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

TO ADMIT TO GUARD

Head of the Department

_____ O.I. Lapenko

"_8_" ____06____ 2022

BACHELOR THESIS

(EXPLANATORY NOTE)

SPECIALTY 192 «BUILDING AND CIVIL ENGINEERING»

Educational and professional program: «Industrial and civil engineering»

Theme: **Apartment building in Odessa**

Performed by: Ali El Haddad

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Design rule check: O. Rodchenko

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
"_8_" ____06____ 2022 р.

ДИПЛОМНА РОБОТА

(ПОЯСНЮВАЛЬНА ЗАПИСКА)

ВИПУСКНИКА ОСВІТНЬОГО СТУПЕНЯ БАКАЛАВРА

ЗА СПЕЦІАЛЬНІСТЮ 192 «БУДІВНИЦТВО ТА ЦИВІЛЬНА ІНЖЕНЕРІЯ»

ОСВІТНЬО-ПРОФЕСІЙНА ПРОГРАМА

«ПРОМИСЛОВЕ І ЦИВІЛЬНЕ БУДІВНИЦТВО»

Тема: «Житловий будинок у м. Одеса»

Виконавець: студент ЦБ-406 Ба гр. ЕЛХАДДАД Алі Ессам Мохамед
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Київ 2022

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

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

ЗАВДАННЯ
на виконання дипломної роботи

ЕЛХАДДАД Алі Ессам Мохамед
(П.І.Б. випускника)

1. Тема роботи «Житловий будинок у м. Одеса»
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: план та переріз житлового будинку, 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: _____ Горб О.Г.

Завдання прийняв до виконання: _____ ЕЛХАДДАД Алі

Content

					EN 406-BA		
Ch.	*Sh.*	*№ doc.*	Signature	Data			
Developer		*El Haddad A.*			*Apartment building in Odessa*	*Let.*	*Sheet*	*Sheets*
Supervisor		*Horb O.*						
						National Aviation University		
N. Control								
Approved		*Lapenko O.*						

1. Introduction

1.1 Features and conditions of the construction site

The city of Odesa is located in climate subzone III B 2.

Perennial minimum and maximum air temperatures are -28 °C and + 37 °C.

The average temperature for the year is + 9.8 °C.

Estimated outdoor air temperature for enclosing structures -18 °C.

The average length of the year without frost for the year is 117 days.

The prevailing winds are northwest. Speed up to 25 m/s. The average wind speed for the year is 5.4 m/s.

The average relative humidity for the year is 87%.

The average number of days with fog per year is 47.

The average duration of fogs for the year is 321 hours.

The average annual rainfall is 340-400 mm.

The normative depth of soil freezing is 0.8 m.

The climate of Odessa is considered continental (steppe) due to the fact that the prevailing winds blow from the open steppes.

Summer is hot, lasting from May to October.

Winter is short, moderately mild.

Odesa is the entrance to the 30-kilometer, so-called breeze zone, where the influence and proximity of the Black Sea is felt. The climate in this area is much milder and the weather is less stable.

Estimated wind load - 50 kgf/m^2.

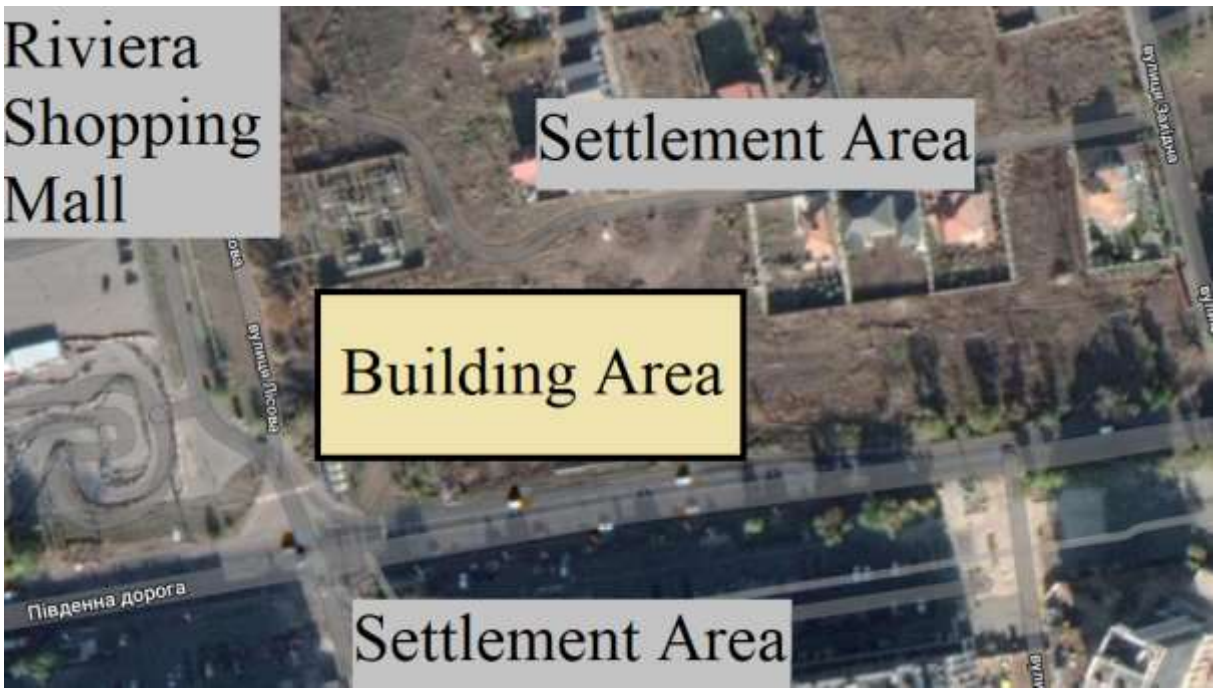
The weight of the snow cover is 100 kgf/m^2.

Estimated seismicity of the operation site - 7 points.

<u>The plot borders:</u>

- in the north, south and east – settlement area;
- in the and west – Riviera Shopping Mall.

Situational plan



1.2. Feasibility study of the adopted option of construction

Economic performance of residential buildings is determined by their volume planning and design solutions, the nature and organization of sanitary and technical equipment. An important role is played by the ratio of living and auxiliary areas in the apartment, the height of the room, the location of sanitary units and kitchen equipment. Residential building designs are characterized by the following indicators:

- building volume (cubic meters) (including the underground part),
- building area (m^2),
- total area (m^2),
- living area (m^2),
- summer premises area (m^2),
- ratio of living space to total area, characterizes the rationality of the use of space.

The living area of the apartment is defined as the sum of the areas of living rooms plus the area of the kitchen over 8 m^2.

The total floor area is calculated as the sum of the floor area of the living

rooms and auxiliary rooms.

Let's determine the coefficient for a one-room two-room apartment:

36.5/24=1.5 - for 2-bedroom;

17,85/26,13=0,68 - for 1-bedroom.

1.3. Characteristics of the insulation used

ISOVER FASOTERM PF is a rigid hydrophobic insulation in mineral wool boards based on basalt rock. It has not only good thermal and technical properties but also a high resistance to stress. It is designed for insulating facades with plastering (thin-layer plaster).

ISOVER FASOTERM PF is a rigid stone fibre board. The material has a longitudinal fibre structure. For ease of installation the boards are marked with burnt strips on their surface (the surface of the board marked with the strips must face the wall being insulated).

The boards are mounted so that the surface marked with the stripes faces the wall to be insulated.

The wall to which the boards are fastened must be even and any cavities must be filled with mortar. The base must be stable, solid, clean and dry. If the insulation is installed on the old plaster, check its adhesion. Panels are attached to the wall with a special adhesive composition or metal dowels and plastic "mushrooms". There should not be any glue on the ends of the panels. If during installation, there will be gaps between the panels, remove them with wedges cut from the insulation. Do not fill the gaps with glue. Glass mesh should be "sunk" into the previously applied reinforcing layer of putty adhesive. After applying a reinforcing layer (it should dry for at least 48 hours), you can apply a layer of plaster.

If you use metal dowels, you will need 4 to 10 pieces per 1 m2 of the insulated wall, depending on the height of the building and the proximity of the board to the corners of the building. The hole for the wall plug must be 1 cm longer than the length of the wall plug. The wall plug must be hammered in so that its head is in the same plane as the surface of the board.

1.4. Selection of basic construction materials, products and structures

The following construction materials are used to erect the residential building:

- monolithic reinforced concrete columns are used as foundations;
- the walls of the basement are made of concrete blocks of series 1.116-1 issue 1;
- exterior walls are made of ordinary clay bricks on cement-sand mortar;
- exterior walls are insulated with a rigid mineral wool board;
- partitions - plaster-concrete, in the size per room: inter-apartment - total thickness - 250 mm, inter-room - thickness 120 mm;
- overlap and covering - monolithic reinforced concrete beam-less;
- window and door openings are covered with precast reinforced concrete lintels of Series 1.39-1 issue 2;
- stairwell - of precast reinforced concrete marshes and landings;
- staircase railings - metal with wooden handrails;
- loggias and balconies are made of precast concrete slabs of series 1.141-1 issue 1 with stained-glass windows;
- pitched roof
- precast reinforced concrete parapet slabs are laid on the parapet;
- windows - wooden, with triple glazing

1.5. Technical characteristics of basic building materials, products and structures

Ordinary clay plastic pressing brick is made of clay with additives, fired, size 250 x 120 x 65 mm. Allowed deviations from the dimensions of the brick shall not exceed (in mm): length ±6, width ±4, thickness ±3. The brick must have the shape of a rectangular parallelepiped with straight ribs and corners and even edges. In terms of shape and appearance of bricks are allowed the following deviations: curvature of faces and ribs of bricks on the bed up to

4 mm and on the spoon up to 5 mm inclusive; cracks through on spoon faces (ie. On the sides of 250 x 65 and 250 x 88 mm) throughout the thickness of the brick extended across the width of a brick to 40 mm inclusive in an amount not exceeding one on one brick; beaten or blunted edges and angles the size of the length of the rib no more than 15 mm in an amount not exceeding two per brick. The brick shall have the manufacturer's mark on one side.

Windows and doors are wooden. Deviations from the nominal dimensions of unpainted windows and doors, and their parts are allowed within: window and door blocks in height ±3 mm, in width ±3 mm, in thickness ±2 mm; sashes, transoms and shutters in height ±2 mm, in width ±2 mm, in thickness ±1 mm; skirtings, slabs, slats, rims for glazing and door trim in width ±1 mm, in thickness ±1 mm; middle boards, imposts and box timbers in width ±2 mm, in thickness ±2 mm. Shrinkage of window sashes, door leaves, transoms and boxes shall not exceed 2 mm; shrinkage of casements - 1 mm. Windows and doors must be made of pine, larch, spruce and fir. Window sashes, transoms, casements, and door frames made of hardwood must be made from beams of the same species of wood.

The moisture content of wood shall not exceed: parts of window bindings, balcony doors, transoms, casements and interior door frames - 12% abs; window frames and exterior door frames (entrance from the street) - 18% abs; frame frames, filling slats (middles) and door linings - 10% abs. The wood of the frame frames and door laths must be healthy, with no signs of rot. On the outer surfaces of the frame review is not allowed, on the lath review must be cleared of bark. Opening window sashes transom length over 1.5 m or width of 0.6 to 0.8 m inclusive and the outer leafs of paired balcony doors of all sizes must be fastened with metal corners on the two upper corners. Opening window sashes and transoms wider than 0.8 m and the outer sashes of coupled bindings of all sizes must be fastened to the four corners of the corners. Surfaces of blocks (boxes) in contact with the walls shall be preserved with antiseptic or painted by the supplier. Windows and doors must be accepted by the technical control

department of the supplying company. When transporting windows and doors, measures must be taken to protect products from deterioration, moisture, sunlight, and contamination. During storage, products are stacked in correct rows on the rib by type and size.

Softwood lumber. Dimensions of sawn timber in lengths from 1 m to 6.5 m are set with a grading of 0.25 m, and for containers - from 0.5 with a grading of 0.1 m. Tolerable deviations from the established dimensions of sawn timber in mm are set as follows: on length +50 and -25; on thickness for sizes up to 32 mm inclusive ±1; on thickness, and for cut and width from 40 to 100 mm ±2 and over 100 mm ±3. Sawn timber shall be made of the following species: pine, spruce, fir, larch and cedar. Boards and squared timber are of five grades: 1st, 2nd, 3rd and 4th, and sawn timber of four grades: 1st, 2nd, 3rd and 4th. Absolute humidity of culled, 1st, 2nd, and 3rd class sawn timber supplied during the period from May 1st till October 1st is not to exceed 22 ±3%; humidity of the 4th class sawn timber is not specified.

Sawn timber must be supplied sorted by size and grade.

Wood-fiber boards made of wood fibers with the addition of special compositions and intended as a finishing and insulating material in the structures and products, protected from moisture. Allowed deviations from the size of boards must not exceed (in mm): in length and width ±5; in thickness: extra-hard and hard boards ±3; half-hard and insulating-finishing boards ±0,7; insulating boards ±1. Extra-hard boards are produced with impregnation with synthetic resins and subsequent heat treatment. The boards must have a regular rectangular shape with parallel edges. The edges of the boards are not allowed to be damaged in the form of fringes, bumped or crumpled corners. The manufacturer must ensure that the boards comply with the requirements of this standard and accompany each batch of supplied boards with documents of prescribed form certifying their quality. Each board must have the following marks: manufacturer's mark, stamp of the quality control department, type of board. Plates must be stored in covered warehouses stacked by type and size.

Wire nails. Round nails are made of heat-treated light-colored low-carbon steel wire. The top surface of the conical head of construction and roofing nails must be corrugated. The sharpened part of a nail can have round or square cross-section, and the angle of sharpening should not exceed 40%. Nails are packaged in wooden crates. The box may contain only one type and size of nails. The gross weight of the box must not exceed 80 kg. On the end side of the box must be marked with paint: mark or name of the manufacturer, nails symbol, net weight of nails.

Window sheet glass. Glass sheets must be rectangular in shape. Glass sheets must have a uniform thickness. Variation in thickness of the same sheet should not exceed: for glass "2", "2.5" and "3" mm - 0.2 mm. The surface of the glass sheets should be flat. Curvature of the sheet (deflection boom) is not allowed to exceed 0.3 % of the length. Glass sheets must have thick edges and intact corners. Chips and nicks in the sheet edges are not allowed in the length (counting from the edge to the center of the sheet) more than 3 mm for "2", "2,5" and "3" glass. Light transmittance of glass must be: for 2 - 2,5 mm not less than 87 %; for 3 - 4 mm not less than 85 %. The glass shall be colorless. The glass must be uniformly annealed and break evenly along the notch without cracking. The window glass must be accepted by the technical control of the company-supplier. The supplier shall ensure that all window glass produced meets the requirements of this standard. Boxes of glass shall be stored in closed dry rooms.

Mineral wool boards on a synthetic binder. Dimensions of the plates must comply with: type of plate - FG; length in mm - 500; 1000; width in mm - 450; 500; thickness in mm - 30; 40; 50; 60; 70. Allowed deviations from the dimensions shall not exceed: length and width ± 10 mm, and thickness ± 5 mm. The boards must be rectangular in shape and have evenly trimmed edges. The difference in diagonals of the boards must not exceed 20 mm. The cut boards must have a homogeneous structure and must not have any segregation. The boards must be packed in cardboard boxes or wooden lattice packaging. The

weight of the package must not exceed 50 kg. When loading and unloading the boards, measures should be taken to protect them from mechanical damage and moisture. Packed boards must be transported in covered wagons or other closed vehicles. Packed boards should be stored in covered warehouses or under a shed. The height of a stack of boards packed in soft packs must not exceed 2 m.

Metal electrodes for arc welding of steels and surfacing. Allowable deviations by electrode length (in mm): when making them by crimping ±3. Types of electrodes for welding steels must comply with regulatory requirements. Characteristics of the electrodes are determined by the passport for a particular brand of electrode. The electrode coating shall be durable, dense, without cracks, swells and lumps of unmixed components. The coating must not break when the electrode is dropped flat on a smooth steel plate from a height of: 0.5 m - for a diameter greater than 3 mm. The coating of electrodes must be moisture-resistant and show no signs of destruction after being in water at 15 - 25 ºC for 24 hours. Welding (technological) properties of the electrodes shall comply with the following requirements: the arc shall easily ignite and stably burn using current, the type and modes of which are recommended by the passport of the electrodes; the coating shall melt evenly without falling off of the coating pieces and without forming a "cover" or "visor" preventing continuous electrode melting; the roll formed on the plate surface shall be evenly covered by slag, which shall be easily removed after cooling; weld metal and metal, covered with slag shall be easily removed. The electrodes shall be packed in waterproof boxes or waterproof paper. Electrodes shall be transported and stored under conditions that protect from damage and moisture.

Construction gypsum produced by grinding of natural gypsum stone. Gypsum is used for making building parts and products, as well as for plastering works. The onset of setting should not come earlier than 4 minutes, and the end of setting - not earlier than 6 minutes and not later than 30 minutes after starting the hardening of gypsum dough. The time from the beginning of hardening of gypsum dough to the end of gypsum crystallization should be no less than 12

minutes. During transportation and storage gypsum must be protected from moisture and contamination by foreign impurities.

The time from the beginning of hardening of gypsum dough to the end of crystallization of gypsum must be at least 12 minutes. When transporting and storing gypsum must be protected from moisture and contamination by foreign impurities.

General usage enamels for internal works, being a suspension of grinded pigments in oil varnish. Enamels are intended for painting of different wooden and metal products, operated indoors, and for internal finishing works on the surface of the plaster. The factory-supplier guarantees the possibility of application of the following layers after drying of the applied enamel at 18 – 20 ^{o}C within 24 hours, and the possibility of polishing the coating after drying - within 48 hours, with thickness of each layer not exceeding 23 mc. Composition of solvents included in enamels and their quantitative content must be coordinated with the Main State Inspectorate of Ministry of Health of Russia. Enamels are poured into metal cans, flasks, containers up to 25 liters and metal drums containing up to 200 kg of the product. Enamels are stored in tightly closed containers, protecting them from sunlight and moisture. Each batch of enamel is accompanied by the document, which certifies quality of enamel and contains confirmation about accordance of enamel to the present standard.

Small panel formwork firm for concreting columns. The formwork consists of modular elements, which allows you to complete the formwork panel in the vertical and horizontal positioning of the shields. The main advantage of this formwork is that it is possible to manually assemble the most various constructions using a minimum number of elements and fasteners. Working surface of formwork is 5 layers wooden plate with thickness of 21 mm, reinforced on both sides, which allows using every element of formwork at least 350 times with regular cleaning and lubrication. The connection of opposite panels of formwork and their mutual fixation can be done by special pins with a

wing nut; the pin is passed through a special half-hole, specially designed on the end surfaces of the formwork.

Asbestos-cement corrugated profile sheets 40/150 intended for the device of attic roofs and wall barriers of residential, public and agricultural buildings. Main dimensions of sheets:

- length L = 1750±15 mm;
- the width of 7-wave sheet B = 980±5 mm;
- thickness t=5.8±0.3 mm;
- the height of the row wave h=40±3 mm;
- height of overlapping waves h1=40±4 mm;
- height of the overlapping wave h2=32±4 mm;
- the width of the overlapping edge b1=43±7 mm;
- the width of the overlapping edge b2=37 mm;
- wave pitch s=150 mm.

Sheets must have a rectangular shape in plan. The deviation from rectangularity must not be more than 15 mm. The longitudinal edges of the sheets must be straight. Deviation from straightness must not be more than 10 mm. Sheets and parts must not have splinters, holes and through cracks.

Minor defects are allowed:

- individual tears with the length in any direction not exceeding 100 mm;
- individual chips on one side of the sheet not more than 15 mm in the direction perpendicular to the edge of the product. The total size of slivers measured along the edge of the product must not exceed 60 mm;
- individual surface tears not exceeding 100 mm in length and 2 mm in width

The total number of insignificant defects on a sheet in any combination must not exceed three, and the number of sheets with such defects in the sample must not be more than one third of its volume.

The front surface of the overlapping part of the sheets shall bear:

- trademark or the name of the manufacturer's enterprise;

- sheet profile designation (abbreviated part designation);

- batch number.

Sheets and parts are delivered without packing.

Nails galvanized wire nails for asbestos-cement roofing with a diameter of 4 mm, length 100 mm (nails 4100). The diameter of the rod d = 4.0 ± 0.08 mm; length of the nail L = 100 ± 4.0 mm; diameter of the head D = 12 mm; head height of not less than h = 1.8 mm. Nails shall be made of heat-treated light-colored low-carbon steel wire. Zinc coating of nails must be continuous, without gaps, cracks and thickening, visible without the use of magnifying devices. Zinc-covered marks from clamps and split dies, as well as minor longitudinal risks are allowed on the rods and supporting surfaces of nail heads. The zinc coating of nail heads must be able to withstand two one-minute dips in copper sulfate solution. The maximum deviation from the alignment of the rod and nail head must not exceed 1 mm. It is not allowed on the nails unsheathed trim.

2. Architectural and construction chapter

2.1. Master Plan

The site has a rectangular shape, size in plan 50 x 80 (m). To the main winds the building is located at an angle of 45 degrees. The gap with existing buildings - in accordance with fire and sanitary standards.

Accepted in the draft scheme of improvement and landscaping of the site placement of 14-storey residential building provides a favorable environment for living and recreation of citizens. On the territory adjacent to the house there are footpaths and sidewalks with asphalt covering, areas for drying clothes, cleaning clothes and carpets, area for rest, area located in front of the central entrances to the cafe located on the first floor of the house, is covered with concrete tiles.

The territory also provides elements of landscaping: sowing grass, shrubs, trees, from the side of the main street - flower beds.

Technical and economic indicators of the master plan are shown in Tab. 2.1.

Table 2.1. Technical and economic indicators of the master plan

№	Name	Unit	Number
1	Site Area	m^2	381200
2	Building area		55539
3	Landscaped area		226296
4	Hard surface area		99365

2.2. Space-planning solution

The apartment building belongs to the multi-storey residential buildings of sectional type:

- building class by degree of durability = 1,

- building class by degree of fire resistance = 1,

- the apartment building is equipped with passenger elevators with carrying capacity of 400 kg, 630 kg.

- garbage chute - asbestos cement pipe d = 400 mm.

- foundation - strip monolithic,

- the walls - brick,

- the foundation - band monolithic walls - brick, floors and coverings - monolithic without beams,

- on the 1st floor provides for the design of cafe-dining room for 60 people.

All the living rooms are lit by natural light in accordance with the requirements of building regulations, rooms in apartments have separate entrances, the height of the room - 2.8 m. The kitchen is equipped with natural ventilation, sink, and electric stove. The walls near the kitchen equipment are lined with glazed tiles, the rest - with washable wallpaper. Floor in the apartments covered with linoleum on mortar screed.

In the projected house, each apartment consists of the following rooms:

- living rooms,
- kitchen,
- front (corridor),
- bathroom,
- toilet,
- balcony.

The stairwell is planned as an internal daily use, of precast reinforced concrete elements. In the entrance staircase junction of individual concrete set stairs. The staircase is double staircase with a footing on the stair landings.

The slope of the stairs - 1:2. The stairwell has access to the roof via a metal staircase equipped with a fire-resistant door. The stairwell has artificial and natural lighting through doorways. All doors in the stairwell and vestibule open towards the exit of the building. The staircase railings are made of metal links, and the handrail is lined with plastic. For vertical communications provided elevator prefabricated reinforced concrete shaft with the installation of elevator installation capacity = 400 kg, 630 kg. The machine room of the elevator is placed on the roof, which allows reducing the length of the leading wire ropes almost three times, simplifying the kinematic scheme of the elevator, reducing the load on the bearing structures of the building and abandoning the device of a special room for blocks. Thus, the cost of the elevator and operating costs are significantly reduced. However, such an upper location of the machine room is less advantageous for acoustic and noise considerations.

2.3. Constructive solution

The composition of the premises of multi-storey residential building in addition to the main element - apartments designed built-in room:

- cafe-dining room for 60 people.

Multistory apartment buildings are the main type of housing in the cities of our country. Such houses allow the rational use of the territory, reduce the length of utilities, streets, urban transport facilities. A significant increase in the density of housing (the number of living space (m2) per 1 hectare of built-up

area) with multi-storey building provides a significant economic effect. In addition, their high-rise composition contributes to the creation of an expressive silhouette of development. The correct choice of the number of floors determines its economic efficiency.

External Walls

The outer walls of the building are designed of M-100 red brick, "ISOVER" heat insulation and faced with "SpanColour" slabs.

Floorings and coverings

The overlaps and ceilings are designed with beam-free monolithic reinforced concrete. The use of monolithic floor slabs and coatings increases the stiffness of the building. The roof is hipped roof of asbestos-cement sheets, laid on the rafters.

Partitions

The partitions are monolithic, inter-apartment and inter-room plasterboard on the metal frame. The use of prefabricated partitions speeds up the construction process and reduces wet processes at the construction site.

However, gypsum partitions are quite fragile and may collapse during transportation, storage and installation due to inattentive handling.

Floors

Floors in residential and public buildings must meet the requirements of strength, resistance to wear and tear, sufficient elasticity, quietness, ease of cleaning. The design of the floor is considered as the soundproofing capacity of the floor slab plus the soundproofing of the floor structure. Floor covering in apartments is accepted from linoleum on a heat-insulating base. The screed is made of mortar on expanded clay aggregate, which is a soundproofing layer. In the built-in rooms, mosaic floors have been adopted.

The positive sides of these floors are their hygiene and quietness. On the negative side, they are very labour intensive, which also increases the construction time.

Finishing

Exterior finish: Basement of factory-made embossed plinth blocks. Finishing walls - from facing red bricks. Window and door blocks are painted with oil paints or enamels of warm colors.

Interior finish: In apartments, the walls are glued with wallpaper after plastering the brick walls. Kitchens are wallpapered with washable wallpaper, and the areas of the walls above the sanitary appliances are tiled with glazed tiles. The sanitary cabins have ceramic tile floors. The walls are tiled with ceramic tiles.

Heating

Heating and hot water supply is designed from the main heating networks, with the lower distribution in the basement. Convectors serve as heating devices. For each block - section and each built-in unit is a separate heating unit for the regulation and accounting of the coolant. Main pipelines and riser pipes, located in the basement of the building are insulated and covered with aluminum foil.

Water supply

Cold water supply is designed from an intra-block water supply manifold with two inputs. The water section is supplied by an in-house main pipeline, located in the basement of the building, which is insulated and covered with aluminum foil. Around the house is performed main fire-fighting water supply system with wells, in which fire hydrants are installed

Sewer

Sewer is performed vnutrvoretovaya with connectors in wells vnutrvartalnoy sewerage. Of each section and each of the built-in rooms performed independent outputs vodnofekalnogo and rain sewerage.

Waste chute

The refuse chute at the bottom ends in the waste chamber hopper - accumulator. The garbage collected in the hopper is emptied into garbage carts, loaded into garbage trucks, and taken to a city landfill. The walls of the waste chamber are lined with glazed tiles, and the floor is metal. The waste disposal

chamber is equipped with cold and hot water supply system with a mixer for flushing the waste chute, equipment and premises of the waste disposal chamber. The garbage chambers are equipped with a trap with water drainage into the sewage system. There is a heating coil in the floor. At the top of the trash chute has an exit to the roof to ventilate the trash chambers and through the trash collecting valves to remove stale air from the stairwells, as well as smoke in case of fire. The entrance to the garbage chambers is separate, from the street side.

2.4. Exterior and interior decoration

Building facades lined with “SpanColour” tiles

The plinths and sidewalls of the porches are lined with ceramic tiles of size 250 x 250 mm.

Metal facade elements - handrails and railings are painted black.

Carpentry items - windows, doors are painted with oil paints.

Lower surfaces of balcony slabs are painted white with silicate or PVC paints.

The entrance visor is plastered over a grid stretched over the metal frame and painted light gray.

The entrance steps and porch cover are mosaic.

In the interior decoration of the brick walls are plastered, partitions are prepared for pasting or painting.

Walls of front living rooms and corridors are pasted with wallpaper without borders with an offset from the ceiling at 7-10 cm. The walls of kitchens and restrooms are painted with light-colored oil paint at a height of 1.6 m. Above the kitchen equipment is made of glazed tiles in 4 rows, in the bathrooms - to a height of 1.8 m.

Ceilings in all rooms and walls above the oil panels - adhesive whitewash.

The trunk of the garbage chute and the risers of the internal drain are painted with PVC paint on the entire height. Walls of the garbage chambers are tiled with ceramic tiles to the entire height, ceilings are painted with oil paint.

The walls of elevator shafts are grouted with cement mortar and painted with PVC paints.

Floors in the living rooms are boarded on the floorboards, in the kitchens - linoleum, in the bathrooms - ceramic tiles. Inside windows and doors are painted white with oil paints. Staircase railings are painted with oil paints black color.

2.5. Thermal calculation of the cover

Determine the value of degree-days of the heating period

$$GSOP = 6341.4^{o}\text{C} \times \text{d.}$$

We find the value of the heat transfer resistance of the enclosing structures: $R_{omp} = 4.75м^2 \cdot{}^{o}\text{C/Wt}$

We assume the following attic floor design:

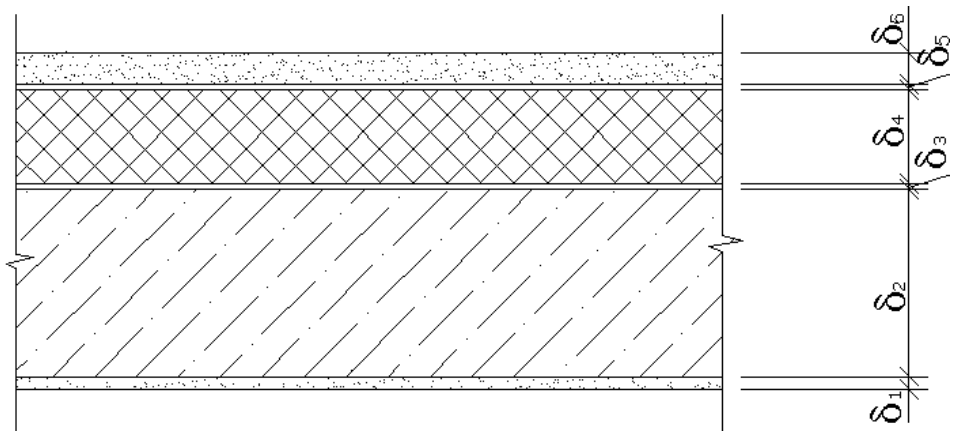


Fig. 2.1. Cutting along the cover plate

Determine the necessary thermal characteristics of the structural layers and summarize them in the Tab. 2.1.

Determine the heat transfer resistance of the attic floor:

$$R_0 = 1/\alpha_в + \delta_1/\lambda_1 + \delta_2/\lambda_2 + \delta_3/\lambda_3 + \delta_4/\lambda_4 + 1/\alpha_н;$$

where $\alpha_в = 8.7$Wt/(m²°C) – heat transfer coefficient of the internal surface of the enclosing structure;

$\alpha_н = 23$ Wt/(m²°C) – heat transfer coefficient of the outer surface of the enclosing structure.

$$R_0 = 0.115+0.053+0.286+4.59+0.029+0.0435=5.01 \text{ (m}^2 \times{}^{o}\text{C/Wt)}$$

R_0 =5.01(m² ×ºC/Wt) > $R_{omp.}$ =4.75 (m² ×ºC/Wt)

Table 2.3. Cover construction

Material name	γ_0, kg/m³	λ, Wt/(m² ºC)	δ, m	δ/λ, m² ºC/Wt
1. Gypsum cladding sheets	800	0.19	0.008	0.027
2. Pine across the fiber	500	0.14	0.12	3.33
3. Semi-rigid basalt mineral wool slabs	80		0.38	0.543
4. Cement-sand mortar	1600	0.76	0.02	0.026

2.6. Thermal calculation of the wall

The value of the heat transfer resistance of the enclosing structures: R_{omp} = 3.2$м^2$ ·ºC/Wt

We assume the following wall design:

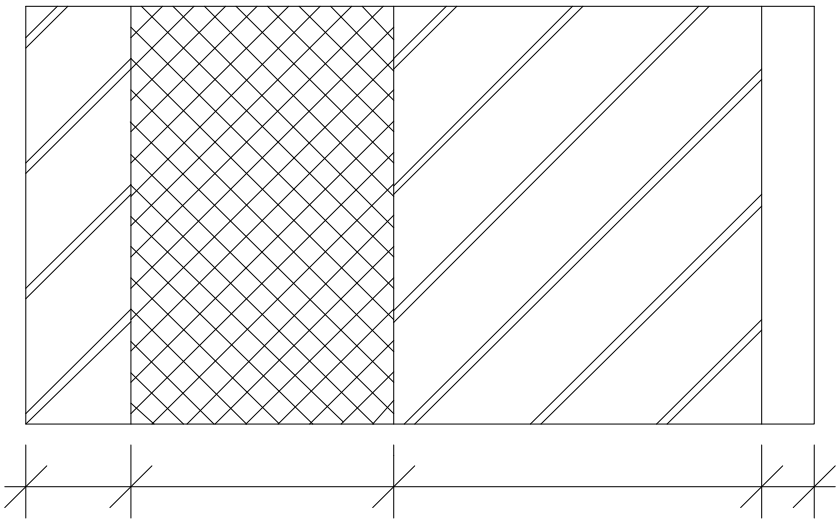


Fig. 2.2. Wall construction

Determine the heat transfer resistance of the outer wall:

$$R_0 = 1/\alpha_в + \delta_1/\lambda_1 + \delta_2/\lambda_2 + \delta_3/\lambda_3 + \delta_4/\lambda_4 + 1/\alpha_н;$$

where $\alpha_в$ = 8.7Wt/(m²ºC) – heat transfer coefficient of the internal surface of the enclosing structure;

$\alpha_н$ = 23 Wt/(m²ºC) – heat transfer coefficient of the outer surface of the enclosing structure.

R_0 =0.115+0.026+3.33+0.543+0.026+0.043=4.08 (m² ×ºC/Wt)

$$R_0 = 4.08(\text{m}^2 \times ^o\text{C/Wt}) > R_{omp.} = 3.2\ (\text{m}^2 \times ^o\text{C/Wt})$$

Table 2.4. Wall construction

Material name	γ_0, kg/m³	λ, Wt/(m² ºC)	δ, m	δ/λ, m² ºC/Wt
1. “SpanColour” plate		0.30	0.008	0.027
2. Insulation “ISOVER”	13	0.036	0.12	3.33
3. Masonry of ordinary clay bricks on cement-sand mortar	1800	0.7	0.38	0.543
4. Cement-sand mortar	1800	0.76	0.02	0.026

3. Basics and foundations

3.1. Engineering survey materials

Engineering and geological works were carried out at this site in 2018. A total of 8 wells drilled to a depth of 12 m, passed 52 p.m., 2 samples with undisturbed structure were taken, groundwater was not uncovered. During engineering and geological surveys, groundwater is not aggressive for all types of cement, uncovered at the absolute mark of 240.55.

Geological structure of the site:

From the surface, the site is represented by a thin bulk layer of crushed compacted soil with sand, sandy loam, and construction debris. Below lie Quaternary, eluvial-deluvial sandy loam with inclusion of rubble and rubbly soils with sandy loam filler, as well as opened only SCV. I sandy loam with rare rubble, plant roots, and lenses of buried soil, presumably of alluvial-deluvial genesis.

Quaternary deposits are underlain by limestones, strongly weathered fractured.

Physical and mechanical properties of soils

According to the position in the section and physical and mechanical properties of soils, 5 engineering and geological elements were identified. The site belongs to the I category of complexity.

Soils of IGE-1 are represented by bulk compacted crushed stone ground with sand, sandy loam and construction debris. The thickness is 0.2-1.0 m.

Soils of IGE-2 are hard sandy loam, low-moisture with rare gravel, plant roots and rare lenses of buried soil. Layer thickness is up to 4.30 m.

density - 1.66 g/cm3;

porosity - 45 %;

porosity coefficient - 0.818;

water saturation level - 0.395;

plasticity number - 0,06;

fluidity index - 0;

strain modulus - 133 kgf/cm2; locking 99 kgf/cm2;

specific coupling - 0,28 kgf/cm2;

angle of internal friction - 27º.

IGE-3 soils - hard sandy loam, light loam (seldom loam)

with crushed stone from 20 % to 40 %;

density - 2,07 g/cm3

porosity - 32 %;

porosity coefficient - 0,46;

level of humidity - 0,65.

Soils IGE-4 -4 - crushed stone ground with sandy filler up to 40%;

density - 1,98 g/cm3

angle of internal friction - 38 º;

specific coupling - 0,00 kgf/cm2;

deformation modulus - 300 kgf/cm2.

Limestone strongly weathered fractured

density - 2,0 g/cm3

porosity - 32%;

compressive strength of 200 kgf/cm2.

The site is suitable for construction. Soils IGE - 3; 4; 5 can serve as a natural base of foundations.

3.2. Evaluation of geotechnical surveys

According to surveys, the construction site is formed at a depth of 0.5 m -

bulk compacted rubbly soil with sand, sandy loam and construction debris, at a depth of 4.3 m - hard sandy loam, low moisture with rare rubble, plant roots and rare lenses of buried soil, at a depth of 5m - heavily weathered cracked limestone. According to the construction experience in this region, the calculated resistance of rocky soils, which are the foundations of the house, is Rî = 600 kPa.

The depth of the foundations does not depend on the depth of seasonal freezing of soils.

3.3. Selection of the foundation

When selecting the type of foundations, the following possible options were considered:

- strip foundation - of precast reinforced concrete pads and concrete wall blocks;

- the pile foundation - made of reinforced concrete piles and tied with a monolithic reinforced concrete stringer;

- monolithic slab - solid monolithic reinforced concrete foundation, corresponding to the building dimensions in terms of plan.

Pillar foundation - made of monolithic reinforced concrete, under each column of the building.

The strip foundation is the least labor-intensive, yet the easiest and most economical type of construction. However, this type of foundation is not suitable for weak soils.

Pile foundation is used to construct buildings on weak soils. Rather labor-intensive and expensive type of foundation.

Monolithic slab - a labor-intensive, expensive foundation that requires complex calculations. It is used on soils of weak and medium bearing capacity, in order to evenly distribute the forces.

According to the engineering and geological surveys, dense rocky soils serve as a base for foundations. Therefore, it is technically impossible to manufacture pile foundations. Of the three remaining types of foundations, the monolithic slab option is more labor-intensive and requires unreasonably high construction costs. Thus, in

the final analysis we take the pillar foundation as the most economical and least labor-intensive.

3.4. Calculation of the pillar foundation

Table 3.1. Load on the foundation

Type of load	Normative loads		Load factor, γ_f	Design loads, kN
	per unit area, kN/m^2	from the cargo area, kN		
Constant loads				
from the insulation (semi-rigid basalt mineral wool boards)	2	72	1.3	93,6
from the monolithic slab (0.2x6x25x15)	0.06	2.16	1.3	2.808
Partitions from gypsum and concrete panels on Floors 16 and 16	-	450	1,1	495
concrete panels on 16 floors.	1.5	840	1.1	936
from the floor and linoleum on the 16th floor.	0.2	98	1.3	127.4
from reinforced concrete columns (0.4x0.4x2.8x25x14)	-	156,8	1.1	172,48
Total		1618,96		1827,3
Temporary loads				
from snow:				
short-term	1.5	54	1.4	75,6
long-term	0.75	27,6	1.4	38,6
overlapping:				
short-term	1.5	54	1.3	70,2
long-term	0.3	10,8	1.3	14,04
Total		146,4		198,44

Table 3.2. Collection of loads on 1 storey basement on the middle column A = 36 m^2

Type of load	Normative loads		Load factor, γ_f	Design loads, kN
	per unit area, kN/m^2	from the cargo area, kN		
Constant loads				
from the monolithic beam-free slab (0.2x25x1x6)	-	30	1,1	33
from reinforced concrete columns (0.5x0.5x2.8x25x1)	-	17,5	1,1	19,25
Total		47,5		52,25
Temporary loads				
on the overlap:				
short-term	1.5	54	1.3	70,2
long term	0.3	10,8	1.3	14,04
of vehicle weight	4	144	1.2	172,8
Total		208,8		257,04

Calculation characteristics of the I group of limiting states

Constant

N= 1879,55 kN

Temporary continuous-acting

N=14,04+14,04+38,6=66,68 kN,

Temporary short-term

N= 172,8+70,2+75,6+70,2=388,8 kN,

Total taking into account the coefficients of reliability and combinations of

N = 0.95 (1879,55 +0.95 *66,68 +0.9 *388,8) = 2215,97 kN

Calculation of the center-loaded pillar foundation middle column

Determine the area of the foundation:

$$A_f = \frac{2215.97 \cdot 10^3}{4 \cdot 10^3 - (20 \cdot 0.6) \cdot 10^3} = 0.56 \text{m}^2$$

The foundation slab is taken from monolithic reinforced concrete with an area of $A_f = 1.8 \times 1.8 = 3.24 m^2$. Foundation height h=0,6 m.

Calculated load at the level of the planned surface N_p=2041.36 kN.

Weight of the foundation slab:

$$G_f = 0{,}025 \cdot 3.24 \cdot 0{,}6 = 0.0486\ MN$$

Weight of soil at foundation cutoffs:

$$G_s = (1.8 \times 1.8) \cdot 0.6 \cdot 0.02 = 0.0388\ MN$$

Average pressure under the bottom of the foundation:

$$p_a = \frac{N}{A_f} + \beta \gamma_f d = \frac{2215.97 \cdot 10^3}{3.24} + 20 \cdot 0.6 = 695.94\ MPa < 4000\ MPa$$

Finally accept the foundation slab of size 1,6x1,6 m and height h=0,6 m.

Determine the design loads from the weight of the foundation and the soil at its ends:

$$G_f^c = 1{,}1 * 0{,}0486 = 0{,}05346\ MN$$

$$G_s^c = 1{,}2 * 0{,}0388 = 0{,}04656\ MN$$

Pressure under the foundation's underside from the action of design loads:

$$p_a^c = 2.215 + 0.05346 + 0.04656/1.8 \cdot 1.8 = 0.714\ MPa$$

Determine the bending moment at the edge of the column:

$$M = 0.125 p_a^c (l - l_к)^2 \cdot b = 0.125 \cdot 0.714 (1.8 - 0.6)^2 * 1.8 = 0.231 MNm$$

As the working bars we accept the reinforcement of C300 class with design resistance f_s = 280 MPa.

Required cross-sectional area of the reinforcement

$$A_s = \frac{M}{0.9 h_0 f_s} = \frac{0.231}{0.9 \cdot 0.6 \cdot 280} = 15.2\ cm^2$$

Take 10 bars with a diameter of 14 mm with A_s = 15.39 cm2

Squeezing calculation

Performed according to the condition:

$$F \leq \phi_b R_{bt} u_m h_0$$

F – design squeezing force;

ϕ_b – coefficient of 1 for heavy concretes;

R_{bt} – design tensile strength of concrete;

u_m – arithmetic mean between the perimeters of the upper and lower base of the punching pyramid within the effective height of the foundation h_0

$$u_m = 2(b_k + l_k + 2h_0) = 2(0.5 + 0.5 + 2 * 0.56) = 4.24\,m$$

b_k, l_k – respectively, the length and width of the column cross section.

$$F = N - p_{cp}^{p} \cdot A,$$

$$A = (l_k + 2h_0)(b_k + 2h_0) = (0.5 + 2 \cdot 0.56)(0.5 + 2 \cdot 0.56) = 2.63\,m^2$$

$$F = 2.215 - 2.63 \cdot 0.714 = 0.337MN$$

$0.337 \leq 1 \cdot 1.2 \cdot 4.24 \cdot 0.6 = 3.05$ - condition is satisfied.

4. Construction technology

4.1. Preparatory works

The works of the 1st stage of the preparatory period include:

- removal of large rocks and debris on the site;
- cutting of bushes and trees;
- removal of the vegetation layer;
- uprooting of stumps.

Cutting down of bushes and removal of the topsoil and moving them beyond the construction site shall be performed by bulldozers. Trees are cut down, as a rule, by electric saws; cut down trees are transported beyond the construction site with the help of cranes and trucks or bulldozers. Stumps are uprooted with the help of uprooters or winches. Large stones are removed with a bulldozer.

The works of the 2nd stage of the preparatory period include:

- fencing and lighting of the site;
- vertical leveling;
- laying of temporary communications;
- installation of temporary buildings and structures;
- arrangement of temporary roads;

- communications.

Fencing of the construction site is carried out prefabricated and dismantled from the inventory of wooden boards and racks. In order to avoid additional excavation work, the posts shall be arranged on planks. For ease of passage of people along the fence with its outer side of the fence is arranged with a visor and a sidewalk of boards. Lighting network arrange on a specially installed support.

Before the excavation work begins, all the axes of the building under construction shall be transferred to the ground. To do this, at a distance of 4 - 5 m from the boundaries of the future building shall be arranged planking. The planking consists of studs installed along the perimeter of the structure at intervals of 3 - 4 m.

At a height of 1.5 m horizontally fasten the struts, on which the axes of the building are marked. The wire corresponding to this or that axis of the building is stretched along the risks.

The construction site must be provided with water and electricity. The water supply system shall be laid underground at a depth not less than the depth of ground freezing. The sewage system shall be laid with slopes that ensure drainage of the liquid. The depth of laying sewer pipes in winter is the same as for the water supply system. Every 50 m arrange a brick well. Power grid is laid underground cable from the transformer substation to the distribution center. The cable is laid in a trench 80 - 110 cm deep. at the bottom of the trench and on top of the cable is laid one layer of brick, which protects the

top of the cable is placed in a layer of brick to prevent accidental damage to the cable. From the distribution centre to the consumers, energy is supplied by a ground cable.

Temporary buildings are erected to house the living quarters and the foreman's room. Inventory wooden houses are used as temporary structures, which are transported in assembled form on trailers with loading and unloading by cranes.

Temporary roads at the construction site are arranged for vehicular traffic and have an unpaved surface. At the entrance to the construction site, a traffic pattern of vehicles must be installed, and on the roads and driveways - clearly visible road signs regulating the order of movement of vehicles. The speed of vehicles near the construction site should not exceed 10 km/h in straight sections and 5 km/h in the corners.

The construction site is provided with telephone communication for prompt resolution of arising issues, as well as in case of emergencies.

4.2. Excavation works

Design and performance of excavation work is carried out with the use of a standard technological map of the complex mechanized process for excavation, and its binding to a given object with the specification of the scope of work. The excavated soil is removed from the construction site and used for backfilling or vertical leveling of newly built facilities. This complex mechanized process consists of preparatory and main operations.

The preparatory operations include:

- The construction of temporary roads for the transportation of soil;
- cutting the topsoil and turf layer;
- leveling of the construction site;
- loading of the vegetative soil with an excavator into dump trucks and its transportation to a dumping site.

The main operations include:

- excavation of the excavation up to the design marks with an excavator and sweeping of the ground with a sweeper;
- transportation of the excavated soil by dump trucks outside the construction site;

The building site has dimensions of 70 * 44 m, the soil on this site loamy sand hard with an admixture of crushed stone. Plot allocated, for construction is undeveloped, so before the start of work to produce a cut vegetative layer, the value of which is 10 cm. During excavation work creates an earthwork, which is

part of the design of the underground part of the building (excavation). Construction is carried out in summer (from June 1), which means that the preliminary loosening of soil is not required.

In the excavation, it is necessary to provide space, taking into account the thickness of the foundation and the space for approaching the foundation to install the formwork; summing up these figures (half of the foundation thickness at the bottom 0.9) m, and the space for installing the formwork 0.5 m we get the dimensions of the excavation shown on the sheet.

$V_k = (F_{down} + F_{up}) \times h/2$;

$F_{down} = 1284.84$ m^2;

$F_{up} = 1731.75$ m^2;

$V_k = (1284.84+1731.75) \times 4.3/2 = 6485.66$ m^3;

Entrance trench:

$V_{tr} = H^2/6 \times (3b + 2mH \times (m' - m)/m') \times (m' - m) = 3.72/6 \times (3 \times 4.6 + 2 \times 0.85 \times 3.7 \times (7 - 0.85)/8) \times (7 - 0.85) = 92$ m^3

where *b* is the trench width which is taken equal to 4.6 m; *m* is the trench slope factor which is taken equal to 0.85; m′ is the entrance trench slope factor which is taken equal to 7.

The total volume of excavation work of the trench is:

$V_e = V_k + V_{tr} = 6485.66 + 92 = 6577.65$ m^3

Cutting of the vegetation layer

Cutting of the vegetative layer is made by bulldozer. All time standards and rates for all types of mechanized excavation work are taken according to current standards.

Mark of dozer - DZ-25 (D522).

Blade type – pivoting.

Blade length - 4,43 m.

Blade height - 1,2 m.

Control – hydraulic.

Power - 132 kW (180 HP).

Type of tractor - T – 180.

Bulldozer equipment weight - 2,85 tons.

Entity of the crew - driver of the 6th category.

DZ-25 bulldozer with a swiveling blade is equipped with hydraulically driven blade tilting and swiveling mechanisms and is designed for earthmoving and planning works that require cutting and moving the soil aside at longitudinal movement of the bulldozer as well as processing the soil by the blade edge. The bulldozer has a large blade length. This gives it a high performance in leveling the ground surface. The bulldozer is mounted on the T-180GP crawler tractor equipped with a hydraulic drive. All control is concentrated in the tractor cabin and the operator does not have to get out of the machine for adjustment works, which increases the productivity of the machine operator.

The composition of the work:

1. Getting the machine into operating position
2. Cutting the ground
3. Lifting and lowering the blade
4. Empty return.

Since the most rational length of earth moving by bulldozer is about 25-30 m, we take the working scheme with intermediate formation of shafts. Shaft forming goes from one side. In this case, it is necessary that the height of the shaft did not exceed 2 m. Angles at the base of the section of the shaft are 30 degrees and 45 degrees.

The length of the site is taken 35 m, the height of the shaft will be 1.96 m, and the width of 5.35 m. The number of shafts on the site is limited to two.

$$P_{SM} = \frac{1000 \times 8{,}2}{0{,}48} = 17083{,}33\ {}^{m^2}/_{cm}$$

Determine the operating capacity of the bulldozer when cutting the vegetation layer:

$$\Pi_T = \frac{3600 \times L \times [B \times n - b(n-1)]}{\sum t},$$

where L is the length of the planned site, m; B is the width of the working width, m; n is the number of planing lanes; b is the width of the overlap between adjacent planing lanes, taken 0.15 m; ∑ t is the total duration of site planing, s.

$$\sum t = \left[\left(\frac{3{,}6 \times L}{V_P} + t_y\right) \cdot n + t_{II}(n-1)\right] \cdot z$$

where V_p - operating speed of the bulldozer, taken as 3.2 km/h = 0.89 m/s; t_y - time to control, taken as 8 s; t_p - time needed to turn, taken as 20 s; z - number of repeated passes during one shift, taken as 2.

$$\sum t = \left[\left(\frac{3{,}6 \times 70}{0{,}89} + 8\right) \cdot 10 + 20 \cdot (10-1)\right] \cdot 2 = 6182{,}8s.$$

$$P_T = \frac{3600 \times 70 \times [4{,}43 \times 10 - 0{,}15(10-1)]}{6182{,}8} = 1750{,}56\,{}^{m^2}/_{h}$$

$$P_T^{SM} = 1750{,}56 \times 8{,}2 = 14354{,}59\,{}^{m^2}/_{sh}$$

$$P_E^{SM} = 14354{,}59 \times 0{,}85 = 12201{,}4\,{}^{m^2}/_{sh}$$

We take the lower of the capacities

$$P_E^{SM} = 12201{,}4\,{}^{m^2}/_{sh}$$

$$S_{P.C.} = 70 \times 44 = 3080m^2$$

$$t = \frac{S_{P.Л.}}{P_{SM}} = \frac{3080}{12201{,}4} = 1$$

The bulldozer needs 1 shift to remove the vegetation layer from the entire construction site.

Selection of excavator for loading of topsoil into dump trucks

For loading the developed topsoil into dump trucks we take an excavator EO-6122.

Composition of work:

1. Installation of the excavator in the working face;
2. Excavation of the soil with bucket cleaning;
3. Excavator shifting;

Cleaning the loading areas and the bottom of the hole. 5;

5. Moving oversized boulders aside when developing loosened frozen or rocky soils.

$V_C = 70 \times 44 \times 0{,}10 = 308 m^3$ – volume of the vegetative layer required for loading.

We select the number of dump trucks to remove the developed topsoil:

$V_C = \frac{V_K \times k_H}{k_P} = \frac{1{,}6 \times 0{,}9}{1{,}08} = 1{,}3 m^3$– the volume of soil in the bucket.

Определяем массу грунта в ковше экскаватора:

$Q = V_C \times \rho = 1{,}3 \times 1{,}4 = 1{,}8\ t.$

where ρ – the volume mass of the vegetation layer according to 1,4 $t/_{m^3}$.

We take the number of buckets loaded in the dump truck equal to 5.

Determine the volume of soil in a dense body, loaded into the body of the dump truck:

$$V = V_C \times n = 1{,}3 \times 5 = 6{,}5 m^3$$

We select a dump truck of suitable carrying capacity and capacity of the body:

KrAZ-222, load-carrying capacity of 10 tons, the body capacity of 8 m^3.

We calculate the duration of one cycle of dump truck operation:

$$t_C = t_{PS} + \frac{60 \cdot L}{V_G} + t_P + \frac{60 \cdot L}{V_P} + t_м = 19{,}5 + \frac{60 \times 0{,}5}{45} + 1 + \frac{60 \times 0{,}5}{60} + 2 = 23{,}66\ mi\ n$$

where t_{ps} – time of loading soil, calculated below, s; L - distance of transportation of soil, km; V_r - speed of a loaded dump truck; t_r - time of unloading, we take 1 minute; V_n - speed of an empty dump truck, taken 60 km/h; t_m - time of maneuvering before loading and unloading, taken 2 min.

$$t_П = \frac{V \times H_{BP}}{100} = \frac{6{,}5 \times 5}{100} = 0{,}325ч = 19{,}5 mi\ n$$

Determine the required number of dump trucks:

$N = \frac{t_C}{t_P} = \frac{23{,}66}{19{,}5} = 2$ dump trucks are necessary for continuous operation of the excavator

Digging a pit with a single-bucket excavator

Composition of work:

1. Installation of the excavator in the working face.

2. Excavation with bucket cleaning.

3. Moving the excavator while working.

4. Cleaning the loading areas

An excavator with a hydraulic drive - EO-6122.

Bucket capacity 1,6 m3.

Maximum depth of digging 7,3 m.

Maximum height of unloading 6,5 m

Max. digging radius 11,8 m

Engine power 222 kW

Excavator weight 56.4 tons

Formation of the unit: the driver of the 6th category

Soil excavation method: with loading into a vehicle

Type of soil to be excavated: sandy loam with low water content.

Determine the cost of developing one m^3 of excavator with a backhoe:

$$P_{CM} = \frac{(uni\ t \times T)}{H_{BP}} = \frac{(100 \times 8{,}2)}{5} = 164\,{}^{m^3}/_{sh}$$

Determine the technical capacity of the excavator:

$$P_T = \frac{3600 \times q \times K_H}{K_P \times t_c} = \frac{3600 \times 1{,}6 \times 0{,}9}{1{,}08 \times 16} = 300\,{}^{m^3}/_{h}$$

where q - excavator bucket volume equal to 1.6 m^3; K_n - excavator bucket filling factor equal to 0.9; K_P - loosening factor equal to 1.08; t_c - excavator cycle time equal to 16 seconds.

$$П_E = П_T \times t_C \times K_B = 300 \times 8{,}2 \times 0{,}6 = 1476\,{}^{m^3}/_{sh}$$

where tr - the duration of excavator operation time, taken equal to one work shift, i.e. 8.2 hours; K_B - the coefficient of machine use in terms of time taken equal to 0.6.

We select the number of dump trucks for removal of the developed soil:

$V_G = \frac{V_B \times K_N}{K_P} = \frac{1,6 \times 0,9}{1,08} = 1,3m^3$– bucket volume.

Determine the mass of soil in the excavator bucket:

$Q = V_G \times \rho = 1,3 \times 2,07 = 2,69$ t.

where ρ – volume weight of soil according to the assumed 2.07 t/m^3.

We take the number of buckets loaded in the dump truck equal to 3 according to the textbook. Determine the volume of soil in a dense body, loaded into the dump truck body: V = V_G ×n = 1,3 x 3 = 4 m^3

We select a dump truck with a suitable capacity and capacity of the body:

KrAZ-222, load-carrying capacity 10 t, body capacity 8 m^3.

We calculate the duration of one cycle of dump truck operation:

$$t_C = t_P + \frac{60 \cdot L}{V_G} + t_P + \frac{60 \cdot L}{V_P} + t_м = 12 + \frac{60 \times 0,5}{45} + 1 + \frac{60 \times 0,5}{60} + 2 = 16,16mi\,n$$

where t_P – loading time, calculated below, s; L - distance of transportation of soil, km; V_G - speed of a loaded dump truck; t_P - unloading time, we accept 1 min; V_P - speed of an empty dump truck, we accept 60 km/h; tm - time of maneuvering before loading and unloading, we accept 2 min.

$$t_P = \frac{V \times H_{BP}}{100} = \frac{4 \times 5}{100} = 0,2H = 12mi\,n$$

Determine the required number of dump trucks:

$N = \frac{t_C}{t_P} = \frac{16,16}{12} = 2$ dump trucks are necessary for continuous operation of the excavator.

n = V_{out} / $V_{z.}$ = 6577,65 /4 = 1644,4 dump truck trips.

Design and calculation of excavator bores

Develop excavation excavator EO-6122, equipped with a backhoe and bucket capacity of 1.6m3 with a hydraulic drive.

Mark of excavator EO-6122

Bucket capacity 1,6 m^3

Max. digging depth 7,3 m

Max. dumping height 6,5 m

Max. digging radius 11,8 m

Minimum digging radius 3 m

The driver of the sixth category

Method of mining to a spoil bank and loading on to vehicles

Job composition: 6p machinist

1. Excavator installation in the working face

2. Excavation with bucket cleaning

3. Moving the excavator while working

Excavator movement during the excavation 4.

Excavation across the excavation as the width of the face (more than 3.5R) with a two-sided excavation.

The maximum width of excavation across the excavation on top of the two-sided discharge of soil:

$B = R_T - b_K / 2$, where R_T – maximum digging radius = 10,6 m; b_K – vehicle width = 2,7 m.

$B = 2b_1 = 2\times(10,6 - 2,7/2 - 1) = 15$ m

Width of the tunnel at the bottom:

$B_1 = B - 2\times m\times H$, where m – slope factor; H – extraction height.

$B_1 = 15 - 2\times 0,85\times 4,2 = 7,86$m

Consequently, we take the excavation across the excavation with double-sided loading.

Soil compaction

Roller DU-29 of medium type is designed for rolling of asphalt, stabilized and gravel and macadam mixtures, has a high efficiency, since it has a large mass and speed. The roller and all its systems are controlled either from the driver's cabin or from the working platform on the right side of the cabin.

Type of roller is self-propelled

Mark of roller DU-29 (D-624)

Width of compacted band - 2.22 m

Thickness of compacted layer - up to 0.4 m

Engine power - 96 kW (130 hp)

Weight of roller - 30 t

Machinist of 6 category - 1.

Technological processes:

1. Getting the machine into operating position
2. Consolidation of soil
3. Turning of the roller and transition to the next compaction lane

Determine the average thickness of the layer to be compacted:

$$\delta_S = \frac{V_H}{S_H} = \frac{136}{1361,4} = 0,09 \text{ m}$$

Determine the number of compacted layers:

$$n_S = \frac{\delta_S}{B} = \frac{0,09}{0,5} = 0,198$$

Determine the volume of planning work:

$$V_P = S_{HAC} \times n_S = 1361,4 \times 0,198 = 269,55 m^2$$

$$P_S = \frac{1000 \times 8,2}{0,79} = 10379,74 \, {}^{m^3}/_{sh}$$

$$n = \frac{V_P}{П_S} = \frac{269,55}{10379,73} = 1$$

Take one roller.

Determine the technical capacity of the roller:

$$P_T = \frac{1000 \cdot (B - b) \cdot h \cdot V}{z},$$

where, B - width of the compaction strip, taken equal to the width of the roller, m; b - width of overlap of adjacent strips taken 0.15 m; h - thickness of the effective compaction layer, m; V - average operating speed of the machine, km/h; z - the required number of passes on one place.

$$P_T = \frac{1000 \cdot (2,22 - 0,15) \cdot 0,4 \cdot 15}{6} = 2070 \, {}^{m^3}/_{h}$$

$$P_T^S = 2070 \times 8,2 = 16974 \, {}^{m^3}/_{sh}$$

$$P_E^{CM} = 16974 \times 0,85 = 14427,99 \, {}^{m^3}/_{sh}$$

Table 4.1. Number of machines and service personnel per shift

Types of work	Machines	Composition of the link	List of works
Preparatory	Bulldozer DZ-25	Machinist of the 5th category - 1	Cutting of vegetative soil, leveling of the construction site, construction of temporary roads
	Excavator EA-6122	Machinist of the 6th category - 1	Loading of plant soil in dump trucks
	Dump truck KrAZ-222	Driver - 1	Transportation of vegetative soil outside the construction site
Basic	Excavator EA-6122	Machinist of the 6th category - 1	Excavation
	Dump truck KrAZ-222	Driver - 1	Transportation of soil outside the construction site
	Self-propelled roller DU-29	Tractor Driver- 1	Compaction of the excavation bottom

Operational quality control of excavation work

The processes of erection of earthworks are subject to systematic control, generally including:

1. position of excavations and embankments in space (planned and height);

2. geometric dimensions of earth structures;

3. properties of soils underlying the structure;

4. properties of soils used for the erection of embankment structures;

5. quality of earth placed in embankment and backfill.

Systematic quality control shall be carried out in a linear manner by engineers and technicians. For this purpose, daily operational control shall be arranged which shall be carried out by the construction site supervisors and foremen in cooperation with the geodetic service and the construction laboratory.

When controlling the position in space and size of structures check:

1. the planned location of earthworks and their dimensions;

2. levels of embankment tops and bottoms of excavations;

3. level of embankment tops taking into account allowance for settlement;

4. marks of planned surfaces;

5. slopes of slopes, embankments and excavations.

This control is carried out using geodetic devices (theodolite and level), as well as the simplest tools and devices - tape measure, "meters", building levels, plumb benches, jigs, stakes length of 2 and 3 m.

Assessment of soil properties in the bases of structures, pits, embankments and backfills are carried out to establish compliance with those adopted in the design of structures. To do this, the main characteristics are determined - density and moisture, which are quality criteria.

Geotechnical control at the construction site is carried out by control posts and construction laboratories.

Employees of the control post at the construction of earthworks perform the following duties:

1. make sure that the ground corresponds to the project;

2. monitor the thickness of the layer being placed and the technologies of work at the site and compaction of the ground, as specified in the project;

3. absence of vegetative and low-quality soils in the backfill layer

4. the number of passes (blows) of compaction equipment on one track;

5. check the surface preparation of the previously compacted layer for backfilling the next layer and the humidity of the soil in the layer before compaction;

6. take samples and samples of soil from foundations, embankments and quarries in a timely manner and in the required quantity;

7. determine the density in each layer of soil in the process of compaction.

The workers of the control post (laboratory) shall inform the technical personnel performing works on erection of this facility of the results of laboratory tests and control measurements, and of any non-compliance with the

design and established work technology; the workers of control posts shall report to the supervisor of works (site supervisor).

Final inspection.

1. inspection of execution of technical documentation;

2. list of permanent reference points;

3. certificates of geodetic lay-out of excavated structures;

4. shop drawings of structures with changes made during the works and coordinated with the design documentation;

5. work logs;

6. acts of certification of hidden works or logs

4.3. Foundation construction

Table 4.2. Calculating the volume of concrete work

Name of work	Formulas	Units	Number
1. Formwork arrangement	$S_F \times n$	m^2	207,36
2. Formwork assembly	$S_F \times n$	m^2	207,36
3. Installation of fittings a) Skeleton b) Grids	$m_F \times n$	t	 0,886 3,24
4. Concrete supply	$V_F \times n$	m^3	93,31
5. Concrete stripping	$S_F \times n$	m^2	207,36

$S_T = 4 \times A_1 \times H = 4 \times 1{,}8 \times 0{,}6 = 4{,}32\ m^2$– lateral surface area of 1 monolithic reinforced concrete single foundation; $m_{F.}$ – weight of 1 running meter of rebar; V_F – volume of monolithic reinforced concrete foundations, n-number of monolithic foundations = 48 pcs.

Selection of machines and mechanisms

Concrete mix will be delivered to the construction site using a C-1036 concrete mixer (volume 2.6 m^3). Concrete mixer will be loaded with ready-mixed concrete, as the existing concrete plant is located 20 km from the construction site. For loading a special charging hopper, and for the distribution of concrete mix - dispenser chute. When unloading, the mixing drum is tilted,

for this purpose, the subframe together with the drum by means of a hydraulic cylinder.

Feeding the concrete to the place of concreting by a bucket (volume 1.5 m^3) lifted crane MKG-16M with an outreach to 23 m and carrying capacity of 16 tons.

Choice of formwork

For this freestanding foundation we choose panel formwork. For the pad (1.8×1.8 m), the width of the panel formwork is 1.8 m, and the height is 0.6 m. The shield consists of a deck, which can be made of metal, wood or waterproof plywood, horizontal beams and vertical trusses. In the lower part of the trusses are installed push-pull props with screw jacks. In the upper part of the shields there are detachable slopes (for convenient placement of concrete) of several standard sizes, whose replacement makes it possible to change the height of the shield. The scaffold for concreting is fixed on the panels. For greater stability of the formwork, additional adjustable push-pull props are used, which are fastened to the formwork, so it is necessary to provide heating of the concrete. Shields of formwork are made individually based on the size of foundations

Table 4.3. Specification of shuttering boards

Pos.	Identification	Name	Number
1	SH - 1	Formwork shield 0,6 x 1,8 m	4 x 48
2	SH - 2	Formwork shield 0,4 x 0,7 m	4 x 48

Reinforcing works

Reinforcement of unstressed reinforced concrete structures consists of: preparation of reinforcing elements, transportation of reinforcement to the construction site, its sorting and storage; consolidation assembly; installation of reinforcing blocks, spatial cages, meshes; connection of mounting units in the designed position into a single reinforcement structure.

Welded meshes and spatial scaffolds are used as reinforcement in the project. In order to reduce the cost of manual labor in the manufacture of

reinforcement, it is recommended to reinforce precast and monolithic structures with welded reinforcement meshes, flat and volumetric cages manufactured in the factory by means of high-performance contact electric spot welding.

The performance of reinforcing works, including installation of reinforcing structures on the site, is recommended to be entrusted to complex teams working according to the brigade calculation method.

Table 4.4. Specification of reinforcement products

Identification	Dimensions	Rod diameter, mm	Mass, kg	Number
C1	1,7 x 1,7	14	7,02	20
C2	0,9 x 0,9	5	4,7	20
KP1	0,6 x 0,6 x 2,7	Working - 20; Clamps - 10	54,9	20

In a welded grid, the distance between the longitudinal rods is taken as 180 mm, and between the transverse 180 mm. With the mesh dimensions of 1.7×1.7 m, we obtain 10 longitudinal rods and 10 horizontal rods. The length of reinforcement in the mesh (1.8×1.8 m) is: m, and the mass of one mesh is equal to $m = \ell \times \rho$, where ρ - weight of 1 running meter of rebar d=14mm, equal to 0,208 $^{kg}/_{m}$

$m = 34 \times 0{,}208 = 7{,}02$ kg.

With a grid size of 0.9×0.9m you get 18 longitudinal and 18 horizontal bars. The length of reinforcement in the grid (0.9×0.9m) is: m, and the mass of one mesh is equal to $m = \ell \times \rho$, где ρ - weight of 1 running meter of rebar d=5 mm, equal to 0,144 $^{kg}/_{m}$ $m = 32{,}4 \times 0{,}144 = 4{,}7$ kg. The grid is installed in the base of each step of the foundation keeping the thickness of the protective layer of 50 mm. For this purpose, special stops or elongated pepper rods are provided in the structures of the reinforcement elements. This method is used if the structure is operated in a dry environment. Concrete, plastic and metal spacers that are taped or slipped onto the reinforcement bars also contribute to the concrete cover's specified dimensions. Plastic spacers are characterized by

high technological properties. Due to a small mass of the mesh, it is assembled manually by a unit consisting of a 3 and 2 grade wireman. Welded spatial frames, due to their light weight, are installed in the formwork by hand. After the meshes and cages are installed, their positions in the formwork must be aligned.

The reinforcement is accepted by drawing up a report and evaluating the quality of the work performed. In addition to checking its design dimensions according to the drawing, the presence and location of clips and the strength of the reinforcement structure assembly, which must ensure the immutability of the forms during concreting, are also checked.

Concrete works

Before laying the concrete mixture in the structure, carry out a set of operations to prepare the formwork, reinforcement and foundation.

The formwork and supporting scaffolding shall be thoroughly inspected, checked for reliable installation of props, scaffolding and wedges under them, fastenings, as well as the absence of gaps in the formwork, availability of embedded parts and plugs provided by the project. The formwork shall be cleaned from debris and dirt. Before placing the concrete mixture, check the reinforcement structures installed. Check the location, diameter, number of reinforcing bars, as well as the distance between them, the presence of tie rods and welded seams at the intersections between the bars. The distances between the rods shall comply with the design specifications.

Before laying the concrete mixture on the ground, prepare the base. The readiness of the base for laying the concrete mixture shall be documented by the act.

The concrete mixture shall be laid in such a way as to ensure the monolithicity of the concrete masonry, the specified physico-mechanical characteristics and the homogeneity of the concrete, its proper adhesion to the reinforcement and embedded parts, and full filling of the space behind the formwork with concrete.

In foundations, the mixture is fed through the top edge of the formwork, with measures against displacement of anchor bolts and embedded parts.

When vibro-compacting, the internal vibrators are immersed into the mixture through the open edges of the stage and repositioned along the perimeter of the stage in the direction of the center of the foundation.

Concrete care

In the process of aging care is carried out for the concrete, which must provide: maintaining the temperature and humidity conditions required for the growth of concrete strength, preventing significant temperature-shrinkage deformations and cracking, protecting the hardening of concrete from strikes, shocks and other influences that degrade the quality of concrete in structures.

Freshly laid concrete keep wet by periodic pouring and frost protection coatings (ethanol varnish, input and asphalt emulsion, polymer films). freshly laid concrete must not be exposed to the action of loads and shocks. Movement of people on the concreted structures, as well as installation of scaffolding and formwork on such structures shall be allowed only after the concrete strength of at least 1.5 MPa. Movement of vehicles and concrete-laying machines on the concreted structures is permitted only after the concrete strength has been reached, stipulated by the project of the works.

Concrete care measures, their duration and frequency of use shall be noted in the concrete work log.

Stripping shall be carried out carefully to ensure the safety of the formwork for reuse, and to avoid damage to the concrete. When the concrete has reached the required strength, the striking of the formwork shall be started. The side panels of the foundation are removed after 48-72 hours. These terms are set on site, depending on the type of cement and the temperature-humidity regime of concrete hardening. The supporting elements of the formwork shall be removed after the concrete reaches the strength necessary to ensure the safety of the structure.

When removing the formwork from the foundation, first cut the tie bolts. Next, the ties and ribs are removed, and then the individual panels are torn from the concrete. Before reuse, the formwork is cleaned and repaired.

Table 4.5. Number of machines and service personnel per shift

Types of work	Machines	Composition of the link	List of works
Concrete works	Auto concrete mixer BS-75	Driver - 2	Concrete delivery to the construction site
	Jib crane MKG-16M	Machinist of 6 category - 1	Concrete placement into the structure
	Tipper KrAZ-222	Driver - 1	Delivery of reinforcement meshes and frameworks to the construction site

Operational quality control of concrete work

Checks:

1. The quality of concrete constituents and storage conditions;
2. The work of batching and concrete farm;
3. Readiness of the structural elements of the structure for concreting;
4. Quality of the concrete mixture during its preparation, transportation and laying;
5. Proper care of concrete, terms of stripping and other parameters of concreting;
6. Strength, density, water resistance and frost resistance of concrete;
7. Correctness of shape and size of made structural elements.

When preparing a concrete mixture in winter conditions, control the temperature of heating of water and aggregates, and the temperature of concrete mix at unloading from concrete mixer shall be carried out every 2 hours.

In the process of preparing the concrete mixture at least every 2 hours, control the absence of ice, snow and frozen lumps in the unheated aggregates fed into the concrete mixer, when preparing a concrete mixture with antifreeze additives, the temperature of water and aggregate before loading into the

concrete mixer, the concentration of the salt solution, the temperature of the mixture at the outlet of the concrete mixer.

Before placing the concrete mixture, check the absence of snow on the elements of the formwork, reinforcement.

When electrically heating the concrete at least 2 times per shift, control the voltage and amperage of the supplying transformer, the values are recorded in the magazine.

For all operations to control the quality of technological processes and quality of materials shall draw up acts of inspection, which shall be submitted to the commission receiving the object.

4.4. Building construction technology

The columns are erected in a small panel formwork it consists of several types of small-sized boards, plywood, as well as elements of fasteners and supporting devices. In order to use mechanisms and to reduce labor costs, the formwork panels are preassembled into large-size formwork panels that are installed and removed using cranes.

The floor-slabs are constructed in Tissen Compact large-area formworks, which are placed on tripod supports. The installation of the formwork is carried out using a crane.

The construction of monolithic reinforced concrete structures is a complex process and consists of technologically related and sequentially carried out simple processes:

1. installation of formwork and scaffolding;
2. installation of the reinforcement;
3. installation of the embedded parts;
4. placement and compaction of the concrete mixture:
5. care of concrete and intensification of its hardening;
6. de-cast construction;

All specialized processes are performed by specialized units, which are combined into a complex brigade. The building is divided into tiers, where one

floor serves as the tier and into work areas (working section of the tier), which makes work organization flowing.

The complex team performs in two shifts, concreting only in the first shift. Installation is carried out in a "window" when the technology in the neighboring area only monitors the process of setting the strength of concrete. On curing the concrete set a day before stripping, but not less than two days before laying precast structures. The walls are erected in the same way.

All construction processes on the floor are divided into 9 complex ones:

1. Column formwork assembly;
2. Concreting the columns;
3. Erection of the brick walls;
4. Exposing and control of the concrete strength of the columns;
5. Disassembly of columns formwork if necessary lubrication;
6. Installation of slab formwork, laying of reinforcement grids and cages;
7. Concreting of the slabs. 8;
8. Exposing and control of the concrete strength of the slabs;
9. Disassembly of slab formwork, repair, lubrication.

When the slab section is concreted and workers return to this area to install the formwork for the next tier, 7.5 days pass, this time is enough to set the concrete strength of 70% of the maturity strength.

Concrete mixture is made on the construction site when organized by the purchased concrete node, which is economically advantageous and fed in buckets volume 0.3 - 1 m^3.

4.5. Roofing works

Asbestos-cement roofs are made of corrugated sheets. Corrugated asbestos-cement sheets of ordinary profile are laid on a wooden crate with a roof slope of more than 27º. The sheets are laid from bottom to top in rows parallel to the eaves. The upper row overlaps the lower, depending on the slope of the roof

120-140 mm. In a row each sheet is overlapped adjacent to one wave. The sheets are attached to the crate with stainless steel nails or screws with a soft washer.

Roof purlins are made in such a way that it is possible to lay a whole number of sheets in the longitudinal and transverse directions. If this is not possible, the roof is introduced cut sheets that are laid in cross-sectional rows penultimate in the gable eaves, and in the longitudinal by the ridge.

The first sheet is laid on a cord along the slope, starting from the eaves, without cutting corners. Then, on the crest of the second wave on the right side of the sheet with a hand drill drill hole at a distance of 80-100mm from the bottom edge and nail the sheet to the eaves slate nail with a lining of rubber, gum, Ruberoid, not achieving nail 2-3 mm. Then the roofer puts in place the second sheet longitudinal row (from the first to the end), exactly fits the sheet with the cut corner on the spot, drilled a hole in the second wave on the right in the middle of the second sheet laps on the first (at a distance of 60 mm from the bottom edge of the second sheet) and nails it to the crate slate nail, not achieving a nail on 3 - 4 mm. In the same way process the following sheets of the first longitudinal row and nailed to the crate.

After covering the slopes on the roof ridge and establish a bar on both sides of it reinforce two crate bars.

4.6. Finishing works

PLASTERING

The process of plastering surfaces consists of the following operations: surface preparation for plastering, surface inspection, spraying and priming, pulling tie rods and cutting corners, covering and grouting the surface, finishing slopes and blinds.

Brick surfaces to be plastered shall be thoroughly cleaned of dust, dirt, grease and other stains. The surfaces shall be checked and beams shall be arranged to verify the levelness and verticality of the surfaces, and to control the thickness of the plaster layer to be applied. Vertical surfaces are checked with a plumb bob, horizontal - with a level with a straightedge-rule.

Correctness of preparation of the surface for plastering must be documented by the act of hidden works.

The plaster must be firmly bonded with the plastered surface: individual layers of the plaster must not delaminate. The adhesion strength is checked by lightly tapping the plaster surface. A muffled sound indicates a lack of adhesion, in these places the plaster layer must be cut out and replaced with a new one. Cracks, bumps, sinks, etc. are not allowed on the plaster surface.

PAINTING WORK

The process of painting work consists of three basic operations: priming, puttying and painting the surface.

Painting work begins only after the device of the roof over the premises being finished and in such an environment that does not allow for damage to the finish or contamination by subsequent work, ie after all the general and special work in the premises being finished and handed over. To avoid uneven drying in all rooms where painting work is carried out, the window coverings shall be glazed. Exterior painting work is performed at an outside temperature of at least +5 ° C. Organosilicon coating is applied with a thickness of 2 mm.

The primer is applied with a spray gun. The drying time of the invoiced layer is 2 hours. The work is performed from scaffolding, which is set up in advance along the entire perimeter of the building.

Type and color of the painted surfaces must comply with the project. Painted surfaces must be monochrome, with no gaps and seams. Stains, streaks, drips, splashes, bubbles, bloat and peeling of the paint film, cracks, hairs from the brush, paint flecks are not allowed.

WALLPAPERING

Wallpapering surfaces consists of the following operations: surface preparation, pasting the surface with paste, grinding the surface and its pasting paper, wallpaper preparation and pasting surfaces with wallpaper.

In rooms where wallpapering is provided, all work must be completed, except for the second painting of joinery. Moisture of the pasted surface should not exceed 8%.

The pasted surfaces must be free of bubbles and stains. All surfaces must have the same color and shade. Gaps, before gluing and peeling are not allowed. Joints of wallpaper when pasted together should not be visible. Skewed, wrinkled, not tight adjacency to the base are not allowed. Acceptance is made only after drying the surface pasted wallpaper.

GLAZING WORKS

Glass work shall be performed before painting and wallpapering works. When carrying out glazing glass be cut in the workshops.

In the wooden windows and doors, glass is fixed with glazing bars on the caulk. In showcases and stained-glass windows with profiles of aluminum alloy glass large sizes are fixed metal glazing bars on the vent. For cutting glass use glass cutters.

Acceptance of glass work is carried out before the end of the painting of windows and no earlier than the formation of a solid film on the surface of the glass putty. The inserted glass surfaces must be clean, without any traces of putty, mortar, paint, etc. The putty must not have cracks and must not come off.

5. Environmental protection

Buildings and structures have a great impact on the environment. Their appearance causes significant changes in the air and water environment, in the state of the soils of the construction site. The vegetation cover changes - artificial planting replaces the destroyed natural one. The regime of moisture evaporation changes. The average temperature in the construction area is constantly higher than outside it.

Poor technologies, organization and production of works determine high consumption of energy and materials, high degree of environmental pollution.

The construction process is relatively short. The interaction of a building or structure with the environment, its nature and consequences are determined in the period of long-term operation. Hence the importance of this period in determining the economy of the object, i.e. how the environment will be affected not only the appearance, but also its long-term operation.

All kinds of human activities aimed at reducing or completely eliminating the negative impact of anthropogenic factors, conservation, improvement and rational use of natural resources refer to environmental protection activities. In the construction of human activities, such activities should include:

- application of low-waste and non-waste technological processes and productions in the extraction and processing of construction materials;

- land reclamation;

- measures to combat soil erosion and pollution;

- measures to protect water and subsoil and rationally use mineral resources;

- measures to protect and reproduce flora and fauna, etc.

The measure of success in achieving these goals is environmental, economic and social results. The environmental result is the reduction of the negative impact on the environment, improving its condition. It is determined by reducing the concentration of harmful substances, radiation, noise and other adverse phenomena.

The social result can be expressed in an increase in the physical standard characterizing the population; reduction of diseases; increase in the life expectancy of people and the period of their active work; improvement of working and rest conditions; preservation of natural, historical and cultural monuments; creating conditions for the development and improvement of the creative abilities of people, the growth of culture.

Planting of trees and shrubs between the road and the cottage building, projected in the landscaping, as well as within the block, lead to the protection

of the house from urban noise and motor vehicle noise. Green plantations lead to an improvement in the gas composition of the air and its purification.

The main structures of the residential building are designed from natural environmentally friendly materials (clay bricks, monolithic reinforced concrete structures, brick partitions, wooden constructions of windows, doors, paper wallpaper).

Construction site is located in a residential area, so the project provides a number of measures to protect the natural environment. During the construction of a two-storey cottage, one of the primary measures is the removal, preservation and use of the natural layer of soil without displacing it with the underlying layers. Soil storage is provided in a specially designated area. In order to protect groundwater from pollution, sewage is discharged through citywide sewer networks to treatment facilities (by agreement with the SES), where they undergo a full cycle of treatment and disposal.

In order to carry out work in winter, excavations for foundations are protected from freezing. For the laying of utilities in the places of their passage, measures are taken to prevent soil from freezing - loosening the soil and others. On-site heating of bitumen is not provided. Mastic is delivered from the central base in a timely manner and in the required quantity. Storage of dust-like materials - cement, lime, etc. at the construction site is not provided. Materials come from the building depot in the finished form - mortars, concretes, milk of lime, paint colors.