loads and forces was performed. Calculation of the strength of a normal section

was performed. Strength calculation of sections inclined to the longitudinal axis was performed. Calculation based on the formation of cracks normal to the longitudinal axis of the panel was performed.

The fourth part describes the technology of construction. This part has two sections. It is Construction technology and the Organization of construction production.

During the construction of the building, as well as the planning and landscaping of the territory, the soil is processed. The specialized earthworks flow includes the following private flows: cutting off the vegetative soil layer from the planned area, which is carried out by a bulldozer of the DZ – 101A brand. The soil is transported to a distance of up to 20 km by dump trucks for the reclamation of agricultural land; vertical planning is carried out to ensure the drainage of water from the construction site with a slope of 5% toward natural drainage. The layout is carried out according to the balance of earthen masses by the bulldozer DZ – 101A; the development of pits is carried out by a single-bucket excavator EO – 2621 with a capacity of $96\,kW\,/\,h$. The excavator is equipped with a straight shovel; manual refinement is carried out by cleaning the bottom of the pit to the design mark with shovels.

The installation of monolithic foundations shall be carried out according to working drawings in compliance with ДБН А.3.2-2-2009.

After the installation of foundations, and their waterproofing, the excavation is backfilled and the soil is compacted. The filled soil is compacted with pneumatic rammers. Installation of prefabricated reinforced concrete elements is carried out using a crane MKG-40.

Before mounting the blocks of the second row, cut or bend the mounting loops of the previous row, then make a bed from the solution. Drive two beacons and two wedges into the bed under each block. Beacons are installed near the outer face of the block at a distance of 8–10 cm from the side face. Lay the wedges

under the inner edge to provide a slight inclination of the block outward. Remove wedges 1–2 days after block installation.

During installation, control the position of the block in the longitudinal direction according to the risks of the axes of the vertical seams and the size of the mounting gap between the installed and installed blocks, in the transverse direction – along the edge of the blocks of the lower row.

Before the commencement of work on the construction of the above-ground part of the buildings, the preparatory work must be completed.

The main method of the organizational process in brickwork is flow-ring.

In the link, duties are distributed in such a way that all masons are equally loaded and perform work operations in terms of complexity corresponding to their category.

The labor productivity of a bricklayer is also influenced by the organization of the workplace. Following the organization of the workplace, it should be in the service of a crane. In this case, three zones should be distinguished: a working zone of 0.6–0.7 m wide, a material zone of 0.65–1 m, and a transport zone of 0.8–1.25 m. The total width of the mason's workplace reaches 2.5 m. The brick is placed along the front of the work, alternating with the solution. When laying walls with openings, the brick should be placed opposite the walls and the mortar - opposite the openings.

The supply of bricks at the workplace should be 2–4 hours required, the mortar is supplied to the scaffold before the start of laying. In the future, the material is supplied as it is spent. In the warm season, the amount of solution is 40–45 minutes of work. The operating load on the scaffold must not exceed 250 kg/m².

Stair flights and landings are mounted similar to slab elements of floors of multi-story buildings. The difference lies in the fact that they are raised in an inclined position and the slope at the same time slightly exceeds their slope in the design position. This is necessary to first support the lower end of the march on

the landing and then lower the upper end onto the support. Before laying the march with a template, they check the correctness of laying the sites.

Installation of plates is carried out by a link of assemblers consisting of five workers.

The quality of brickwork must meet the requirements of national codes. Quality control must be carried out in the course of laying and, if necessary, acceptance of hidden work with the preparation of acts.

During the installation process, operational quality control of work is carried out. The main criteria for the quality of installation work: are the accuracy of the installation of elements and the thoroughness of the permanent fastening of the joints.

When installing reinforced concrete structures, it is necessary to comply with the requirements of national codes. The quality control of the installation is carried out from the moment the structures arrive at the construction site, the object is subjected to incoming control by external inspection. If deviations from the project exceed the allowable national codes, then they make a complaint and, together with the rejected products, are sent to the manufacturer.

Tolerances and deviations in the assembly of prefabricated structures: the offset in terms of pavement slabs relative to their design position is ±13 mm.

Installation work is allowed for persons not younger than 18 years old, trained in special. program and have a certificate for the right to carry out these works, undergoing a medical examination and appropriate safety briefing. To prevent workers from falling from a height, inventory scaffolding or temporary flooring with fencing of the workplace should be installed when it is located above 1 m from the floor level. Workers employed at the installation are provided with overalls, footwear, and helmets. Hazardous areas must be identified and fenced off at the construction site.

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APPENDIX

Explication of rooms

Pos.	Room	Square, m^2
Basement floor		
1	Dining room	51.0
2	Washbasin area	23.0
3	Dispensing	18.8
4	Preliminary	5.8
5	Cutting bread	5.8
6	Washing tableware	6.5
7	Comoros	2.5 × 2
8	Cooler installation room	7.5
9	Office	7.2
10	Staff room (special room)	12.5
11	Shower	3
12	Bathrooms	3 × 2
13	Pantry	5.2
14	Corridors	11
15	Tambourines	1.8 × 2
16	Technical premises	10.5 × 2
17	Fire station	13.7
18	Pantry of harvesting equipment	2.3
19	Waiting room	9.3
20	Cabinets	10.8 × 2; 11.8

Pos.	Room	Square, m^2
21	Vent chamber	19
22	Observation corridor	0.7
23	Boiler house	20.7
24	Male restroom	21.9
25	Female restroom	21.9
First floor		
1	Tambour	9.5
2	Lobby	28
3	Security post	4
4	Operating room	35.7
5	Operation zone	33.3
6	Chief of Opera (Zone)	18
7	Accounting	16
8	Oblique hall	27.2
9	Head of the cash operations department	3.4
10	Office room	6
11	Staff room	6.0×2
12	Staff room	16
13	Office room	6
14	Office room	3
15	Office room	6
16	Stairwells	$15 \times 2;\ 17$
17	Office room	11.2

Pos.	Room	Square, m^2
18	Office room	14.5
19	Observation corridor	6.7
20	Staff room	25.6
20a	Staff room	6
21	Staff room	7.2
22	Staff room	11
23	Staff room	43.5
24	Staff room	12.6
Second floor		
1	Office room	15
2	Office room	15
3	Waiting room	19.3
4	Meeting room	36.8
5	Office room	21.4
6	Office room	2.1
7	Office room	17.7
8	Corporate Lending Department	24.2
9	Interbank Credit Department	13.6
10	Resource Raising Department	13.6
11	Securities Department	13.6
12	Office room	13.6
13	Office room	11.7
14	Server	6.7

Pos.	Room	Square, m^2
15	Premises for electronic payments	6.6
16	Premises of cable equipment	1.8
17	Fire extinguishing room	7
18	Archive	14.4
19	Women's restroom	14.5
20	Men's restroom	7.5
21	Corridor	79.4
Third floor		
1	Administrative and economic department	24.2
2	Legal Department	17.7
3	Personnel Inspector	20.1
4	Human Resources Department	20.1
5	Department of Interstate Settlements	20.1
6	Head of the Department of Interstate Settlements	20.1
7	Head of the currency department	20.1
8	Currency Department	20.1
9	Corridor	35.2
TOTAL		**1419.9**