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FACULTY OF CONSTRUCTION

Department of Construction, Geotechnics and Geomechanics

EXPLANATORY NOTE
of a Bachelor's qualification work

student Ibrahim Abdelrahman Adel Badr

academic group 192-17-1 IC

specialty 192 Building and Civil Engineering

under educational programme Building and Civil Engineering

topic: "Construction project of two-storey cottage in village Novooleksandrivka, Dnipropetrovsk region"

Supervisors	Name	Grade system		Signature
		ranking	institutional	
qualification work	Ishchenko O.K.	88	good	
Chapters:				
1 chapter	Ishchenko O.K.	89	good	
2 chapter	Ishchenko O.K.	84	good	
3 chapter	Ishchenko O.K.	89	good	
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Reviewer	Krimchak P.V.	89	good	
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TASK
for a Bachelor's qualification work

student ___Ibrahim Abdelrahman Adel Badr___**academic group** ___192-17-1 IC_____
(name) (code)
Specialty _____192 Building and Civil Engineering_____
specialization _____Building and Civil Engineering_____
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topic: "Construction project of two-storey cottage in village Novooleksandrivka, Dnipropetrovsk region"
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Chapter	Content	Deadlines
1	Architectural and construction chapter	
2	Calculation and design chapter	
3	Organizational and technological chapter	
4	Equipment and economic chapter	

Task is issued _____ _____ ___Ass. Prof. Ishchenko O.K._____
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Acceptance for execution _____ ____Ibrahim Abdelrahman Adel Badr___
(student's signature) (name)

ABSTRACT

Qualification work: 63 pages, 2 tables, 1 figure, 1 annex, 7 sources.

RESIDENTIAL BUILDING, CONSTRUCTION SCHEME, BUILDING PROJECT, COTTAGE CONSTRUCTION, HOLLOW FLOOR PLATES, CALCULATION OF HOLLOW PLATE SLABS.

The object of work is a two-storey cottage building in the village of Novooleksandrivka, Dnipropetrovsk region.

The purpose of the work is to design two-storey cottage buildings taking into account the tendencies to the rapid construction of buildings and the development of construction in rural areas.

Methods of work - development of working drawings, technical calculations justifying the choice of technology and structural elements of the building, development of technological maps, determination of technical and economic indicators of construction.

The results and their novelty - developed and substantiated technology of construction of a two-storey residential building, developed architectural drawings and technological schemes for the arrangement of the foundation of concrete blocks and installation of hollow floor slabs, calculated hollow floor slabs, developed method statement and schemes, calculated economy.

Scope - technologies of construction of civil engineering objects.

The practical significance of the work is to increase the construction time and the development of rural construction.

CONTENT

INTRODUCTION

The development of construction in rural areas promotes the rural way of life, which leads to the development of villages and their infrastructure. The main advantages of this way of life are clean air, water, lack of noise and urban smog from the activities of industrial enterprises and many vehicles. The presence of constant contact with nature has a positive effect on the nervous system and the development of young children, which is a key factor for the growth of a healthy nation.

Modern construction is very actively developing, which opens new architectural and construction solutions. The main criteria for construction are always the timing of construction and installation work and cost, and the effects of urbanization lead to rapid population growth in large cities, however, the main problem of modern Ukraine remains the development of rural construction. Therefore, the creation of low-rise residential complexes using new technologies with energy-efficient solutions in rural areas remains relevant.

The task of this project is to create a modern low-rise residential buildings of cottage type using modern technologies of construction and compliance with safety, further operation and energy efficiency, by selecting modern economic devices for space heating and a reasonable approach to the choice of external insulation and exterior facade insulation, in order to maintain a constant microclimate inside the building.

1 ARCHITECTURAL AND CONSTRUCTION SECTION

The house is designed for families consisting of spouses and children, is designed in the village of Novooleksandrivka, Dnipropetrovsk region, located on the banks of the river Mokra Sura in the central part of Dnipropetrovsk region. Near the river, the height above sea level is 55-60 meters, in other parts of the village it reaches 90 meters.

Territorially, the village is 24 km away from the district center of Jubilee. From the north to Novooleksandrivka adjoin the southern outskirts of the regional center of the city of Dnipro, in the west it borders with the village of Sursko-Litovske, in the east - with the village of Bratske. The nearest settlements are Dorohe village, Doslidne village, Chervonyi Sadok village, Aviatorske village, Antonivka village.

The settlement is a part of the Dnieper agglomeration. Administratively, the village of Novooleksandrivka is subordinated to the Novooleksandrivka village council.

The housing stock of the village is about 171.3 thousand m^2, of which 12.18 thousand m^2 - apartment, and 159.12 thousand m^2 - homestead housing. Housing security on average in the village is 34.5 m^2 / person total area.

The designed buildings consist of two floors: the first and second where there are bedrooms, no basement. System-structural approach to the formation of subject-spatial environment allows to identify spatial relationships between objects of design and architecture and their impact on the development of suburban lifestyle. The residential group of modular block houses forms modern architectural compositions and influences the development of rural settlements.

Features of the planning decision are: convenient location of rooms, absence of corridor zoning, existence of a sufficient number of windows for requirements of insolation of buildings.

1.1 Initial data for design

The designed house is designed for Dnipropetrovsk region (II B climate zone). Climate with. Novooleksandrivka is moderately continental with hot and dry summers with frequent showers, strong southeast and east winds that cause droughts. Winters are mild, with little snow, and thaws and ice. Average January temperature: from - 4.5 ° C in the south-west to - 6.5 ° C in the south-east; July, respectively + 22.5 ° C and + 21.5 ° C. The duration of the frost-free period is 228 days. The period with a temperature above + 10 ° C is 178 days. It lies in an arid, very warm agro-climatic zone.

The average long-term air temperature is +9.0 ° C, the lowest is in January (-3.6 ° C), the highest is in July (+ 22.1 ° C). The lowest long-term minimum temperature was in January 1950 (-30 ° C), the absolute maximum temperature was registered in 2010 (+40.9 ° C).

Geological data:

Vegetation layer - 0.3 m.

Loam - 0.85 m, R_0 = 0.17 MPa

Clay more than 5 m, R_0 = 0.26 MPa

Basic constructions:

Foundations - strip from foundation solid wall blocks;

Walls - brick with internal insulation, 510 mm thick;

Floors - prefabricated reinforced concrete panels with round cavities;

Stairs - wooden;

Partitions - gas silicate, brick;

Roof - steel from galvanized sheets; the roof is gabled.

1.2 General plan

The building area of the residential building has a rectangular shape. The main facade is oriented to the west. The house is located at 14 m from the district road. On the land plot there is an entrance to the garage and a place for temporary parking of the car, organized footpaths along the house. There are seating areas in the backyard. The area around the house provides landscaping and planting of fruit trees.

1.3 Spatial planning solutions

The apartment house has the following dimensions in axes:

width 11.80 m;

length 13.60 m;

number of floors - 2;

floor height 2.8;

building height 9.30 m;

number of apartments - 1.

Planning decision:

1st floor: living room, kitchen, dining room, workshop, garage, boiler room, bathroom, veranda. Living area 24.97 m^2; The total area is 111.88 m^2.

2nd floor: greenhouse, 4 bedrooms, sauna, balcony. Living area 47.97 m^2; The total area is 113.77 m^2. The construction volume of the building is 1011.02 m^3.

1.4 Structural solution of the building

1.4.1 Foundations

Foundations for external and internal walls are designed on slightly abyssal soils, shallow in the form of strips of foundation solid wall blocks (FSWB) on a sand bed. sand bed 20 cm thick is made of medium-sized sand with careful compaction. Blocks are mounted in 1 row 600 mm thick. After the installation of FSWB, joints between the blocks

are concreted with class B10. For waterproofing shallow foundations and reducing freezing forces between the soil and concrete, the leveled side surfaces of the foundation are coated with bitumen mastic over a primer coating. The foundation is coated from its base to the planning mark. The first layer of coating is thin with careful lapping, the second is 8-10 mm thick. On the top of the foundation, waterproofing is provided - 2 layers of roofing material. The basement part of the walls is made of clay solid bricks of plastic pressing on M100 mortar. In order to avoid atmospheric water under the foundation, waterproofing of its sinuses is provided by a blind area made of asphalt 30 mm thick, laid on a layer of expanded clay 100 mm thick. The blind area is laid along the perimeter of the building from the outside and has a width of 0.7 m with a slope of 2 - 3% from the walls of the building.

1.4.2 Walls

In the project, the outer walls with insulation of masonry are made with a thickness of 510 mm from silicate bricks with a size of 250x120x88 grade M100 on cement mortar Mr50. The inner walls are made of 250 mm thick silicate bricks. The walls that meet energy-saving requirements in the project are designed with an internal insulation made of mineral wool boards with a volumetric density of 45 kg / m^3. To ensure the strength of the brickwork, it is planned to install steel ties made of reinforcing meshes with a diameter of 4 mm, installed every 4-5 rows in height. The wall is laid in the following sequence. First, the outer part is laid out of a facing clay hollow brick (size 250x120x88), 120 mm thick, 0.4-0.5 m high. Then a mineral wool slab insulation is installed so that there is a displacement of the vertical joints. Internal masonry of a wall with a thickness of 250 mm of a chain linking system for plastering joints (i.e. in wastelands). After 400 mm, flexible ties (mesh) are installed from reinforcement with a diameter of 4-5 mm. Above the window and door openings, reinforced concrete lintels (ordinary, reinforced) are installed, and from the outer part of the wall, the masonry rests on a steel corner 110x80 (equal-flange). The outer walls are completed with a brick cornice by filling in bricks.

1.4.3 Floor slab

The building has prefabricated reinforced concrete floor slabs with round voids. The slabs are made of B25 class concrete with prestressed reinforcement. The thickness of the slabs is 220 mm, the diameter of the voids is 159 mm. Plates are mounted on a layer of cement-sand mortar. To connect the slabs to the walls and to each other, their anchoring with reinforcement with a diameter of 8-10 m is provided, which ensures the overall stability of the building. The voids at the ends of the panels are sealed with concrete inserts to protect them from crushing from the overlying masonry, as well as for heat and sound insulation. The seams between the panels are filled with cement-sand mortar of grade not less than M100.

1.4.4 Floors

On the ground floor, plank floors are designed, made of 29 mm thick sheet pile boards, nailed to the joists. The logs rest on brick posts with a section of 250x250 mm, located at 500-600 mm. Plank shields rest on brick posts and are nailed to the logs. The boards are covered with mineral wool and then plastic foil to prevent the mineral wool from getting wet. Parquet boards are laid on the polymer film. Along the perimeter of the walls, expanded clay backfill is provided to ensure thermal insulation. Heat and sound insulation linoleum on a soft porous base is arranged on top of the boards. The floors of the second floor are designed from heat and sound insulating linoleum on a porous base along the floor slabs. The surface is pre-leveled with cement-sand mortar 20 mm thick, grade M50. For the sanitary unit and in the boiler room, tiled floors made of ceramic tiles with a thickness of 10 mm square were designed. They are laid on the expanded clay base on a cement screed 20 mm thick. The tiles are laid on a flat, hard, dry base on special mixtures. In the garage, the floors are designed as asphalt concrete with a thickness of 50 mm. The mixture consists of bitumen with pulverized aggregate, sand and gravel.

1.4.5 Interior walls

The partitions are designed plasterboard, they are lighter than brick ones, therefore they are installed on a lightweight basement. Initially, a profile frame is installed with alignment and fastening, the dimensions of the profiles are 2500x80x40, the pitch of the frame racks is 600 mm. Fastening of drywall sheets is carried out with self-tapping screws on both sides of the frame. Filling the inner part of partitions made of mineral wool slabs P_0 = 140kg / m^3 provides sound insulation from airborne sound.

1.4.6 Ladder

Wooden two-flight staircase with an intermediate platform. With a floor height of 2.8 m, the slope of the stairs is 1: 1.25; the dimensions of the risers and treads are respectively 200x250 mm. Wooden stairs are arranged on bowstrings. The bowstrings have cutouts 15-20 mm deep for the installation of step elements. Bowstrings are pulled together with reinforcement d = 10mm. In order to be safe from variable humidity and to give an aesthetic appearance, wooden elements are impregnated with a special solution. Treads and risers are made of 45 mm thick boards. The porch staircase is designed on wall string. The platform is mounted on the cantilever part of the beams (its length is 70 - 90 cm). The lower ends of the wall string rest on a concrete support-beam, on top of which waterproofing is laid.

The ends of the stringers cut in the support without nails. Their upper parts are interconnected with a support board, which lies freely at the ends of the beams. So that it does not move, it is fastened with one or two through thorns. The tread of the upper step serves as a continuation of the site. The slope and dimensions of risers and treads are the same as for internal stairs.

1.4.7 Windows. Doors

The project adopted window fillings from plastic blocks with double-glazed windows. Window frames are insulated from brickwork with a layer of roofing material along the entire perimeter. The seams between the box and the wall are filled with polyurethane foam with insulation gasket. The boxes are fastened to the walls with self-

tapping screws. For glazing, glass with a thickness of 3.5 - 4 mm is used. From the outside, ebbtides made of galvanized steel are arranged, intended for the drainage of atmospheric waters. Slopes are plastered outside and inside.

Door blocks consist of door frames with quarters and steel hinges, and door leaves that are hung on these hinges. The door leaves have door handles and embedded locks. The seams between the frame and the opening are 15-20 mm. In the outer walls, they are insulated with strips of roofing material and filled with polyurethane foam.

1.4.8 Roof

The roof is designed from polymer-coated galvanized steel sheet, which is transversely stamped to obtain a pattern imitating natural tiles. The metal tile is laid on a crate made of 50x50 mm bars with self-tapping screws to the rafters. The roof is designed with an external drain. All wood installed for the roof must be treated with antiseptics and fire retardants to prevent it from rotting and burning. In the project, it was decided to lay thermal insulation boards, a polyethylene film with a thickness of at least 0.2 mm is stretched onto the inner surface of the insulation layer and attached to the boards with staples. Separate strips of film are overlapped with subsequent sealing of the joints with adhesive tape. The thickness of the insulating layer is chosen so that a gap of 2-5 cm remains between it and the roof covering, which will ensure enough air circulation.

1.4.9 Exterior and interior decoration

The inner surface of the brick walls is finished with plasterboard sheets. A frame made of steel profiles is attached to the walls and plasterboard sheets are attached to it with self-tapping screws. Wallpaper is glued to them. The ceiling is also finished with plasterboard sheets. The decoration is made in unique forms for each room according to the idea of the designers and agreed with the customer. The bathrooms, bathtubs and shower room are faced with 2.5 m high ceramic tiles. The ceiling is designed with a tension structure. The kitchen also provides wall decoration with tiles, but only the working area to a height of 2.5 m. The rest of the walls are finished with plasterboard and

wallpaper. The walls of the garage are plastered. Exterior wall decoration is carried out partially with hinged panels and plastering on a grid.

Conclusion

The section considers the features of construction of cottages in rural areas. The constructive scheme with the substantiation of base choice is developed. The general plan is considered, developed and described considering features of district, the facade of buildings is developed, the volume-planning decision is described, and technical and economic indicators are resulted.

2 CALCULATION AND DESIGN SECTION

2.1 Calculation of multi-hollow reinforced concrete slabs

2.1.1 Initial data

It is required to calculate and construct a prestressed slab with round cavities for a 1.5 m wide floor covering with a span of 3.6 m when resting on walls. Temporary overlap load 1.5 kN / m^2. The sizes of a plate are accepted based on formwork forms of plates of overlappings on a series 1.041.

The slab is made of heavy concrete of the D2400 medium density, B25 compressive strength class and is heat treated at atmospheric pressure during manufacture.

Tensioning armature from cores of a periodic profile of the AT-IV class with a tension electrothermally on stops of forms. Transverse and structural fittings made of ordinary reinforcing wire of periodic profile of class Bp-1.

Estimated characteristics of materials:

- for concrete of class B25 the calculated resistances for the limit states of the first group R_b = 14.5 MPa, R_{bt} = 1.05 MPa, the initial modulus of elasticity E_b = 29x103 MPa, the coefficient of operating conditions γb_2 = 0.9;

- for prestressed reinforcement, the calculated tensile strength for the limit states of the second group $R_{s.ser}$ = 590 MPa, the calculated tensile strength for the limit states of the first group R_s = 510 MPa, the modulus of elasticity E_b = 19x104 MPa;

- for fittings of welded grids and frameworks from a reinforcing wire of the Bp-1 class at d = 4 mm. Rs = 365 MPa, R_{sw} = 265 MPa.

The transfer strength of concrete R_{bp}, based on the conditions $\sigma_{bp} / R_{bp} \leq 0.75$ and R_{bp} = 0.5xB = 0.5x25 = 12.5 MPa.

The prestressing of the armature is accepted σ_{sp} = 0,75x$R_{s.ser}$ = 0,75x590 = 443 MPa. At electrothermal tension the admissible deviation from size of preliminary tension, at length of cores L = 3,3 m according to the formula:

$$\Delta\sigma_{sp} = 30 + 360 / L.$$

$S_p\sigma_{sp}$ = 30 + 360 / 3.3 = 139 MPa.

Condition check:

$$\sigma_{sp} + \Delta\sigma_{sp} \leq R_{s.ser} \quad \sigma_{sp} - \Delta\sigma_{sp} \geq 0{,}3R_{s.ser}$$

443 + 139 = 582 <$R_{s.ser}$ = 590 MPa

443-139 = 304> 0.3x590 = 177 MPa, i.e. the conditions are met.

Tension accuracy factor:

$$\gamma_{sp} = 1 \pm \Delta\gamma_{sp}$$

where $\Delta\gamma_{sp} = 0{,}5\frac{\Delta\sigma_{sp}}{\sigma_{sp}} * \left(1 + \frac{1}{\sqrt{n_p}}\right)$,

$$\Delta\gamma_{sp} = 0{,}5\frac{139}{443} * \left(1 + \frac{1}{\sqrt{6}}\right) = 0{,}213,$$

here n_p = 6 is the number of tensioned rods

γ_{sp}=1-0,213=0,787

Prestressing of armature considering a factor of accuracy of a tension: σ_{sp} = 0,787 x 443 = 349 MPa.

2.1.2 Determination of design loads and efforts

When determining the design forces, the slab is considered as a single-span, freely lying on the supports beam, loaded with a uniformly distributed load from its own weight, the weight of the floor structures and the temporary load. The load is collected from the cargo area per 1 m of slab length.

A_{gr} = 1 * V_{pl} = 1 x 1.5 = 1.5 m^2.

At the area of A_{gr} = 1 * V_{pl} = 1 * 1.5 = 1.5 m^2 loading on 1 m of a plate:

- short-term normative $P^{н}_{cd}$ = 1.2 * 1.5 = 1.8 kN;
- constant and long-term normative $P^{н}_{ld}$= (3.51 + 0.3) * 1.5 = 5.72 kN;
- full normative q_n = 5.01 * 1.5 = 7.52 kN;
- full calculated q * = 5.81 * 1.5 = 8.72 kN.

Table 2.1 – Loads on floor slab, kN / m^2

Loads	Regulatory load	Load reliability factor	Estimated load
Constant - from linoleum t = 0.0035 m, ρ = 11 kN / m^3	0,039	1,2	0,047
- from DSP t = 0.018 m, ρ = 10 kN / m^3	0,18	1,2	0,216
- from a cement-sand coupler t = 0.03 m, ρ = 20 kN / m^3	0,600	1,3	0,780
- from sound insulation, thermal insulation mineral wool t = 0.06 m, ρ = 1.5 kN / m^3	0,09	1,2	0,108
- from a plate (according to the catalog)	2,600	1,1	2,860
Total constant $q^н$	3,509		q=4,011
Temporary, including - long $P^н_{ld}$ - shot-term $P^н_{cd}$	0,3 1,2		$P^н_{ld} = 0,36$ $P^н_{cd} = 1,44$
Total temporary $P^н$	1,5		P=1,8
Full load $q^н$	5,01		q*=5,811

For calculated span we take the distance between the centers of the support platforms on the walls:

$$L_o = 3600 - \left(\frac{200}{2} + \frac{200}{2}\right) = 3400 = 3,4 \text{ m}$$

Bending moments in a plate according to the formula:

$$M = \frac{q l_p^2}{8}$$

- from normative short-term loading

$$M^н_{cd} = \frac{1,8 * 3,4^2}{8} = 2,6 \text{ kNm}$$

- from normative constant and long loading

$$M^н_{ld} = \frac{5,72 * 3,4^2}{8} = 8,27 \text{ kNm}$$

- from full regulatory load

$$M^н = \frac{7,52 * 3,4^2}{8} = 10,87 \text{ kNm}$$

- from full design load

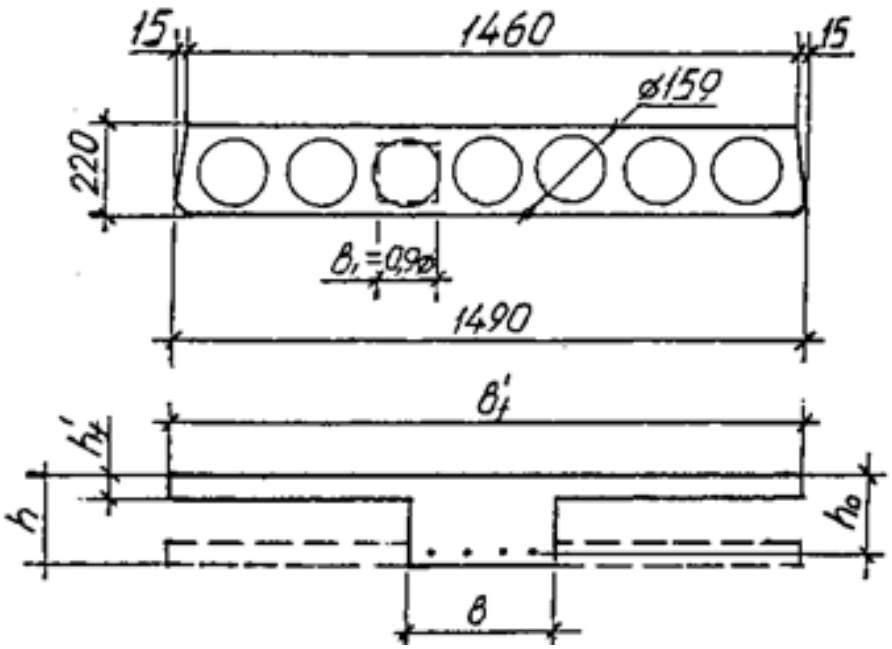
$$M = \frac{8,72*3,4^2}{8} = 12,60 \text{ kNm}$$

The maximum transverse force on the support from the design load is determined by the formula:

$$Q = \frac{qL_p}{2}$$

$$Q = 8,72 * \frac{3,4}{2} = 14,82 \text{ kN}$$

2.1.3 Calculation of the strength of the slab along the section normal to the longitudinal axis



Picture 2.1 – Cross section of slab

When calculating the strength of the slab, its cross-section is replaced by an equivalent T-section with a shelf in the compressed zone, having the following dimensions: shelf width b`f = 146 cm, shelf height h`f = (22-15.9) * 0.5 = 3 cm , the total width of the ribs is b = (146-7 * 15.9) = 35 cm, the working height of the section is $h_0 = h_a$ = 22-3 = 19 cm.

Calculated case of T-section according to the condition:

$$M \leq \gamma_{b2} * R_b * b_f^` * h_f^` * (h_0 - 0,5 * h_f^`)$$

$$M = 12{,}60 < 0{,}9 * 1{,}45 * 146 * 3 * (19 - 0{,}5 * 3) = 10028{,}2 \text{ kNcm} = 100{,}3 \text{ kNm}$$

So x <h`f - we have the first case of calculation.

We calculate the coefficient A_0 by the formula:

$$A_0 = \frac{M}{\gamma_{b2} R_b * b * h_0^2};$$

$$A_0 = \frac{1260}{0{,}9 * 1{,}45 * 146 * 19^2} = 0{,}02$$

At $A_0 = 0.02$ $\eta = 0.99$, $\xi = 0.02$, the characteristic of the compressed section zone according to the formula:

$$\omega = 0{,}85 - 0{,}008\gamma_{b2} R_b$$

$$\omega = 0{,}85 - 0{,}008 * 14{,}5 * 0{,}9 = 0{,}75$$

The boundary height of the compressed zone according to the formula:

$$\xi_R = \frac{\omega}{1 + \frac{\sigma_{sr}}{500} * \left(1 - \frac{\omega}{1{,}1}\right)}$$

$$\xi_R = \frac{0{,}75}{1 + \frac{328}{500} * \left(1 - \frac{0{,}75}{1{,}1}\right)} = 1{,}34,$$

where $\sigma_{sr} = R_s + 400 - \sigma_{sp} = 510 + 400 - 443 - 139 = 328$ MPa

Coefficient of the working condition of the reinforcement γ_{sb}, considering the resistance of the reinforcement above the conditional yield strength, according to the formula:

$$\gamma_{sb} = \eta - (\eta - 1) * \left(2 * \frac{\xi}{\xi_R} - 1\right) \leq \eta,$$

$$\gamma_{sb} = 1{,}2 - (1{,}2 - 1) * \left(2 * \frac{0{,}02}{1{,}34} - 1\right) = 1{,}39 > \eta = 1{,}2,$$

Where $\eta = 1.2$ - for reinforcement we take $\gamma_{sb} = \eta = 1.2$. Sectional area of longitudinal prestressing reinforcement according to the formula:

$$A_S = \frac{M}{\gamma_{sb} * R_S * \eta * h_0}$$

$$A_S = \frac{1260}{1{,}2 * 51 * 0{,}99 * 19} = 1{,}11 \text{ см}^2$$

According to the assortment, 2Ø10, $A_s = 1.57$ cm^2 are accepted.

2.1.4 Calculation of the strength of a slab for an inclined section to the longitudinal axis

Strength check along an inclined strip between inclined cracks, shallow $\varphi_{w1} = 1$ (in the absence of design transverse reinforcement) according to the condition:

$$Q \leq 0{,}3\varphi_{w1} * \varphi_{в1} * R_B * \gamma_{B2} * b * h_0$$

where $\varphi_{в1} = 1 - \beta * R_B * \gamma_{B2} = 1 - 0.01 * 14.5 * 0.9 = 0{,}87$

here $\beta = 0.01$ for heavy concrete

$$Q = 14{,}82 < 0{,}3 * 1 * 0{,}87 * 1{,}45 * 0{,}9 * 35 * 19 = 227\text{kN}$$

The condition is fulfilled, the dimensions of the cross-section of the slab are enough.

Checking the strength of an inclined section for the action of a shear force along an inclined crack according to the condition:

$$Q \leq Q_B + Q_{SW}$$

We preliminarily define: Coefficient considering the effect of compressed flanges (with 8 ribs) according to the formula:

$$\varphi_f = 8 * \frac{0{,}75(в'_f - в) * h'_f}{вh_0}$$

Where $(в'_f - в) = 146 - 35 = 111$ cm, what more then 3 $h'_f = 3 * 3 = 9$ см

We accept $(в'_f - в) = 3h'_f = 9$ cm, $P_2 = A_s(\sigma_{sp} - \sigma_{loc})$; $\sigma_{loc} = 100$ MPa

The coefficient of influence of the longitudinal compression force at N = P2 = 44.1 kN according to the formula:

$$\varphi_n = \frac{0.1N}{R_{Bt} * \gamma_{B2} * bh_0}$$

$$\varphi_n = \frac{0.1 * 44{,}1}{0.105 * 0.9 * 35 * 19} = 0{,}100 < 0{,}5$$

The total coefficient is $1+\varphi_f+\varphi_n = 1+0{,}24+0{,}100 = 1{,}34 < 1{,}5$, then the value of B according to the formula:

$$B = \varphi_{в2}(1+\varphi_f+\varphi_n)\, R_{Bt} * \gamma_{B2} * bh_0^2$$

Where $\varphi_{в2} = 2$ - for heavy concrete

$B = 2 * 1{,}34 * 0{,}105 * 0{,}9 * 35 * 19^2 = 32{,}11$ kNm = 32 kN*m

The length of the projection of an unfavorable inclined section according to the formula:

$$C=\sqrt{\frac{\text{B}}{q}}$$

$$C=\sqrt{\frac{32,0}{8,72}}=1,92=192\text{см}>2h_0=2*19=38\text{ cm},$$

Accept c = 2h0 = 38 cm

Shear force perceived by concrete according to the formula:

$$Q_{\text{B}}=\frac{\text{B}}{\text{c}}$$

$$Q_{\text{B}}=\frac{3200}{38}=84\text{kN};$$

Q = 14.82, therefore, according to the calculation, transverse reinforcement is not required. In accordance with the design requirements (150 <h <300mm), transverse reinforcement is installed on the support sections of length L / 4 in the form of welded frames KP1 made of reinforcing wire of class BpI with a diameter of 4 mm. The pitch of the transverse bars of the frames is SW = 100 mm.

2.1.5 Geometric characteristics of the reduced section

The ratio of the moduli of elasticity of reinforcement and concrete:

$$v=\frac{E_S}{E_b}\leq\frac{19000}{29000}=6,55$$

The reduced cross-sectional area when replacing the circular cross-section of voids with an equivalent square one with a side h_1 = 0.9 * 15.9 = 14.3, the thickness of the shelves h_f = (22-14.3) * 0.5 = 3.85 cm, the width of the rib b = 146-7 * 14.3 = 45.9 cm.

$$\text{A}_{red}=146*22-7*14,3^2+6.55*1,57=1773$$

Static moment relative to the bottom edge of the slab

$$S_{red}=146*22*11-7*14,3^2*11+6.55*1,57=19579\text{cm}^2$$

Distance from the bottom face to the center of gravity of the reduced section

$$Y_0=\frac{S_{red}}{A_{red}}=\frac{19579}{1773}=11;$$

Distance from the point of application of force in prestressing reinforcement to the center of gravity of the reduced section

$$e_{op} = y_0 - a = 11 - 3 = 8$$

The moment of inertia of the reduced section:

$$I_{red} = I + vI_s = 146 * \frac{22^3}{12} - 7 * \frac{14{,}3^3}{12} + 6.55 * 1{,}57 * 8^2 = 127371 \text{ cm}^4$$

The moment of resistance of the reduced section along the upper zone

$$W_{red} = \frac{I_{red}}{Y_0} = \frac{127371}{11} = 11580\text{cm}^3$$

The moment of resistance of the reduced section along the upper zone

$$W'_{red} = \frac{I_{red}}{h - Y_0} = \frac{127371}{22 - 11} = 11580\text{cm}^3$$

Distance of the upper core point to the center of gravity of the section

$$r = \varphi_n \frac{W_{red}}{A_{red}} = 0.85 \frac{11580}{1773} = 5{,}55\text{cm}$$

Where:

$$\varphi_n = 1{,}6 - \frac{\sigma_{bp}}{R_{bp.ser}} = 1.6 - 0.75 = 0.85,$$

Accepted $\frac{\sigma_{bp}}{R_{bp.ser}} = 0{,}75$

Distance of the lower core point to the center of gravity of the section

$$r = 0.85 \frac{11580}{1773} = 5{,}55\text{cm}$$

Elastoplastic moment of resistance along the stretched zone

$$W_{pl} = \gamma W_{red} = 1.5 * 11580 = 17370\text{cm}^3$$

Here γ = 1.5 for the I-section at 2 = b'_f / b = 146 / 45.9 = 3.2; elastoplastic moment of resistance along the stretched zone at the stage of manufacturing (reduction)

$$W_{pl} = 1.5 * 11580 = 17370\text{cm}^3$$

2.1.6 Calculation of prestressing losses

Determination of prestressing losses when tensioning the reinforcement on the stops. The prestress in the reinforcement is taken as σsp = 0.75 Rs.ser = 0.75 * 590 = 443MPa. Coefficient of tension accuracy when calculating losses γsp = 1.

First losses:

- from stress relaxation in reinforcement $\sigma_1 = 0.03 * \sigma_{sp} = 0.03 * 443 = 13.3$ MPa;

- from the temperature difference $\sigma_2 = 0$, because during steaming, the mold with stops is heated together with the panel;

- from rapidly flowing creep according to the formula: $\sigma 1 = 40\sigma_{bp} / R_{bp}$

We pre-calculate:

- compression force $P_1 = A_S * (\sigma_{sp} - \sigma_1 - \sigma_2) = 1.131 * (44.3-1.33-0) = 48.6$ kN;

- eccentricity of force P1 relative to the center of gravity of the reduced section eop = y_0-a_p = 11-3 = 8 cm;

- stress in concrete during compression

$$\sigma_{bp} = \frac{P_t}{A_{red}} + \frac{P_t * e_{op} * y_0}{I_{red}}$$

$$\sigma_{bp} = \frac{48,6}{1773} + \frac{48,6 * 8 * 11}{127371} = 0,1\text{MPa}.$$

We set the value of the transfer strength of concrete from the condition $\sigma_{bp} / R_{bp} \leq 0.75$, then $R_{bp} = \sigma_{bp} /0.75=0.1/0.75=0.13$MPa, which is less than 0.5V = 0.5 * 25 = 12.5MPa. Then $\sigma_{bp} / R_{bp}0.1 / 12.5 = 0.01$ and compressive stresses at the level of the center of gravity of the prestressing reinforcement from the compression force P1.

$$\sigma_{bp} = \frac{P_t}{A_{red}} + \frac{P_t * e^2{}_{op}}{I_{red}}$$

$$\sigma_{bp} = \frac{48,6}{1773} + \frac{48,6 * 8^2}{127371} = 0,1 \frac{\text{кН}}{\text{см}^2} = 1,0\text{MPa}$$

With $\sigma_{bp} / R_{bp} = 0.1 / 12.5 = 0.01 < \alpha = 0.25 = 0.025$

$R_{bp} = 0.25 + 0.025 * 12.5 = 0.56$ (which is <0.8). Loss from fast flowing creep

$$\sigma_6 = 0.85 * 40\sigma_{bp}/R_{bp}$$

$$\sigma_6 = 0.85 * 40 * 0.01 = 0,34\text{MPa}.$$

The total value of the first losses: $\sigma_{lok} = \sigma_1 + \sigma_2 + \sigma_6$ (26) $\sigma_{lok} = 13.3 + 0 + 0.34 = 13.64 \approx 14$MPa.

Considering the first stresses losses σ_{bp}at

$$P_1 = A_s * (\sigma_{sp} - \sigma_{lok1})$$

$$P_1 = 1{,}57(44{,}3 - 1{,}4) = 48{,}5 \approx 49\text{kN}$$

$$\sigma_{bp} = \frac{49}{1773} + 49 * \frac{8^2}{127371} = 0{,}1 = 1{,}0\text{MPa}$$

Second losses:

- from concrete shrinkage $\sigma_8 = 35$MPa

- from concrete creep at $\sigma_{bp} / R_{bp} = 1.0 / 12.5 = 0.08 < 0.75$ and $\alpha = 0.85$ for concrete subjected to steaming:

$\sigma_9 = 150k * \sigma_{bp} / R_{bp}$

$\sigma_9 = 150 * 0.85 * 0.08 = 10.2 \approx 10$MPa.

Second stresses loss:

$\sigma_{lok2} = \sigma 8 + \sigma 9$

$\sigma_{lok2} = 35 + 10 = 45$MPa.

Total loss of prestressing of reinforcement

$\sigma_{lok} = \sigma_{lok1} + \sigma_{lok2}$

$\sigma_{lok} = 14 + 45 = 59$MPa <100MPa - the established minimum loss.

We accept $\sigma_{lok} = 100$ MPa.

Then the compression force, considering all stress losses in the reinforcement

P2 = As (σsp- σlok)

P2 = 1.131 (44.3-10.0) = 38.79kN.

2.1.7 Design for cracking normal to the longitudinal axis

We determine moment of the compression force at $\gamma_{sp} = 0.852$ by the formula:

$M_{gr} = P_2 (e_{op} + r)$

$M_{gr} = 38.79 (8 + 5.6) = 527.54$ kNcm.

The moment of cracking according to the formula:

$M_{crc} = R_{bt,\,ser} * W_{pl} + M_{rp}$

M_{crc} = 0.13 * 17370 + 52.75 = 2311kNcm = 23.11kNm≈23kNm

What is more M = 12.60 kNm.

Consequently, cracks are not formed in the tensioned zone, and the calculation for crack opening is not performed.

2.1.8 Calculation of slab deflection

In areas without cracks, the total curvature of the bent elements is determined by the formula:

$$\frac{1}{r} = \frac{1}{r_1} + \frac{1}{r_2} - \frac{1}{r_3} - \frac{1}{r_4}$$

Curvature from short-term load according to the formula:

$$\frac{1}{r_1} = \frac{M_{cd}^{н}}{\varphi_{в1} * E_в * I_{red}}$$

Where: $\varphi_{в1}$= 0.85 is a coefficient that considers the short-term creep of heavy concrete.

$$\frac{1}{r_1} = \frac{260}{0{,}85 * 2900 * 127371} = 0{,}15 * 10^{-5}\text{cm}^{-1},$$

Curvature from constant and long-term temporary loads according to the formula:

$$\frac{1}{r_2} = \frac{M_{ld}^{н}\varphi_{в2}}{\varphi_{в1} * E_в * I_{red}}$$

Where $\varphi_{в2}$= 2 is a coefficient that considers the effect of long-term creep of heavy concrete.

$$\frac{1}{r_2} = \frac{827 * 2}{0{,}85 * 2900 * 127371} = 0{,}59 * 10^{-5}\text{cm}^{-1},$$

The curvature caused by the bend from the short-term action of the compression force P_2 according to the formula:

$$\frac{1}{r_3} = \frac{P_2 * e_{op}}{\varphi_{в1} * E_в * I_{red}}$$

$$\frac{1}{r_3} = \frac{38{,}79 * 8}{0{,}85 * 2900 * 127371} = 0{,}13 * 10^{-5}\text{cm}^{-1},$$

Curvature due to bending due to shrinkage and creep of concrete from the pre-compression force according to the formula:

$$\frac{1}{r_4} = \frac{\varepsilon_в * \varepsilon'_в}{h_0}$$

Where

$$\varepsilon_в = \frac{\sigma_в}{E_s} = \frac{45}{190000} = 0.00023$$

Here $\sigma_v = \sigma_{lok2} = 45MPa$

$\varepsilon'_в = 0$, in the absence of upper prestressing reinforcement.

$$\frac{1}{r} = \frac{0{,}00023}{19} = 1{,}2 * 10^{-5}см^{-1}$$

Total curvature

$$\frac{1}{r} = 0{,}15 * 10^{-5} * 0{,}59 * 10^{-5} - 0{,}13 * 10^{-5} - 1{,}2 * 10^{-5} = 1{,}24 * 10^{-5}cm^{-1}$$

Estimated slab deflection according to the formula:

$$f = \frac{5}{48} * \frac{L_p^2 1}{r}$$

$$f = \frac{5}{48} * 340^2 * 1{,}24 * 10^{-5} = 0{,}97cm < [f] = \frac{1}{200}L = \frac{340}{200} = 1{,}7cm$$

Slab deflection is within acceptable limits.

Conclusion

The section collects loads to calculate the hollow slab. As a result of calculations, the selection of reinforcement of the multi-hollow slab was performed. Working drawings of the hollow slab of the floor and the scheme of the foundation are developed.

3 ORGANIZATIONAL AND TECHNOLOGICAL SECTION

3.1 Work technology

Excavation

Excavation works are carried out by a set of machines consisting of: an EO-2621A excavator with a bucket capacity of 0.25 m^3 (leading machine), a DZ-29 bulldozer, a ZIL MMZ-555K vehicle. The excavator develops trenches for the foundation with an end face with loading into dump trucks. The removal of the fertile soil layer and the layout of the site are carried out by the DZ-29 bulldozer. The trench is reworked manually with pneumatic ramming.

Stone and installation work

The masonry is carried out by units of bricklayers in the composition: mason 4 category - 4, 3 category - 2, 2 category - 2 according to a single-grip system. At the end of masonry the 3rd tier, installation work is carried out. In this case, the masonry ceases. The outer walls are arranged for the installation of floor slabs, a brand crane (automobile) is used.

The assembly of prefabricated reinforced concrete structures is carried out with a preliminary layout of the elements in the assembly area. Installation work is carried out by a link of installers, which are part of a complex team of bricklayers.

Finishing work

Finishing work is carried out by a complex team of plasterers, painters, lining workers. Plastering works are carried out by the flow-cyclical method, in which each unit of the same type of brigade performs the whole range of works without dividing it into operations.

The links are equipped with the plastering unit, which allows the solution to be supplied to any point in the building. Grouting is performed with trowels. Preparation and

delivery of paint compositions is carried out centrally. Oil painting of the walls is done with a roller. The walls are glued with a spray gun.

Roofing

Roofing made of asbestos-cement sheets is laid along the lathing. The basis for a roof made of ordinary profile sheets is a wooden lathing made of bars with a cross section of 60 * 60 mm, located at a distance of 540 mm, the sheets are laid in regular rows from the bottom (from the eaves) upwards.

In the rows, each sheet overlaps the adjacent one by one wave. Asbestos-cement sheets of an ordinary profile are fixed on a wooden crate with nails or a screw with a small washer. The eaves sheets are additionally fastened with anti-wind brackets.

The eaves ridge piece is nailed to the ridge with two nails. The overlap of ridge parts on ordinary sheets should be at least 150 mm. The adjoining of the roof to the wall is carried out using asbestos-cement transition pieces, which are attached to the rail with screws.

The upper edge of the overhang parts is covered with a metal apron made of roofing steel. The base for the steel roof is a lathing made of 50x50mm bars with a step of 250mm. Roofing work begins with the preparation of sheets and pictures. Pictures are connected by single or double standing, or recumbent folds. Standing folds are placed along the drain, recumbent - across the drain. Pictures on the slope are attached to the crate with clamps. One end of the clamps is nailed to the sheathing bar, the other end goes under the standing seam and covers it.

Floor arrangement

The floors are made of cement-sand screed. The screed is arranged on prefabricated floor slabs. The grade of the mortar used for the leveling screed must be at least 150; screed thickness - from the type of soundproof backfill 15-50mm.

The solution is leveled with the rule, moving it along the lighthouse rails, and compacted with vibrating rails with vibrations directed parallel to the treated surface.

Smoothing the screed is finished before the mortar begins to set. After the cement-sand screed hardens, linoleum is laid on it.

3.2 Safety instructions

Excavation

Prior to commencement of earthworks, it is necessary to obtain an earthwork permit. In the area of existing underground communications, work should be carried out under the direct supervision of a foreman or foreman, and in the security zone of a cable or gas pipeline - under the supervision of a representative of the electricity or gas industry. Places for people to cross the trench must be equipped with walkways, at least 0.8 m wide, with handrails at least 1 m high.

Stone and installation work

In a 2-storey building, in places where stone work is being carried out, it is not allowed to perform other work and find unauthorized persons.

Simultaneous execution of masonry and assembly work is prohibited. During breaks, during the production of stone work, it is prohibited to leave materials and tools on the masonry. The method of slinging elements of prefabricated structures must ensure their supply to the installation site in a position close to their design. Before starting the installation, the serviceability of the mounting equipment, lifting mounting devices must be checked; it is strictly forbidden to leave the lifted elements on the weight, on the crane hook, during a break.

Finishing work

Plastering work is carried out directly from the floor or from movable tables. The operation of the mortar pumps is carried out at a pressure not exceeding the maximum specified in the technical passport. Mortar pumps are tested with a pressure equal to 1.5 times the working pressure. Temporary electrical wiring for internal plastering and painting works should be in voltage no more than 36V.

Roofing

Roofing work must not be carried out with a wind force exceeding 6 points.

3.3. Method statement for installation of hollow core slabs

3.3.1 Scope

Method statement was developed for the installation of floor slabs during the construction of a one-story 5-room residential building with a garage under construction in Novooleksandrivka village. Installation is carried out with a boom crane KS-35719-3-02

Work performance time is summer. The works are carried out in the summer. The weight of the structure is from 0.9t to 2.8t.

The scope of work includes:

- unloading floor slabs
- laying of slabs
- filling of seams
- acceptance of the solution
- solution supply

3.3.2 Technology and organization of work

3.3.2 1 Work execution technology

The installation of floor slabs is allowed only after design fixing of walls, after acceptance of supporting elements, including a geodetic check of compliance of their planned and high-altitude position with design one with the drawing up of an executive scheme.

Before lifting each slab, it is necessary to check compliance with its design grade, clean the supporting surfaces of the slab, walls from debris, dirt.

The laying of slabs in the direction of span to be covered should be carried out in compliance with dimensions of depth of their bearing on supporting structures established by the project. The installation of slabs in transverse direction of span to be covered should be carried out according to markings that determine their design position.

Floor slabs must be laid on a mortar layer no more than 20 mm thick, aligning the surfaces of adjacent slabs along the seam from the side of the ceiling.

The grouting of joints should be performed after checking correct installation of the plates, accepting welded joints of elements at interface units and making an anti-corrosion coating of welded joints and damaged areas of coating of embedded products. Concrete mixtures used for embedding joints must meet requirements of the project. The largest grain size of coarse aggregate in the concrete mixture should not exceed 1/3 of smallest size of joint section.

3.3.2.2 Organization of work performance

Before starting the installation of floor slabs, an M4 installer (a 2nd grade installer) inspects slab, cleans it from dirt, ramps slab, moves away from it by 4-5m and gives the crane driver a signal to raise the slab by 0.2-0.3m, gives a signal to give stove to place of installation and follows its movement.

At this time, installers M1 (installer of 4th grade - senior in link), M2 (installer of the 3rd grade) prepare a place for laying slabs: they clean stone shelf from dust, from concrete, apply risks, lay the solution on a stone shelf and level it with an even layer

The crane operator lifts and delivers the slab to installation site, leaving it at a height of 0.5 m above ceiling to be installed, the M1 and M2 installers turn slab in required direction. Then the crane operator, at command of M1 installer, slowly lowers slab, and the M1 and M2 installers support it and direct it to design position close to previously laid one. Then, at the signal of the installer M1, the crane operator loosens tension of the sling branches, and installers M1 and M2 open the hook locks and remove the hooks of the sling from the mounting loops of the slab. The M1 installer gives command to the driver to lift the sling, and the M3 installer (3rd grade installer) proceeds to fasten the slab.

3.4 Requirements for quality control

Table 3.1 – Scope of operations and controls

Stages of work	Controlled operations	Control (method, volume)	Documentation
Preparatory work	Check: - availability of a quality document; -the quality of the surface, the accuracy of the geometrical parameters, the appearance of the plates; -cleaning of supporting surfaces of previously mounted structures and mounted plates from debris, dirt, snow and trouble; -the presence of an act of survey (acceptance) of previously performed work; - the presence of markings that determine the design position of the slabs on the supports.	Visual Visual, measuring, every element Also Measuring	Passports (certificates), general work log, certificate of survey (acceptance) of previously performed work
Installation of floor slabs	Control: -installation of the slabs in the design position (deviation from the symmetry of the depth of support of the slabs in the direction of the span to be covered, the difference in the marks of the front surfaces of two adjacent slabs). - the depth of support of the plates; -thickness of the mortar layer under the slabs	Measuring, each element Also Same	General work log
Acceptance of completed work	Check: - the actual position of the mounted slabs (deviation of the marking, which determines the design position of the slabs on the supports, the difference in the marks of the front surfaces of adjacent slabs, the depth of support of the slabs); - the appearance of the front surfaces	Measuring each element Visual	Certificate of inspection (acceptance) of the work performed, executive geodetic scheme
Control and measuring tool: tape measure, metal ruler, level			
Operational control is carried out by: foreman (foreman), surveyor - in the process of work. Acceptance control is carried out by: quality service workers, foreman (foreman), representatives of the customer's technical supervision			

3.4.1 Technical requirements

Limit deviations

- the difference in the marks of the front surfaces of two adjacent floor slabs in the seam with the length of the slabs, m:

- up to 4 - 8mm;

- more than 4 to 8 - 10mm;

-from symmetry (half the difference in the depth of support of the ends of the element) when installing the slabs in the direction of the span to be covered with the length of the element, m:

- up to 4 - 5mm;

- more than 4 to 8 - 6mm;

The thickness of the mortar layer under the floor slabs should be no more than 20mm.

Mortar grade - according to the project, mobility - 5 - 7 cm.

The surface of adjacent floor slabs along the seam on the side of the ceiling must be aligned.

Slab bearing depth - according to the project.

Not allowed:

- the use of linings not provided for by the project for aligning the elements to be laid according to the marks without agreement with the design organization;

- the use of a solution, the setting process of which has already begun, as well as the restoration of its plasticity by adding water.

3.4.2 Requirements for quality control of materials

Deviations from the nominal dimensions of the plates indicated in the working drawings should not exceed the following values:

- along the length of the slabs: -up to 4m - ± 8mm;

- more than 4 to 8m - ± 10mm;

- across the thickness of the slabs - ± 5mm;

- across the width of the slabs:

- up to 2.5m - ± 6mm;

- over 2.5m - ± 8mm.

The flatness of the bottom surface of the slab should not exceed for slabs of length:

- up to 8m - 8mm;

Deviation from the nominal position of steel embedded products should not exceed:

- in the plane of the slab - 10mm;

- from the plane of the slab - 5mm.

The quality of the surfaces and the appearance of the plates, depending on the established category of surfaces, must meet the requirements given in the table.

Requirements for surface quality

The slabs supplied for installation must not have:

- grease and rust stains on the front surfaces of the plates;

- cracks on the surfaces of slabs, with the exception of shrinkage and other surface technological cracks with a width no more than 0.5 mm;

- concrete overflows on open surfaces of steel embedded products, reinforcement outlets and mounting hinges.

3.5 Safety, labor protection, environmental and fire safety

3.5.1 Occupational health and safety

Before starting work, the workers must be instructed on the correct working methods and safety rules with a record of the person who conducted and received the instructions.

Before starting the installation work, it is necessary to establish a procedure for the exchange of signals between the person supervising the installation and the driver. All signals are given by only one person (foreman, team leader, rigger-slinger), except for the "Stop" signal, which can be given by any worker who has noticed a clear danger.

The slinging of the mounted elements should be carried out in the places indicated in the working drawings, and ensure their lifting and supply to the installation site in a position close to the design one.

It is forbidden to lift elements of building structures that do not have mounting loops, holes or markings and marks to ensure their correct slinging and installation.

Cleaning of the elements of structures to be installed from dirt must be carried out before they are lifted.

The elements to be mounted should be lifted smoothly, without jerking, swinging or rotating. The structures should be lifted in two steps: first, to a height of 20-30cm, and then, after checking the reliability of the slinging, carry out further lifting.

When moving structures or equipment, the distance between them and the protruding parts of the mounted equipment or other structures must be at least 1 m horizontally, and at least 0.5 m vertically.

During breaks in work, it is not allowed to leave lifted elements of structures and equipment suspended.

Elements of structures or equipment installed in the design position must be fixed in such a way as to ensure their stability and geometric invariability.

It is forbidden to carry out installation work at a height in open places with a wind speed of 15 m / s or more, thunderstorm or fog, excluding visibility within the work front.

On the site (seizure) where installation work is being carried out, it is not allowed to perform other work and find unauthorized persons.

In the process of erection of structures of buildings or structures, installers must be on previously installed and securely fixed structures or paving means.

It is forbidden for people to stay on the elements of structures and equipment during their lifting and movement.

3.5.2 Environmental instructions

When organizing construction production, it is necessary to carry out special work to protect the natural environment: to prevent air, water and soil pollution, to preserve trees and shrubs.

When performing construction and installation work, they are guided by the following provisions. Waste and material residues must not be burned at the construction site. Waste and garbage can only be dumped from the floors of buildings and structures

using closed lots and storage bins. To prevent pollution of surface and ground waters, it is necessary to catch contaminated water when washing vehicles and equipment.

All industrial and domestic wastewater generated at the construction site must be cleaned and neutralized.

It is not allowed to discharge water from construction sites directly onto slopes without proper protection against erosion. On the territory of facilities under construction, destruction of tree and shrub vegetation and backfilling of root necks and trunks of growing trees and shrubs with soil, which is not provided for by design documentation, is not allowed.

3.5.3 Fire safety

By a special order of the head of construction, the heads of the sections are responsible for ensuring fire safety, and they, in turn, organize briefings and classes to study safety rules and take the necessary measures in the event of a fire.

All workers must be familiar with fire safety rules and undergo fire safety training. At the construction site, it is prohibited to: obstruct driveways, entrances and exits to buildings, as well as approaches to fire shields and hydrants.

At the end of welding work, it is necessary to carefully inspect the workplace and eliminate violations that can lead to a fire. The facility under construction must be equipped with modern effective fire extinguishing means, which are in constant readiness. On the construction site, warning posters and inscriptions on fire-prevention topics, instructions on observing fire safety measures should be posted. Before starting work, the foreman or work manufacturer acquaints riggers, fitters and electric welders with these instructions and gives instructions for the safe performance of work.

Conclusion

In organizational and technological section, general provisions on organization of construction from the preparatory stage to quality control of work performed were considered. The method statement for installation of hollow floor slabs has been developed, construction master plan has been developed and a work schedule has been drawn up.

A more detailed description of all these operations is given, taking into account the needs for skilled workers, machines and mechanisms. The main part of the report discusses the main elements of labor protection, fire safety measures and safety instructions for installer.

4 EQUIPMENT AND ECONOMIC SECTION

The pricing system in construction is based on regulatory and calculation indicators and current prices of labor and material resources.

Normative indicators are resource element estimates. On the basis of these norms and current prices for labor and material and technical resources, direct costs in the cost of construction are determined.

Resource element estimates are designed to determine the amount of resources required to perform various types of construction work, installation of equipment, repair and construction, restoration and commissioning, to determine the direct costs of construction.

The cost of construction is determined:

- at the design stage;

- as part of the investor's budget documentation;

- at the stage of determining the contractor (procurement procedure);

- in the bid price of the bidder (contract price, which can be set fixed or approximate (dynamic);

- at the stage of mutual settlements - by specifying certain cost indicators determined at the previous stages, depending on the type of contract price in the manner specified in the Contract.

The estimated cost of construction consists of construction work, the cost of equipment that is installed or not installed, furniture, inventory and other costs.

When determining the cost of construction, construction works include works provided in the collections of resource element estimates for construction works, installation of equipment, repair and construction, restoration and commissioning works.

The cost of equipment, furniture and inventory, which is taken into account in the construction estimates, includes:

- cost of purchase (manufacture) and delivery to the on-site warehouse:

- sets of all types (technological, energy, lifting and transport, pump and compressor, etc.) equipment that is installed or not installed, including non-standardized

(including the cost of its design), equipment of computer centers, laboratories, workshops for various purposes, medical offices, etc.;

- vehicles technologically related to the process of industrial production, including rolling stock for the carriage of goods on the tracks provided by the design documentation, as well as special rolling stock of other modes of transport for the carriage of non-bulk goods, etc.;

- control and measuring devices, means of automation and communication, etc.;

- tools, inventory, stamps, devices, equipment, special containers for transportation of semi-finished or finished products, which are included in the initial fund of production facilities, etc.;

- equipment, tools, inventory, furniture and other interior items necessary for the initial equipment of non-production facilities, etc.;

- cost of equipment supervision.

Calculated Local Estimate, Resource Statement, Object Estimate, Consolidated Estimate and Contract Price added at Annexes A.

Construction cost at current price level with VAT – UAH 4 374 196.

DSTU BD.1.1-1: 2013, Appendix C
Form № 9

Customer: DniproTech
(name of organization)

Contractor: DniproTech
(name of organization)

CONTRACTUAL PRICE №

for construction Two-storey cottage in the village of Novooleksandrivka, Dnipropetrovsk region

(name of the object of construction, start-up complex, house, building, construction, linear object of engineering and transport infrastructure)

which is carried out in 2021
Type of contract price: "fixed contract price"
Agreement № 1 dated 02.07.2021
Defined in accordance with DSTU B D.1.1-1: 2013
Compiled in current prices as of July 1, 2021

№	Reasoning	Name of costs	Cost, thousand UAH		
			Total	including:	
				construction works	other costs
1	2	3	4	5	6
1	Calculation №1-1	Direct costs	3 309,404	3 309,404	
		including			
		Salary of builders, installers	576,851	576,851	
		Cost of material resources	2 621,558	2 621,558	
		Cost of exploitation of construction machines	110,995	110,995	
2	Calculation №1-2	Total expenditures	297,525	297,525	
3		Total direct and overhead costs	3 606,929	3 606,929	
4	Calculation №3 (DSTU B D.1.1-1: 2013 Dod.K p.26)	Additional costs for construction work in the winter	28,495	28,495	
5	Calculation №4 (DSTU B D.1.1-1: 2013 Dod.K p.27)	Additional costs for construction work in the summer outdoors at an outdoor temperature of more than +27 C	9,739	9,739	
		Total	3 645,163	3 645,163	
		Total contract price	3 645,163	3 645,163	
6		VAT	729,033		729,033
		Total contract price	4 374,196	3 645,163	729,033

The head of the enterprise (organization) - the customer

(signature, initials, surname, seal)

Head (General) contractor

(signature, initials, surname, seal)

Conclusion

In equipment and economic section of report the main criteria for determining the cost of construction were considered. Calculated Local Estimate, Resource Statement, Object Estimate, Consolidated Estimate and Contract Price. According to the results of calculations, the construction cost amounted to UAH 4 374 196.

GENERAL CONCLUSIONS

The section considers the features of construction of cottages in rural areas. The constructive scheme with the substantiation of base choice is developed. The general plan is considered, developed and described considering features of district, the facade of buildings is developed, the volume-planning decision is described, and technical and economic indicators are resulted.

In calculation and design section collects loads to calculate the hollow slab. As a result of calculations, the selection of reinforcement of the multi-hollow slab was performed. Working drawings of the hollow slab of the floor and the scheme of the foundation are developed.

In organizational and technological section, general provisions on organization of construction from the preparatory stage to quality control of work performed were considered. The method statement for installation of hollow floor slabs has been developed, construction master plan has been developed and a work schedule has been drawn up.

A more detailed description of all these operations is given, taking into account the needs for skilled workers, machines and mechanisms. The main part of the report discusses the main elements of labor protection, fire safety measures and safety instructions for installer.

In equipment and economic section of report the main criteria for determining the cost of construction were considered. Calculated Local Estimate, Resource Statement, Object Estimate, Consolidated Estimate and Contract Price. According to the results of calculations, the construction cost amounted to UAH 4 374 196.

LIST OF REFERENCE SOURCES

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6. ДСТУ Б Д.1.1-1:2013 Правила визначення вартості будівництва
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ANNEX A

DSTU BD.1.1-1: 2013, Appendix A
Form No. 1

Two-storey cottage in the village of Novooleksandrivka, Dnipropetrovsk region
(name of the construction object)

Local estimate for construction works № 02-001-001

of Earthworks . Two-storey cottage in the village of Novooleksandrivka, Dnipropetrovsk region
(name of works and expenses, name of the house, building, construction, linear object of engineering and transport infrastructure)

Based on:
drawings (specifications) № 1-5

Estimated cost	52,929	thousand UAH
Estimated complexity	0,33068	thousand man-hours
Estimated salary	22,042	thousand UAH
The average category of work	2,3	category

Compiled in current prices of July 1, 2021

№	Name of works and costs	Unit	Quantity	Unit cost, UAH		Total cost, UAH			Labor costs of workers, man-hours. unoccupied service-machines	
				Total	operation of machines	Total	salary	operation of machines	those who service the machines	
				salary	including salary			including salary	per unit	total
1	2	3	4	5	6	7	8	9	10	11
1	Planning areas with 59 kW [80 hp] bulldozers per pass	1000m2	1,18035	200,39	200,39	237	-	237	-	-
				-	56,05			66	0,7740	0,91
2	Excavation of soil in the dump by excavators "dragline" or "backhoe" with a bucket capacity of 2.5 [1.5-3] m3, soil group 1	1000m3	0,42	6 154,48	5 723,16	2 585	181	2 404	7,1600	3,01
				431,32	2 373,47			997	31,4781	13,22
3	Excavation of soil with a load on dump trucks with single-bucket electric excavators on a crawler with a bucket capacity of 2.5 [1.5-3] m3, soil group 1	1000m3	0,42	8 783,25	8 270,10	3 689	209	3 473	8,2600	3,47
				497,58	3 170,81			1 332	41,3838	17,38
4	Excavation of soil manually in trenches with a width of more than 2 m and pits with a cross-sectional area up to 5 m2 with fasteners at a depth of trenches and pits up to 2 m, soil group 1	100m3	0,504	15 111,20	-	7 616	7 616	-	275,4000	138,80
				15 111,20	-			-	-	-
5	Transportation of soil up to 5 km	т	420,0	36,51	36,51	15 334	-	15 334	-	-
				-	7,17			3 011	0,0990	41,58
			0,38	3 924,27	3 924,27	1 491	-	1 491	-	-

6	Backfilling of trenches and ditches with bulldozers with a capacity of 59 kW [80 hp] with soil movement up to 5 m, soil group 1	1000m3		-	1 097,69			417	15,1575	5,76
7	Compaction of the soil under the base of the building by ramming slabs in the pits with a bottom area of more than 100 m2 with 6-9 blows on one track, the diameter of the rammer up to 2 m	1000m2	0,36	36 603,15 4 444,15	27 404,38 10 058,55	13 177	1 600	9 866 3 621	87,3800 126,6424	31,46 45,59
	Total direct cost estimates					44 129	9 606	32 805		176,74
								9 444		124,44
	Total direct costs				UAH	44 129				
	including:									
	cost of materials, products and structures				UAH	1 718				
	cost of EMM				UAH	32 805				
	incl. wages in EMM				UAH		9 444			
	salary of workers				UAH		9 606			
	total wages				UAH		19 050			
	Total expenditures				UAH	8 800				
	labor-intensive in overhead costs				man-hours					29,50
	wages in overhead costs				UAH		2 992			
	TOTAL according to the estimate				UAH	52 929				
	Estimated complexity				man-hours					330,68
	Estimated salary				UAH		22 042			

[position, signature (initials, surname)]

[position, signature (initials, surname)]

DSTU BD.1.1-1: 2013, Appendix A
Form No. 1

Two-storey cottage in the village of Novooleksandrivka, Dnipropetrovsk region
(name of the construction object)

Local estimate for construction works № 02-001-001

of Foundation. Two-storey cottage in the village of Novooleksandrivka, Dnipropetrovsk region
(name of works and expenses, name of the house, building, construction, linear object of engineering and transport infrastructure)

Based on:
drawings (specifications) № 1-5

Estimated cost	173,087	thousand UAH
Estimated complexity	0,94810	thousand man-hours
Estimated salary	68,708	thousand UAH
The average category of work	4,2	category

Compiled in current prices of July 1, 2021

№	Name of works and costs	Unit	Quantity	Unit cost, UAH		Total cost, UAH			Labor costs of workers, man-hours. unoccupied service-machines	
				Total	operation of machines	Total	salary	operation of machines	those who service the machines	
				salary	including salary			including salary	per unit	total
1	2	3	4	5	6	7	8	9	10	11
1	Stacking blocks and slabs strip foundation pit with a depth of 4 m, the mass of designs to 0.5 m	100pcs	0,3	122 832,61	11 649,21	36 850	1 688	3 495	94,5400	28,36
				5 626,08	4 898,40			1 470	61,6842	18,51
2	Arrangement of sand pillows 30 cm thick	100m	0,0938	9 770,70	2 635,20	916	304	247	64,6700	6,07
				3 238,03	1 024,73			96	15,6608	1,47
3	Compaction of the soil under the base of the building by ramming slabs in the pits with a bottom area of more than 100 m2 with 6-9 blows on one track, the diameter of the rammer up to 1.5 m	1000m2	0,36	49 044,71	39 845,94	17 656	1 600	14 345	87,3800	31,46
				4 444,15	15 370,74			5 533	190,7290	68,66
4	Installation of waterproofing coated with bituminous mastic in one layer 2 mm thick	100m2	1,68	8 642,91	5,86	14 520	3 487	10	31,7000	53,26
				2 075,72	5,24			9	0,0777	0,13
5	Add to each subsequent layer of waterproofing coating with bituminous mastic 1 mm thick	100m2	1,68	2 309,42	1,67	3 880	1 134	3	10,3100	17,32
				675,10	1,50			3	0,0222	0,04
6	Arrangement of a waterproofing with a polyethylene film on butyl rubber glue with protection by roofing material, the first layer	100m2	1,68	26 303,21	20,09	44 189	25 436	34	218,0400	366,31
				15 140,70	17,98			30	0,2664	0,45

7	Arrangement of a waterproofing	100m2	1,68	15 879,62	1,67	26 678	17 806	3	152,6300	256,42
	with a polyethylene film on			10 598,63	1,50			3	0,0222	0,04
	butyl rubber glue with									
	protection by roofing material,									
	the following layer									
	Total direct cost estimates					144 689	51 455	18 137		759,20
								7 144		89,30
	Total direct costs				UAH	144 689				
	including:									
	cost of materials, products and structures				UAH	75 097				
	cost of EMM				UAH	18 137				
	incl. wages in EMM				UAH		7 144			
	salary of workers				UAH		51 455			
	total wages				UAH		58 599			
	Total expenditures				UAH	28 398				
	labor-intensive in overhead costs				man-hours					99,60
	wages in overhead costs				UAH		10 109			
	TOTAL according to the estimate				UAH	173 087				
	Estimated complexity				man-hours					948,10
	Estimated salary				UAH		68 708			

[position, signature (initials, surname)]

[position, signature (initials, surname)]

DSTU BD.1.1-1: 2013, Appendix A
Form No. 1

Two-storey cottage in the village of Novooleksandrivka, Dnipropetrovsk region
(name of the construction object)

Local estimate for construction works № 02-001-001

of Building of the house. Two-storey cottage in the village of Novooleksandrivka, Dnipropetrovsk region
(name of works and expenses, name of the house, building, construction, linear object of engineering and transport infrastructure)

Based on:
drawings (specifications) № 1-5

Estimated cost	2 367,542	thousand UAH
Estimated complexity	7,11004	thousand man-hours
Estimated salary	493,645	thousand UAH
The average category of work	4,0	category

Compiled in current prices of July 1, 2021

№	Name of works and costs	Unit	Quantity	Unit cost, UAH		Total cost, UAH			Labor costs of workers, man-hours. unoccupied service-machines	
				Total	operation of machines	Total	salary	operation of machines	those who service the machines	
				salary	including salary			including salary	per unit	total
1	2	3	4	5	6	7	8	9	10	11
1	Laying of external walls 380 mm thick from a brick (ceramic) (silicate) (hollow) with facing by a brick at floor height to 4 m	м3 laying	220,014	3 324,66	99,13	731 472	148 562	21 810	10,4300	2 294,75
				675,24	45,92			10 103	0,6256	137,64
2	Warming of facades by mineral plates 100 mm thick with finishing by a decorative solution on the "Seresit" technology. The walls are smooth	100m2	4,314	66 072,98	-	285 039	145 885	-	479,9400	2 070,46
				33 816,57	-			-	-	-
3	Laying of floor slabs	100m3	1,17	95 295,48	23 691,32	111 496	16 135	27 719	223,3000	261,26
				13 791,01	6 457,86			7 556	88,6375	103,71
4	Laying in one-storeyed buildings and constructions of plates of a covering up to 6 m long, the area to 10 m2, at weight of rafter and subroof designs to 10 t, at height of buildings to 25 m	100psc	0,18	652 515,58	21 727,83	117 453	3 321	3 911	298,7000	53,77
				18 447,71	8 529,12			1 535	112,0597	20,17
5	Arrangement of mansard roofs from a metal tile "Spanish"	100m2	2,4287	77 065,22	319,40	187 168	29 398	776	208,7000	506,87
				12 104,60	110,29			268	1,4775	3,59
6	Assembling of attic overlappings on wooden beams with laying of boards nakat with warming by plates mineral wool	100m2	1,2	8 048,64	1 008,97	9 658	8 166	1 211	119,4500	143,34
				6 805,07	430,80			517	5,1972	6,24

7	Installation of window blocks with separate [separate-paired] frames in the stone walls of residential and public buildings with an area of more than 2 m2	100m2	0,4995	564 552,45	2 138,73	281 994	7 459	1 068	247,9000	123,83
				14 933,50	913,17			456	11,0166	5,50
8	Installation of door blocks in external and internal openings of stone walls, the area of an opening to 3 m2	100m2	0,4332	501 170,79	4 568,77	217 107	3 781	1 979	139,6700	60,51
				8 727,98	1 950,73			845	23,5338	10,19
9	Installation of door blocks in external and internal openings of stone walls, the area of an opening to 3 m2	100m2	0,0836	870 011,68	4 568,77	72 733	730	382	139,6700	11,68
				8 727,98	1 950,73			163	23,5338	1,97
10	Arrangement of partitions on a metal single-row framework with a covering by gypsum cardboard sheets or gypsum fiber plates in one layer with isolation in inhabited and public buildings	100m2	1,8928	79 266,08	198,64	150 035	36 630	376	306,0600	579,31
				19 352,17	141,17			267	2,0328	3,85
11	Assembling stairs with handrails and platforms with direct marches	100m2	0,0342	18 566,30	1 298,94	635	556	44	251,2200	8,59
				16 263,98	439,32			15	5,2200	0,18
	Total direct cost estimates					2 164 790	400 623	59 276		6 114,37
								21 725		293,04
	Total direct costs				UAH	2 164 790				
	including:									
	cost of materials, products and structures				UAH	1 704 891				
	cost of EMM				UAH	59 276				
	incl. wages in EMM				UAH		21 725			
	salary of workers				UAH		400 623			
	total wages				UAH		422 348			
	Total expenditures				UAH	202 752				
	labor-intensive in overhead costs				man-hours					702,63
	wages in overhead costs				UAH		71 297			
	TOTAL according to the estimate				UAH	2 367 542				
	Estimated complexity				man-hours					7 110,04
	Estimated salary				UAH		493 645			

[position, signature (initials, surname)]

[position, signature (initials, surname)]

DSTU BD.1.1-1: 2013, Appendix A
Form No. 1

Two-storey cottage in the village of Novooleksandrivka, Dnipropetrovsk region
(name of the construction object)

Local estimate for construction works № 02-001-001

of Finishing works. Two-storey cottage in the village of Novooleksandrivka, Dnipropetrovsk region
(name of works and expenses, name of the house, building, construction, linear object of engineering and transport infrastructure)

Based on:
drawings (specifications) № 1-5

Estimated cost	1 013,371	thousand UAH
Estimated complexity	1,93206	thousand man-hours
Estimated salary	136,592	thousand UAH
The average category of work	4,2	category

Compiled in current prices of July 1, 2021

№	Name of works and costs	Unit	Quantity	Unit cost, UAH		Total cost, UAH			Labor costs of workers, man-hours. unoccupied service-machines	
				Total	operation of machines	Total	salary	operation of machines	those who service the machines	
				salary	including salary			including salary	per unit	total
1	2	3	4	5	6	7	8	9	10	11
1	Arrangement of concrete preparation	100m3 of concrete, rubble concrete and reinforced concrete in practice	0,3388	196 552,54	1 782,93	66 592	2 829	604	150,7000	51,06
				8 348,78	782,73			265	10,6641	3,61
2	Arrangement of a waterproofing from a polyethylene film on butyl rubber glue with protection by roofing material, the first layer	100m2	3,388	26 303,21	20,09	89 115	51 297	68	218,0400	738,72
				15 140,70	17,98			61	0,2664	0,90
3	Arrangement of a waterproofing from a polyethylene film on butyl rubber glue with protection by roofing material, the following layer	100m2	3,388	15 879,62	1,67	53 800	35 908	6	152,6300	517,11
				10 598,63	1,50			5	0,0222	0,08
4	Laying a log on a brick substrate	100m2	3,388	11 288,11	-	38 244	12 016	-	61,1500	207,18
				3 546,70	-			-	-	-
5	Arrangement of coverings from parquet boards on the concluded logs	100m2	3,388	208 986,12	29,30	708 045	13 117	99	60,5300	205,08
				3 871,50	26,22			89	0,3885	1,32

	Total direct cost estimates		955 796	115 167	777	1 719,15
					420	5,91
	Total direct costs	UAH	955 796			
	including:					
	cost of materials, products and structures	UAH	839 852			
	cost of EMM	UAH	777			
	incl. wages in EMM	UAH		420		
	salary of workers	UAH		115 167		
	total wages	UAH		115 587		
	Total expenditures	UAH	57 575			
	labor-intensive in overhead costs	man-hours				207,00
	wages in overhead costs	UAH		21 005		
	TOTAL according to the estimate	UAH	1 013 371			
	Estimated complexity	man-hours				1 932,06
	Estimated salary	UAH		136 592		

[position, signature (initials, surname)]

[position, signature (initials, surname)]

DSTU BD.1.1-1: 2013, Appendix C
Form № 9

Customer: DniproTech
(name of organization)

Contractor: DniproTech
(name of organization)

CONTRACTUAL PRICE №

for construction Two-storey cottage in the village of Novooleksandrivka, Dnipropetrovsk region
(name of the object of construction, start-up complex, house, building, construction, linear object of engineering and transport infrastructure)

which is carried out in 2021
Type of contract price: "fixed contract price"
Agreement № 1 dated 02.07.2021
Defined in accordance with DSTU B D.1.1-1: 2013
Compiled in current prices as of July 1, 2021

№	Reasoning	Name of costs	Cost, thousand UAH		
			Total	including:	
				construction works	other costs
1	2	3	4	5	6
1	Calculation №1-1	Direct costs including Salary of builders, installers Cost of material resources Cost of exploitation of construction machines	3 309,404 576,851 2 621,558 110,995	3 309,404 576,851 2 621,558 110,995	
2	Calculation №1-2	Total expenditures	297,525	297,525	
3		Total direct and overhead costs	3 606,929	3 606,929	
4	Calculation №3 (DSTU B D.1.1-1: 2013 Dod.K p.26)	Additional costs for construction work in the winter	28,495	28,495	
5	Calculation №4 (DSTU B D.1.1-1: 2013 Dod.K p.27)	Additional costs for construction work in the summer outdoors at an outdoor temperature of more than +27 C	9,739	9,739	
		Total	3 645,163	3 645,163	
		Total contract price	3 645,163	3 645,163	
6		VAT	729,033		729,033
		Total contract price	4 374,196	3 645,163	729,033

The head of the enterprise (organization) - the customer

(signature, initials, surname, seal)

Head (General) contractor

(signature, initials, surname, seal)

DSTU B D.1.1-1: 2013, Appendix L
Form № 5a

Two-storey cottage in the village of Novooleksandrivka, Dnipropetrovsk region
(name of the construction object)

Statement of resources

to the Contract Price №1

№	Resource code	Name	Unit	Quantity	Current price per unit, UAH	including		
						selling price, UAH	transport component, UAH	procurement and storage costs, UAH
					total UAH	total UAH	total UAH	total UAH
1	2	3	4	5	6	7	8	9
I. Labor costs								
1	1	Labor costs of construction workers	man-hours	8 769,46	65,78	-	-	-
2		The average category of work performed by construction workers	category	4,00	-	-	-	-
3	3	Labor costs of workers engaged in the management and maintenance of machines	man-hours	471,11	75,8252	-	-	-
4		The average category of workers engaged in the management and maintenance of machines	category	5,00	-	-	-	-
5	3	Labor costs of workers engaged in the management and maintenance of road transport in the transportation of soil and construction waste	man-hours	41,58	72,4146	-	-	-
6		Labor costs of workers whose wages are provided in overhead costs	man-hours	1 038,73	101,473	-	-	-
7		Labor costs of workers whose wages are provided in the additional costs of performing work in the winter	man-hours	213,49	-	-	-	-
8		Labor costs of workers whose wages are provided in the additional costs of performing work in the summer	man-hours	102,10	-	-	-	-
9		Together, the total estimated complexity	man-hours	10 636,47	69,8571	-	-	-
10		The average category of works	category	4,00	-	-	-	-
II. Construction machines and mechanisms								
1	CH201-12	Automobiles are onboard, loading capacity is 5 t	machine-hours	42,43537	223,04 9 465	-	-	-
2	CH207-148	Bulldozers, power 59 kW [80 hp]	machine-hours	8,23321	333,98 2 750	-	-	-
3	CH207-149	Bulldozers, 79 kW [108 hp]	machine-hours	1,6086	434,76 699	-	-	-
4	CH206-411	Excavators single-bucket electric on a caterpillar course, capacity of a ladle is 2,5 m3	machine-hours	8,9838	576,35 5 178	-	-	-
5	CH205-102	Compressors mobile with the internal combustion engine, pressure to 686 kPa [7 at], productivity of 5 m3 / min	machine-hours	0,040334	215,23 9	-	-	-
				101,20644	215,50	-	-	-

6	CH202-128	Tower cranes, loading capacity is 5 t	machine-hours		21 810			
7	CH202-129	Tower cranes, loading capacity is 8 t	machine-hours	2,361436	255,80 604	-	-	-
8	CH202-1141	Cranes on automobile course, loading capacity is 10 t	machine-hours	1,333366	373,26 498	-	-	-
9	CH202-1244	Cranes on a caterpillar course, loading capacity is 25 t	machine-hours	6,1596	411,33 2 534	-	-	-
10	CH202-1243	Cranes on caterpillar course, loading capacity to 16 t	machine-hours	70,968838	355,27 25 213	-	-	-
11	CH202-1801	Jib cranes on a rail course, loading capacity is 50-100 t	machine-hours	19,6794	1 038,12 20 430	-	-	-
12	CH216-401	Crane boring machines on a tractor with a capacity of 66 kW [90 hp], drilling depth 1.5-3 m	machine-hours	7,812	317,94 2 484	-	-	-
13	CH212-1601	Watering and washing machines, capacity 6000 l	machine-hours	6,732	446,52 3 006	-	-	-
14	CH233-201	Electric drilling machines	machine-hours	15,179375	3,40 52	-	-	-
15	CH203-1090	Hoists are cargo-passenger, loading capacity is 0,8 t	machine-hours	3,179904	118,24 376	-	-	-
16	CH203-1080	Mast construction elevators, loading capacity is 0,5 t	machine-hours	2,65468	83,71 222	-	-	-
17	CH204-502	Installation for welding of manual arc [direct current]	machine-hours	12,8934	25,71 331	-	-	-
18	*C311-5	Transportation of soil up to 5 km	t	420,0	36,51 15 334	-	-	-
		Total:	UAH	-	110 994	-	-	-
				III. Mechanized tool				
1	CH270-106	Apparatus for gas welding and cutting	machine-hours	1,1934				
2	CH211-101	Buddy, capacity 2 m3	machine-hours	3,7268				
3	CH270-116	Surface vibrators	machine-hours	9,6558				
4	CH270-115	Electric drills	machine-hours	71,91438				
5	CH270-108	Boilers are bituminous mobile, capacity is 400 l	machine-hours	15,036				
6	CH203-401	Electric winches, traction force up to 5,79 kN [0,59 t]	machine-hours	91,224903				
7	CH270-241	Parquet-grinding machine	machine-hours	23,716				
8	CH270-122	Parquet and planing machines	machine-hours	6,0984				
9	CH270-135	Electric perforators	machine-hours	147,145152				

10	CH270-90	Electric circular file	machine-hours	14,884735				
11	CH270-236	industrial Vacuum Cleaner	machine-hours	10,8416				
12	CH233-1100	Pneumatic rammers working from the compressor	machine-hours	0,080668				
13	CH270-124	Installations for welding of a polyethylene film	machine-hours	48,6528				
14	CH270-119	Screwdrivers	machine-hours	106,886416				
		Total:	UAH	-	1 060	-	-	-
IV. Building materials, products and structures								
1	C111-9	Asbestos hrizotilovyy, grade K-6-30 [292.14 UAH / t * 1.01 t]	t	0,02016	25 942,63	25 138,89	295,06	508,68
		[292.14 UAH / t * 1.01 t]			523	507	6	10
2	C124-65	Armature mesh, class A1, diameter 12-14 mm [173,01 грн/т * 1,0 т]	t	0,2808	19 367,05	18 814,29	173,01	379,75
					5 438	5 283	49	107
3	C1113-3	Acetone technical, I grade [292.14 UAH / t * 1.49 t]	t	0,0111496	57 213,61	55 656,48	435,29	1 121,84
					638	621	5	13
4	C111-74	Building bitumen, grade BN-70/30 [336.79 UAH / t * 1.03 t]	t	0,03192	12 648,63	12 053,73	346,89	248,01
					404	385	11	8
5	C111-73	Bitumens petroleum construction, BN-90/10 brand [336.79 UAH / t * 1.03 t]	t	0,3948	14 152,16	13 527,78	346,89	277,49
					5 587	5 341	137	110
6	C111-1600	Gasoline solvent [292.14 UAH / t * 1.13 t]	t	0,470792	53 360,54	51 984,13	330,12	1 046,29
					25 122	24 474	155	493
7	K53-6131-P021	Blocks window with separate shutters of the OP18-15 GOST 11214-86 brand [225.28 UAH / t * 0.098 t]	pcs	20,979	12 973,98	12 697,51	22,08	254,39
					272 181	266 381	463	5 337
8	K53-6111-1	Blocks door wooden DNG21-9 GOST 14624-84 brands with continuous filling of a board, deaf [225.28 UAH / t * 0.118 t]	pcs	22,9596	9 072,91	8 868,43	26,58	177,90
					208 310	203 616	610	4 085
9	C1411-28	Foundation blocks and slabs with a size of less than 3x3 m ribbed, box-shaped, volume more than 0.2 to 1 m3, weight up to 5 tons, concrete class B15 [144.11 UAH / t * 2.5 t]	m3	6,6	4 798,06	4 343,70	360,28	94,08
					31 667	28 668	2 378	621
10	C1113-101	Andesite acid - resistant flour, brand A [292.14 UAH / t * 1.03 t]	t	0,31584	6 067,71	5 647,84	300,90	118,97
					1 916	1 784	95	38
11	C112-85	Bars cut from coniferous breeds, length is 2-3,75 m, width is 75-150 mm,	m3	8,343995	3 801,33	3 582,51	144,28	74,54
					31 718	29 892	1 204	622

		thickness is 40-75 mm, III grade [236.53 UAH / t * 0.61 t]						
12	C112-25	Bars cut from coniferous breeds, length is 4-6,5 m, width is 75-150 mm, thickness is 40-75 mm, III grade [236.53 UAH / t * 0.61 t]	m3	0,0005814	3 989,50 2	3 766,99 2	144,28 -	78,23 -
13	C1113-14	Butyl rubber, brand A [292.14 UAH / t * 1.55 t]	t	0,040544	191 653,37	187 442,64	452,82	3 757,91
14	C142-10-2	Water	m3	33,76635	7 770 11,38	7 600 11,38000	18 -	152 -
15	C111-219	Gypsum binders G-3 [292.14 UAH / t * 1.01 t]	t	0,01334372	384 3 120,13 42	384 2 763,89 37	- 295,06 4	- 61,18 1
16	C111-1849	Self-tapping screws, CM1-35 brand [182.97 UAH / t * 1.11 t]	t	0,005746352	274 117,32	268 539,37	203,10	5 374,85
17	C111-1624-2	Deep penetration primer [292.14 UAH / t * 0.0016 t]	l	89,49776	1 575 13,42 1 201	1 543 12,69 1 136	1 0,47 42	31 0,26 23
18	C121-251	Doors steel warmed two-floor 2DSU 2.0x2.1, primed and painted [220.73 UAH / t * 0.125 t]	pcs	4,0128	17 702,19 71 035	17 542,82 70 396	27,59 111	131,78 529
19	C121-777	Details of fastening of rails, fastening elements of false ceilings, pipelines, air ducts, embedded details, details of fastening of wall panels, gates, frames, lattices, etc. not more than 50 kg, with advantage of profile hire, consisting of two and more details, with openings and without holes that are connected by welding [224.57 UAH / t * 1.0 t]	t	0,1044	56 255,30 5 873	55 611,96 5 806	224,57 23	418,77 44
20	C112-113	Eaves boards from coniferous breeds, length is 2-3,75 m, width is 75-150 mm, thickness is 25 mm, III grade [236.53 UAH / t * 0.61 t]	m3	0,81312	3 830,70 3 115	3 611,31 2 936	144,28 117	75,11 61
21	C112-53	Eaves boards from coniferous breeds, length is 4-6,5 m, width is 75-150 mm, thickness is 25 mm, III grade [236.53 UAH / t * 0.61 t]	m3	0,041344	4 308,77 178	4 080,00 169	144,28 6	84,49 3
22	C112-58	Eaves boards from coniferous breeds, length is 4-6,5 m, width is 75-150 mm, thickness is 32,40 mm, IV grade [236.53 UAH / t * 0.61 t]	m3	0,05382	3 297,78 177	3 088,84 166	144,28 8	64,66 3
23	C112-256	Parquet boards, lined with parquet slats of beech, elm [225.28 UAH / t * 0.019 t]	m2	16,02942	1 049,28 16 819	1 024,43 16 421	4,28 69	20,57 330
24	C112-255	Parquet boards, lined with parquet slats of oak, ash, elm, maple	m2	352,352	1 941,77 684 187	1 899,42 669 264	4,28 1 508	38,07 13 414

		[225.28 UAH / t * 0.019 t]						
25	C111-822	Low-carbon steel wire for various purposes is black, diameter 1.6 mm	t	0,002664	25 365,30	24 694,93	173,01	497,36
		[173.01 UAH / t * 1.0 t]			68	66	-	1
26	C111-1608	Duds	kg	10,3833	12,72	11,99	0,48	0,25
		[423.21 UAH / t * 0.00113 t]			132	124	5	3
27	C111-140	Dowels with the calibrated head [in clips] 4x100 mm	t	0,0033124	37 144,86	36 197,41	219,12	728,33
		[195.64 UAH / t * 1.12 t]			123	120	1	2
28	Ц1-228	The expansion bolt shield for fastening of heat-insulating plates	100pcs	34,85712	133,63	129,55	1,46	2,62
		[292.14 UAH / t * 0.005 t]			4 658	4 516	51	91
29	C111-1529	Electrodes, diameter is 6 mm, E42 brand	t	0,01062	54 816,00	53 518,15	223,03	1 074,82
		[195.64 UAH / t * 1.14 t]			582	568	2	11
30	C111-1865	Metal clips	kg	19,38	131,71	128,91	0,22	2,58
		[195.64 UAH / t * 0.0011 t]			2 553	2 498	4	50
31	C114-110-У	Cardboard heat and sound-proof of superfine fiber for the construction purposes, the TK-1-10 brand	m2	272,5632	149,61	145,90	0,78	2,93
		[277.27 UAH / t * 0.0028 t]			40 778	39 767	213	799
32	C111-324	Oxygen is gaseous	m3	0,819	21,51	17,47	3,62	0,42
		[292.14 UAH / t * 0.0124 t]			18	14	3	-
33	C111-1708-1	Tow	kg	33,301665	9,55	9,04	0,32	0,19
		[292.14 UAH / t * 0.00111 t]			318	301	11	6
34	C1113-80	Varnish BT-783	t	0,5068	40 042,13	38 888,89	368,10	785,14
		[292.14 UAH / t * 1.26 t]			20 293	19 709	187	398
35	C111-741	Sheets gypsum cardboard for partitions, thickness is 12 mm	m2	397,488	45,94	42,67	2,37	0,90
		[204.47 UAH / t * 0.0116 t]			18 261	16 961	942	358
36	C111-1695	Bituminous-rubber insulating mastic	t	0,587888	18 087,56	17 402,78	330,12	354,66
		[292.14 UAH / t * 1.13 t]			10 633	10 231	194	209
37	C111-1697	Adhesive mastic coumarono-rubber, brand KN-3	t	0,0984256	38 045,41	36 969,30	330,12	745,99
		[292.14 UAH / t * 1.13 t]			3 745	3 639	32	73
38	C1545-111	Metal structures from sheet steel	t	0,8160432	47 169,69	46 023,15	221,64	924,90
		[221.64 UAH / t * 1.0 t]			38 493	37 557	181	755
39	C1113-110	Sodium silicon fluoride technical, I grade	t	0,09690513	41 458,80	40 277,78	368,10	812,92
		[292.14 UAH / t * 1.26 t]			4 018	3 903	36	79
40	C1113-107	Sodium fluoride technical, brand A, I grade	t	0,027104	46 262,20	44 987,00	368,10	907,10
		[292.14 UAH / t * 1.26 t]			1 254	1 219	10	25
41	C1421-10634	Sand natural, ordinary	m3	0,66598	548,94	224,12	314,06	10,76
		[196.29 UAH / t * 1.6 t]			366	149	209	7
42	C111-1604	Sanding paper	m2	107,4488	115,14	112,85	0,03	2,26
		[423.21 UAH / t * 0.00008 t]			12 372	12 126	3	243
43	C111-1721	The film is polyethylene, thickness is 0,2-0,5 mm	t	0,222992	62 500,38	60 796,65	478,23	1 225,50
		[423.21 UAH / t * 1.13 t]			13 937	13 557	107	273

44	Ц1-226	Mineral wool plates [277.27 UAH / t * 0.0005 t]	m2	54,16001	78,87 4 272	77,18 4 180	0,14 8	1,55 84
45	*К58-4121-К735	Slabs mark UPTR54-13A 1 Series 87 Part 10 [167.03 UAH / t * 1.81 t]	pcs	117,0	308,37 36 079	- -	302,32 35 371	6,05 708
46	К58-4111-2	Plates of a covering with preliminary tension of fittings of the 2PG6-2AT6 brand, # series 1.465.1-7 / 84 issue.0,1 [167.03 UAH / t * 1.5 t]	pcs	18,0	5 906,23 106 312	5 539,87 99 718	250,55 4 510	115,81 2 085
47	С114-5-У	Plates heat-insulating of mineral wool on synthetic binding, the M125 brand [277.27 UAH / t * 0.164 t]	m3	9,74792	2 741,40 26 723	2 642,18 25 756	45,47 443	53,75 524
48	С114-4-У	Plates heat-insulating of mineral wool on synthetic binding, the M75 brand [277.27 UAH / t * 0.0983 t]	m3	46,1598	1 930,68 89 120	1 865,56 86 114	27,26 1 258	37,86 1 748
49	С111-566-3	Surface rolled thickness of 5 mm [292.49 UAH / t * 0.00303 t]	m2	36,4305	272,20 9 916	265,97 9 689	0,89 32	5,34 195
50	С1546-66	Propane-butane technical [292.14 UAH / t * 0.01856 t]	m3	0,2106	33,85 7	27,77 6	5,42 1	0,66 -
51	С1425-11683	The ready solution masonry heavy cement, M100 brand [214.59 UAH / t * 2.2 t]	m3	3,34948	2 003,47 6 711	1 492,09 4 998	472,10 1 581	39,28 132
52	С1425-11680	The solution is ready masonry heavy cement, M25 brand [214.59 UAH / t * 2.2 t]	m3	0,47432	1 539,56 730	1 037,27 492	472,10 224	30,19 14
53	С1425-11688	The solution is ready masonry heavy cement-limestone, brand M50 [214.59 UAH / t * 2.2 t]	m3	53,12559	2 191,55 116 427	1 676,48 89 064	472,10 25 081	42,97 2 283
54	С1425-11702	The solution is ready finishing cement-limestone 1: 1: 6 [214.59 UAH / t * 2.2 t]	m3	0,036	1 959,78 71	1 449,25 52	472,10 17	38,43 1
55	С111-857	Roofing material lining with RPP-300B powder filling [292.49 UAH / t * 0.00126 t]	m2	10,116	12,58 127	11,96 121	0,37 4	0,25 3
56	С111-1760	Roofing material roofing with small topping, the RM-350 brand [292.49 UAH / t * 0.00263 t]	m2	567,616	11,64 6 607	10,64 6 039	0,77 437	0,23 131
57	С111-1757	Smartly [292.14 UAH / t * 0.0003 t]	m2	94,222	25,88 2 438	25,28 2 382	0,09 8	0,51 48
58	С111-1784	Grid construction glass, grade SS-1 [195.64 UAH / t * 0.0005 t]	m2	496,11	23,56 11 688	23,00 11 411	0,10 50	0,46 228
59	Ц1-1-1	Ceresit Silicon Universal silicone sealant [292.14 UAH / t * 0.00028 t]	pack	6,31462	82,01 518	80,32 507	0,08 1	1,61 10
60	Ц1-24	Ceresit CD 24 Polymer-cement putty	kg	115,4608	26,70 3 083	25,89 2 989	0,29 33	0,52 60

		[292.14 UAH / t * 0.001 t]						
61	*Ц1-23	Ceresit SU 23 Elastic waterproof glue	kg	5 176,8	0,30	-	0,29	0,01
		[292.14 UAH / t * 0.001 t]			1 553	-	1 501	52
62	Ц1-16-1	Ceresit ST 16 Priming paint	l	73,338	53,01	51,65	0,32	1,04
		[292.14 UAH / t * 0.0011 t]			3 888	3 788	23	76
63	Ц1-44-2	Ceresit ST 44 Acrylic paint	l	216,5628	101,98	99,66	0,32	2,00
		[292.14 UAH / t * 0.0011 t]			22 085	21 583	69	433
64	С111-1591	Coal tar for road construction	t	0,012206816	8 807,43	8 254,17	380,57	172,69
		[336.79 UAH / t * 1.13 t]			108	101	5	2
65	С1545-97	Glass thread tape	kg	90,8544	202,51	198,29	0,25	3,97
		[221.64 UAH / t * 0.00111 t]			18 399	18 016	23	361
66	С1424-11632	Concrete mixtures ready heavy, concrete class B10 [M150], aggregate size 10 mm and less	m3	9,495	2 032,72	1 477,84	515,02	39,86
		[214.59 UAH / t * 2.4 t]			19 301	14 032	4 890	378
67	С1424-11608	Concrete mixtures ready heavy, concrete class B3,5 [M50], aggregate size more than 20 to 40 mm	m3	34,5576	1 763,29	1 213,70	515,02	34,57
		[214.59 UAH / t * 2.4 t]			60 935	41 943	17 798	1 195
68	С1424-11643-5	Mixes concrete ready heavy, class B-3,5 of concrete [M-50], size of a filler of 20-40 mm, brand on frost resistance 50	m3	1,764	1 787,38	1 237,31	515,02	35,05
		[214.59 UAH / t * 2.4 t]			3 153	2 183	908	62
69	С111-631	Sawdust wood	m3	3,388	279,05	229,17	44,41	5,47
		[292.14 UAH / t * 0.152 t]			945	776	150	19
70	С111-1762	Roofing felt with coarse-grained topping is waterproofing, TG-350 brand	m2	184,8582	11,06	10,64	0,20	0,22
		[292.49 UAH / t * 0.0007 t]			2 045	1 967	37	41
71	С111-414	Oil paint special densely rubbed for external works of MA-015 protective 736	t	0,002525848	25 717,08	24 888,54	324,28	504,26
		[292.14 UAH / t * 1.11 t]			65	63	1	1
72	С111-180	Construction nails with a flat head of 1,8x50 mm	t	0,0467544	37 169,81	36 221,87	219,12	728,82
		[195.64 UAH / t * 1.12 t]			1 738	1 694	10	34
73	С111-181	Construction nails with a flat head of 1,8x60 mm	t	0,017299259	35 708,24	34 788,96	219,12	700,16
		[195.64 UAH / t * 1.12 t]			618	602	4	12
74	С111-135	Screw nails of 4,5x90 mm	t	0,0013986	33 815,14	32 932,98	219,12	663,04
		[195.64 UAH / t * 1.12 t]			47	46	-	1
75	С111-170	Galvanized wire nails for asbestos-cement roof of 4,0x90 mm	t	1,42443255	27 339,74	26 584,55	219,12	536,07
		[195.64 UAH / t * 1.12 t]			38 944	37 868	312	764
76	С111-160	Finishing nails round 1,0x16 mm	t	0,00108528	50 523,43	49 313,65	219,12	990,66
		[195.64 UAH / t * 1.12 t]			55	54	-	1
77	С1422-10936	Brick ceramic single corpulent, the sizes are 250x120x65 mm, the	1000pcs	0,88088	4 072,05	3 340,38	651,83	79,84
					3 587	2 942	574	70

		M100 brand [173.82 UAH / t * 3.75 t]						
78	C1422-11061	Brick silicate single corpulent, the sizes are 250x120x65 mm, the M300 brand [173.82 UAH / t * 3.7 t]	1000pcs	87,785586	5 067,00 444 810	4 324,52 379 631	643,13 56 458	99,35 8 721
79	C111-1895	Glue putty [292.14 UAH / t * 1.2 t]	t	0,0227136	5 967,58 136	5 500,00 125	350,57 8	117,01 3
80	C111-1484	Screws with a semicircular head, diameter of a core of 8 mm, length of 100 mm [195.64 UAH / t * 1.12 t]	t	0,0036963	24 507,66 91	23 808,00 88	219,12 1	480,54 2
81	C111-1481-П	Screws with a flat head of 4x40 mm [195.64 UAH / t * 1.12 t]	t	0,5756019	40 153,94 23 113	39 147,49 22 533	219,12 126	787,33 453
82	C1421-9472	Crushed stone from a natural stone for construction works, fraction of 40-70 mm, the M400 brand [255.72 UAH / t * 1.5 t]	m3	0,0084	778,50 7	379,66 3	383,58 3	15,26 -
		Total:	UAH	-	2 614 913	2 403 390	161 174	50 349
Final indicators								
		Estimated complexity (I)	man-hours	10 636,47	743 033	-	-	-
		Construction machinery and equipment (II)	UAH	-	110 994	-	-	-
		Building materials, products and constructions (III + IV)	UAH	-	2 615 973	-	-	-
Resources consumed by construction machinery, vehicles and power tools								
		Petrol	kg	192,0763	30,15		5 791,1008	
		Diesel fuel	kg	394,2995	26,13		10 303,0076	
		Electricity	kWh	2 938,6822	3,3595		9 872,3018	
		Wood	m3	1,8043	119,13		214,9486	
		Lubricants	kg	49,0751	72,85		3 575,6873	
		Hydraulic fluid	kg	2,0011	74,42		148,8638	

Current prices of material resources are accepted as of July 1, 2021.

* Marked resources, the price of which has changed.

Compiled by: _____ [position, signature (initials, surname)]

Checked by: _____ [position, signature (initials, surname)]

REVIEW

For qualification work of student Ibrahim Abdelrahman Adel Badr.

“Construction project of two-storey cottage in the village Novooleksandrivka, Dnipropetrovsk region”.

The relevance of this project is the implementation of modern design solutions and technological solutions in rural areas, which positively affects the development of rural infrastructure, and the speed of construction and optimization of the construction process confirms the relevance of this project.

The paper considers: general architectural and construction design; design of building structures; organizational and technological design; labor protection and environmental protection.

Calculations and substantiation of the main structural elements of the building are performed and detailed technological ones are developed, which are reflected in the working drawings.

I think that the work is done at high level and deserves grades “good – 89”.

Reviewer

Director of LLC "Dniprospetsservice-Ukraine" P.V. Krymchak

RESPONSE

Supervisor of qualification work
Ph.D., Associate Professor of Construction,
Geotechnics and Geomechanics Department,
Ishchenko Oleksii Kostyantinovich,

For qualification work of student Ibrahim Abdelrahman Adel Badr: "Construction project of two-storey cottage in the village Novooleksandrivka, Dnipropetrovsk region".

Qualification work includes the following sections: architectural and construction, design and construction, organizational and technological and technical and economic.

In this qualification work the peculiarities of construction of cottage-type houses in rural areas are considered. The master plan is considered, developed and described taking into account the peculiarities of the area, the facade of the buildings is developed, the spatial planning decision is described and the technical and economic indicators are given.

The constructive scheme with the substantiation of the choice of the base is developed and the hollow plates of overlapping with the substantiation of reinforcement are calculated in detail. A technological map for the installation of hollow floor slabs has been developed, which is reflected in the working drawings. Estimated documentation has been compiled.

During work the set goal is reached completely. The very high degree of independence of execution and rather high qualification deserves attention.

I believe that the qualifying work of Ibrahim Abdelrahman Adel is performed at high level and deserves grades **"good – 88 points"**.

Supevisor of qualification work
Ph.D., Assoc. Prof. BGGM O.K. Ishchenko