A REINFORCED CONCRETE FORMWORK FLOOR SLAB

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Abstract. The quick evolution of the construction field encourages designers and scientists to design and manufacture building structures that would satisfy the current state of affairs in world globalization. The world is changing and the construction industry is also changing based on the research, theories and inventions of the past. During the simulation, designing and manufacturing of various building structures, specialists must consider the necessary load-bearing capacity of the structure, the economical, energy-efficient, sound-insulating need to use this structure, and in some cases, the quick and high-quality construction or reconstruction of structures for the fast return of residents to their homes that were damaged by military operations. To obtain a positive solution to these problems, designers and scientists should use not only standardized methods of research and analysis but also innovative methods. Moreover, in some cases, designers and scientists have to create new building structures from well-known materials (for example, normal concrete) and materials that have not yet gained widespread use (for example, non autoclaved foam concrete), and in some cases materials whose advantages and disadvantages have not yet been fully explored. Quite often, designers and scientists must research the construction parts to decide on using certain building structures. The knowledge, experience and creativity of scientists and designers will allow creating the latest building structures that will be able to provide various advantages for the future residents of these buildings. **This paper aims** to simulate the stress-strain state of reinforced concrete formwork floor

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slabs for the possibility of their use as a fixed formwork for a composite reinforced concrete-foam concrete floor slab. **The methodology of this study** is based on general research methods of analysis and synthesis used in the theory and practice of the construction field, and also experimental studies of floor slabs. **The result of this paper** is a model of reinforced concrete formwork floor slab and its stress-strain state. **The study's practical value** lies in proposing the use of a reinforced concrete formwork floor slab as a part of constructing a composite reinforced concrete-foam concrete floor slab. This is aimed at shortening construction terms and material consumption, improving technical and economic indicators of construction.

1. Introduction

The rapid development of scientific and technical progress intensifies a certain contradiction in society – guaranteeing the environment safety and preserving the rapid rise of the economy. The decline of this contradiction is feasible only with the use of the concept of sustainable development, reduced to the implementation of a whole range of actions aimed at meeting the daily needs of humanity with the mandatory preservation of the environment and resources both for the current generation and for the next ones [1; 2].

The modern construction of buildings obliges scientists and designers to create such buildings that would solve some main tasks: shortening the construction period and reducing the material capacity and cost of production. Scientists and designers can achieve these criteria using non-removable formwork in the floors' construction. This formwork enables cost reduction for floors by eliminating the need for heavy-duty construction mechanisms and special reusable formwork. The use of non-removable formwork is appropriate for the construction of energy-efficient floors (for example, composite reinforced concrete-foam concrete floor slabs), which allows you to meet today's high requirements for improving the technical and economic indicators of the floor slab [3].

Also, considering the current global situation in the world, designers are faced with the problem of quick and high-quality restoration of housing for residents who have suffered from wars and military operations. Using reinforced concrete formwork floor slabs as non-removable formwork for composite reinforced concrete-foam concrete floor slabs will partially solve this problem.

However, the use of floor slabs, which would act as a fixed formwork, requires their research and the creation of recommendations for their use based on this. Unfortunately, energy-efficient floor slabs have not yet gained widespread use and significant popularity in Ukraine. Monolithic or prefabricated reinforced concrete floors are usually used in construction, requiring the installation of additional heat and sound insulation layers. Despite this, fixed formwork as an element of floor construction is used in Ukraine mostly in TERIVA-type floors [4], PLASTBAU system floors [5] and fixed polystyrene formwork [6]. However, the study of reinforced concrete formwork floor slabs, as a fixed formwork, for the subsequent concreting of their upper parts with non-autoclaved foam concrete and the formation of composite reinforced concrete-foam concrete floor slabs was practically not carried out [7].

The purpose of the study was to experimentally investigate formwork floor slabs and determine their potential use as fixed formwork for composite reinforced concrete-foam concrete floor slabs [3].

2. Materials and methods

To achieve the purpose of this work, experimental studies of the stress-strain state of six reinforced concrete formwork floor slabs were carried out. These floor slabs consisted of a spatial reinforcing frame in the form of a trihedral prism. The lower side of these researched samples was concreted with the normal concrete (Figs. 1, 2).

The geometric dimensions of the reinforced concrete formwork floor slabs FF-1.1, FF-1.2, FF-2.1 and FF-2.2 floor were b x h x L = 0.5 x 0.175 x 4.2 m. The geometric dimensions of the reinforced concrete formwork floor slabs FFS-1.1 and FFS-1.2 were b x h x L = 0.5 x 0.175 x 2.1 m. Such dimensions of reinforced concrete formwork floor slabs were adopted on the condition of the possibility of their installation by hand or with the use of construction mechanisms of small load capacity, as well as their use in the role of fixed formwork, thus reducing costs during the construction of buildings.

The height of the layer of normal concrete in the reinforced concrete formwork floor slabs was equal to 40 mm to place the lower longitudinal

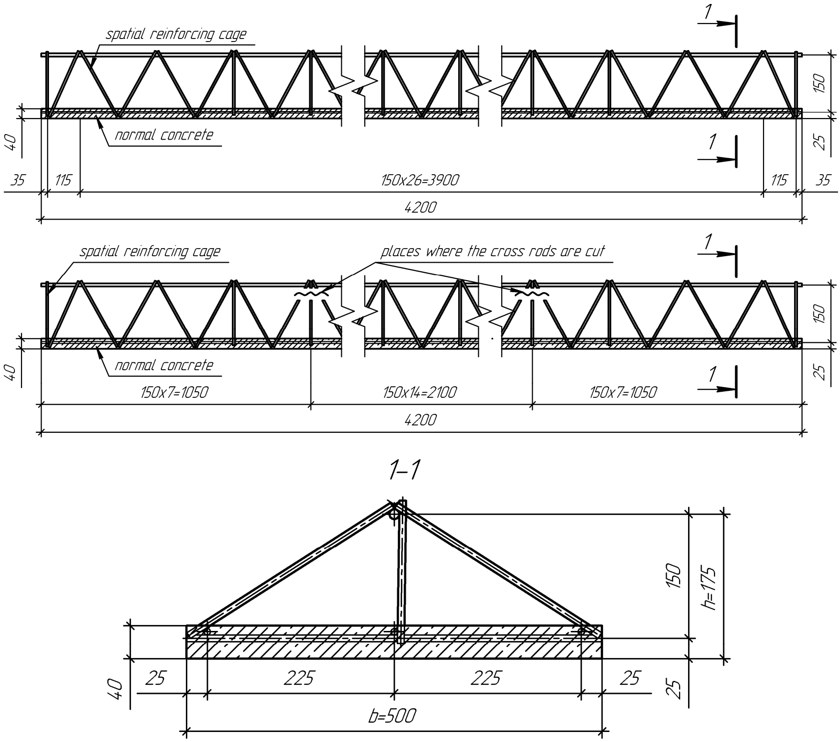

Figure 1. The structures of reinforced concrete formwork floor slabs FF-1.1 and FF-1.2 [8; 9]

reinforcement of the spatial reinforcing cage in it, considering the structural and fire requirements.

The normal concrete C25/30 for the lower layer of the test samples was adopted to ensure the strength and crack resistance of the tensile zone of the test samples.

The reinforced concrete formwork floor slabs differed in the type and step of transverse reinforcement bars. The diameter of the lower longitudinal reinforcement bars was 8 mm for slabs FF-1.1 and FF-1.2. On the contrary, the diameter of the lower longitudinal reinforcement bars was 10 mm for slabs FF-2.1, FF-2.2, FFS-1.1 and FFS-1.2.

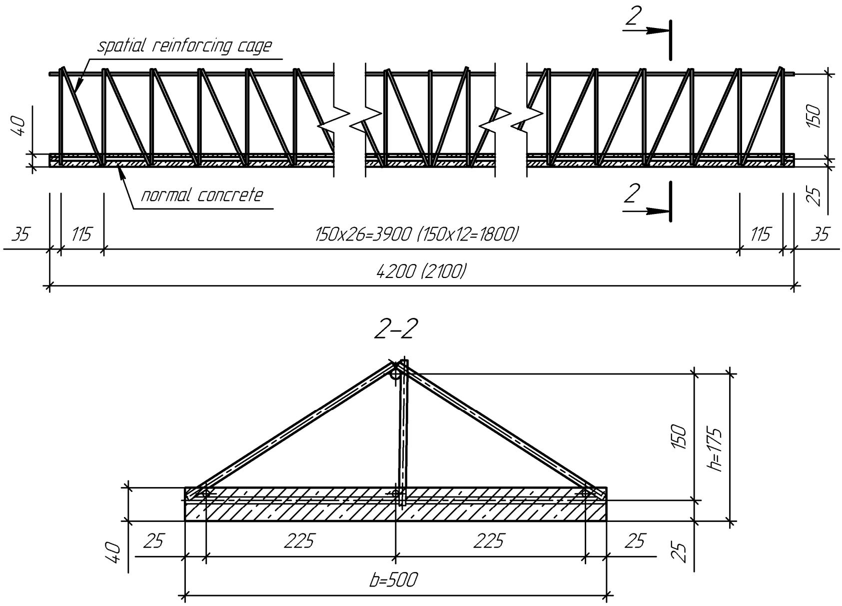

Figure 2. The structures of reinforced concrete formwork floor slabs FF-2.1, FF-2.2, FFS-1.1 and FFS-1.2 [8; 9]

The change in the type and the step of transverse reinforcement bars in the test samples FF-2.1, FF-2.2, FFS-1.1 and FFS-1.2 (Fig. 2) was adopted to ensure a necessary bearing capacity of the structure of the composite reinforced concrete – foam concrete floor slabs on inclined sections. The bigger diameter of the lower longitudinal reinforcement was adopted to reduce the deflections and the crack opening width of the composite reinforced concrete – foam concrete floor slabs.

In the reinforced concrete formwork floor slab FF-1.2, before its experimental study, at a distance of 1/4 of the span from the support, inclined transverse bars were previously excluded from work (cut) to experimentally establish the effect of the step of transverse reinforcement on the character of the slab's destruction.

The reinforcement of all test samples was made as a spatial reinforcing cage (Fig. 3) from reinforcement rods of the A-400C class [10]. The upper and lower longitudinal reinforcing bars were connected using transverse reinforcing bars, thus forming rectangular or triangular lattices. The joining of the reinforcing bars of the spatial reinforcing cage was carried out by electric arc welding. A spatial reinforcing cage as a trihedral prism was selected to ensure rigidity.

After manufacturing the spatial reinforcing cage, its lower face was inserted into a wooden formwork. Its height was 40 mm. After that, its concreting was carried out with a normal concrete of C25/30 class, which was made according to [11]. M500 Portland cement was used as a binding for concrete. The sand was used as fine aggregate, and crushed stone of fraction 5-20 mm was used as coarse aggregate. For concreting, ordinary tap water was used, and a C-3 superplasticizer was added to the concrete mixture. This additive made possibility to increase the mobility of the concrete mix and its water resistance.

Care for normal concrete began after the concrete mixture was placed in the wooden formwork. Hardening of normal concrete took place under

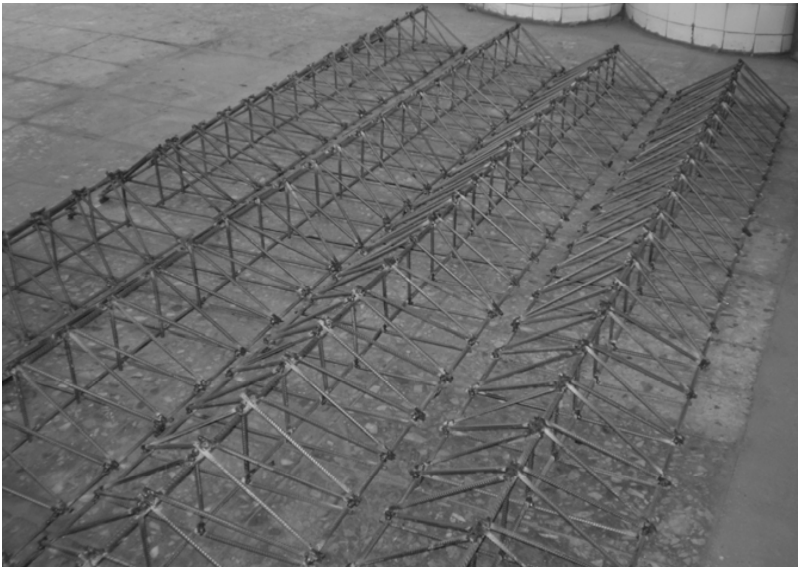

Figure 3. View of the spatial reinforcing cage after its manufacture [8; 9]

normal temperature and humidity conditions. The wooden formwork was disassembled after 28 days of sample hardening.

Manufacturing of a spatial reinforcing cage and concreting of reinforced concrete formwork flour slabs by a layer of concrete (Fig. 4) was carried out at the factory of reinforced concrete products.

The reinforced formwork floor slabs were investigated using the beam bending test method on two supports (hinged fixed and hinged movable) by two concentrated forces in thirds of the span [7-9].

The load on each test sample was applied in steps using a hydraulic jack and symmetrically distributed in thirds of the span with a value of 0.5N through the distribution traverse.

The specific support tables (their sizes were 0.5 x 0.15 x 0.175 m) made of M100 cement-sand mortar were made in thirds of their span to apply the load to the reinforced formwork floor slabs.

At each stage of the load, the value of which was 1 kN, after a 5-minute exposure, readings from the devices were recorded, namely:

– from the ring dynamometer – force in kN;

– from the deflection gauges – the deflection along the middle of the span in mm;

– from clock-type indicators with a division price of 0.01 mm – settlement of supports;

– from micro-indicators with a division value of 0.001 mm and a measurement base of B = 100 mm in the middle of the span along the height of the layer of heavy concrete of the experimental sample – deformation of concrete;

– from a micro-indicator with a division price of 0.001 mm installed on the lower longitudinal reinforcement – tensile deformation of this reinforcement bar;

– from a microindicator with a division price of 0.001 mm installed on the upper longitudinal reinforcement – the compression deformation of this reinforcement bar.

During the research, visual observations were made of the general behaviour of formwork slabs, sound effects, and the moment of their destruction and the cause were recorded.

Figure 4. The view of the reinforced formwork floor slabs after their manufacture [8; 9]

3. Results and discussions

During the experimental studies of reinforced concrete formwork floor slabs, the development of deformations in normal concrete along its height, in the upper and lower longitudinal reinforcement bars, the deflections of the test samples, and their nature of destruction were determined. The conducted tests recorded certain features of the work of reinforced concrete formwork floor slabs.

The formation of the first cracks in the reinforced concrete formwork floor slabs occurred along the lower face of the layer of normal concrete. When the load increased, the development of the formed and the appearance of new cracks on the lower face of the test samples were recorded, as well as the formation of the cracks on the side faces of the reinforced concrete formwork floor slabs. The step of crack propagation along the lower face of the layer of normal concrete coincided with the step of the structural transverse reinforcement connecting the lower longitudinal reinforcing bars.

When the load was further increased, cracks formed on the upper face of the layer of concrete. In slab FF-1.1, the propagation of these cracks occurred at the junction of concrete and the spatial reinforcing frame, the transverse reinforcement of the spatial cage was a stress concentrator, and cracks began to form from it. In the slab FF-1.2, in the places of "exclusion" of the inclined reinforcement bars from work at a distance of 1/4 of the span from the support along the upper face of the slab, cracks occurred in the "exit" zone of the transverse bars of the spatial reinforcing frame made of concrete.

The destruction of the slab FF-1.1 occurred due to the loss of stability of the bar of the upper longitudinal reinforcement in the middle of the slab span. The slab FF-1.2 collapsed as a result of the loss of stability of the upper longitudinal reinforcement bar at a distance of 1/4 of the span from the support, i.e. in the places where the inclined transverse bars were cut off before conducting experimental studies. A loss of stability of the transverse reinforcement bars has occurred. These transverse reinforcement bars were located near the distance of 1/4 span from the support.

The destruction of slabs FF-2.1 and FF-2.2 occurred due to the loss of stability of the rod of the upper longitudinal reinforcement near the place of application of the concentrated force.

The slab FFS-1.1 collapsed due to the failure of the weld connecting the upper longitudinal reinforcement and the transverse reinforcement so, the rods of the inclined transverse reinforcement, located near this rod, lost their stability. The destruction of the slab FFS-1.2 occurred due to the loss of stability of the rod of the upper longitudinal reinforcement in the middle of the span of the concrete slab and the loss of stability of the bars of the transverse reinforcement.

In studying the stress-strain state of the floor slabs, it is important to consider the formation of cracks and their width. Therefore, studies on crack resistance were carried out for reinforced concrete formwork floor slabs. Accordingly, the forces at which the formation of cracks N_w and their maximum opening w_{max} occurred under the action of the force N_u are presented in Table 1.

According to the results of experimental studies, the diagrams “bending moment – deflections” for reinforced concrete formwork floor slabs were drawn. These diagrams are shown in Fig. 5, 6 [7-9].

Considering the values of the maximum deflections and maximum allowable deflections for reinforced concrete formwork floor slabs, according to the diagrams (Figs. 5, 6), the values of destructive and critical loads were determined. The values of these loads are given in the Table 2.

Table 1

The value of the maximum crack opening width of reinforced concrete formwork floor slabs

The test samples	N_w, kN	N_u, kN	w_{max}, mm
FF-1.1	4	6	0.2
FF-1.2	5	8	0.25
FF-2.1	7	9	0.15
FF-2.2	6	8	0.2
FFS-1.1	8	12	0.15
FFS-1.2	10	13	0.1

M_u – bending moment when the test sample destructed due to the loss of stability of the upper longitudinal reinforcement of the space frame;

M_f – bending moment upon reaching the maximum allowable deflection;

f_f – the maximum allowable deflection of the test sample;

f_u – maximum deflection at failure of the test sample.

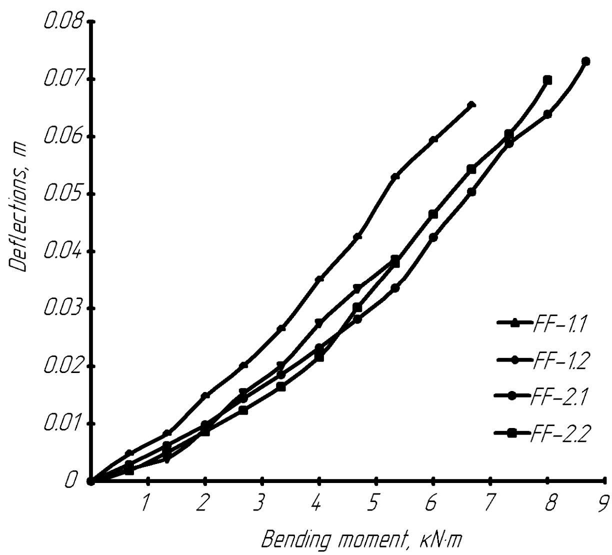

Figure 5. Experimental diagrams “bending moment – deflections” for reinforced concrete framework floor slabs FF-1.1, FF-1.2, FF-2.1 and FF-2.2 [8; 9]

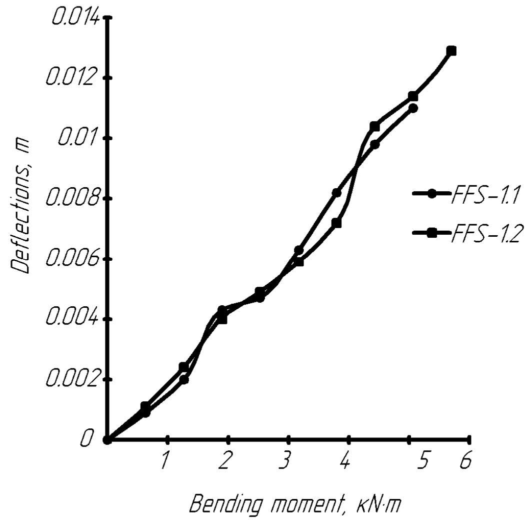

Figure 6. Experimental diagrams "bending moment – deflections" for reinforced concrete framework floor slabs FFS-1.1 and FFS-1.2 [8; 9]

Table 2

Experimental values of destructive loads for reinforced concrete formwork floor slabs

The test samples	M_u, kN·m	M_f, kN·m	f_f, m	f_u, m
FF-1.1	5.33	3.33	0.02	0.0386
FF-1.2	6.67	2.67	0.02	0.0654
FF-2.1	8.67	3.55	0.02	0.0731
FF-2.2	8	3.82	0.02	0.0698
FFS-1.1	5.07	4.3	0.0095	0.011
FFS-1.2	5.70	4.3	0.0095	0.0129

Based on the values of the experimental forces at which destruction occurred or the experimental critical forces when the maximum allowable deflection was reached, the values of the corresponding equivalent uniformly distributed loads were calculated for reinforced concrete formwork slabs of the floor. These values are given in the Table 3.

Table 3

Values of equivalent uniformly distributed loads for reinforced concrete formwork floor slabs

The test samples	M_u, kN·m	$q_{u(equiv)}$, kN/m²	M_f, kN·m	$q_{f(equiv)}$, kN/m²
FF-1.1	5.33	5.33	3.33	3.33
FF-1.2	6.67	6.67	2.67	2.67
FF-2.1	8.67	8.67	3.55	3.53
FF-2.2	8	8.00	3.82	3.87
FFS-1.1	5.07	19.65	4.3	18.11
FFS-1.2	5.70	22.46	4.3	17.54

$q_{u(equiv)}$ – the equivalent uniformly distributed load in the case of the destruction of the test sample due to the loss of stability of the upper longitudinal reinforcement of the space cage;

$q_{f(equiv)}$ – the equivalent uniformly distributed load when the test specimen breaks when the maximum allowable deflection is reached.

The equivalent uniformly distributed load (Fig. 7) was determined by equating the expressions for determining the area of the bending moment plot under the action of a concentrated force in thirds of the span (formula (1)) and for determining the area of the bending moment plot under the action of a distributed load (formula (2)) [8; 9; 12; 13 and 14].

$$M'_{\Sigma} = \frac{1}{2}\cdot q_{u(equiv)}\cdot l^2\cdot\int_0^l\left(\frac{z}{l}-\frac{z^2}{l^2}\right)dz = \frac{1}{2}\cdot q_{u(equiv)}\cdot l^2\cdot\left[\frac{1}{2}\cdot\frac{z^2}{l}\Big|_0^l-\frac{1}{3}\cdot\frac{z^3}{l^2}\Big|_0^l\right]=$$

$$=\frac{1}{2}\cdot q_{u(equiv)}\cdot l^2\cdot\left[\frac{1}{2}\cdot\frac{l^2}{l}-\frac{1}{3}\cdot\frac{l^3}{l^2}\right]=\frac{1}{2}\cdot q_{u(equiv)}\cdot l^2\cdot\left[\frac{1}{2}\cdot l-\frac{1}{3}\cdot l\right]=$$

$$=\frac{1}{12}\cdot q_{u(equiv)}\cdot l^3 \tag{1}$$

$$M''_{\Sigma} = 2\cdot\left(\frac{1}{2}\cdot\frac{N_u}{2}\cdot a^2\right)+\frac{N_u}{2}\cdot a\cdot(l-2\cdot a)=\frac{N_u}{2}\cdot a^2+\frac{N_u}{2}\cdot a\times$$

$$\times(l-2\cdot a)=\frac{N_u}{2}\cdot\left(a^2+a\cdot l-2\cdot a^2\right)=\frac{N_u}{2}\cdot\left(a\cdot l-a^2\right)=\frac{N_u}{2}\cdot a\cdot\left(l-a\right) \tag{2}$$

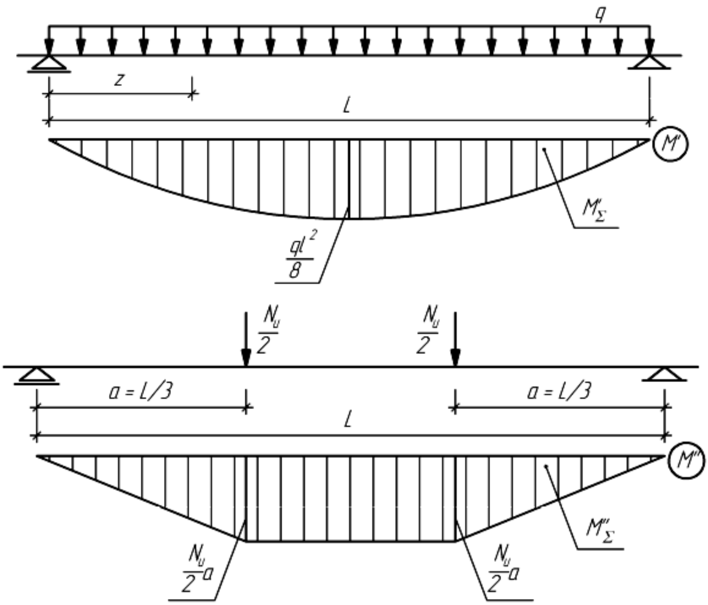

Figure 7. Schemes for calculating the equivalent distributed load for reinforced concrete formwork floor slabs FF-1.1, FF-1.2, FF-2.1, FF-2.2, FFS-1.1, and FFS-1.2 [8; 9; 13; 14]

$q_{u(equiv)}$ – equivalent uniformly distributed load when the test sample is destroyed due to the loss of stability of the upper working armature of the space frame.

Equating expressions (1) and (2) and performing mathematical operations, formula (3) was obtained:

$$q_{u(equiv)} = \frac{8}{3} \cdot \frac{N_u}{2 \cdot l} \tag{3}$$

N_u – the load during the destruction of the test sample due to the loss of stability of the upper working reinforcement of the space frame;

l – the calculated span of the test sample.

$q_{f(equiv)}$ – equivalent uniformly distributed load upon reaching the maximum allowable deflection, which was determined by the same method as qu(equiv) and calculated by formula (4):

$$q_{f(equiv)} = \frac{8}{3} \cdot \frac{N_f}{2 \cdot l} \tag{4}$$

N_f – the critical load when the maximum allowable deflection is reached.

We propose calculating characteristic load q_{char} using the formula:

$$q_{char} = \frac{8}{3} \cdot \frac{N_u}{2 \cdot l \cdot b}\ . \tag{5}$$

When designing floor slabs, the value of the useful load is important. These loads for reinforced concrete formwork floor slabs FF-1.1, FF-1.2, FF-2.1, FF-2.2, FFS-1.1 and FFS-1.2 are given in the Table 4.

Table 4

Useful loads for reinforced concrete formwork slabs

The test samples	**$q_{u(equiv)}$, kN/m²**	**$q_{f(equiv)}$ kN/m²**	**g_s, kN/m²**	**g_c, kN/m²**	**$g_{k(u)}$, kN/m²**	**$g_{k(f)}$, kN/m²**	**Марка плити**
FF-1.1	ОП-1.1	5.33	3.33	0.42	0.96	3.95	1.95
FF-1.2	ОП-1.2	6.67	2.67	0.42	0.96	5.29	1.29
FF-2.1	ОП-2.1	8.67	3.53	0.47	0.91	7.28	2.15
FF-2.2	ОП-2.1	8.00	3.87	0.47	0.91	6.61	2.48
FFS-1.1	ОПК-1.1	19.65	18.11	0.30	0.91	18.43	16.89
FFS-1.2	ОПК-1.2	22.46	17.54	0.30	0.91	21.24	16.33

g_s – own weight of the spatial reinforcement frame;

g_c – own weight of a layer of normal concrete;

$g_{k(u)}$, $g_{k(f)}$ – the useful load on the formwork slabs, respectively, at its destruction and when the maximum permissible deflection is reached, which was defined as the difference from the equivalent distributed load $q_{u(equiv)}$ ($q_{f(equiv)}$), own weight of the spatial reinforcement frame g_s and own weight of a layer of normal concrete g_c.

According to the calculations, the useful load on reinforced concrete formwork floor slabs is within 3.95...7.28 kN/m² (for slabs FF-1.1, FF-1.2, FF-2.1 and FF-2.2) and 18.43...21.24 kN/m² (for slabs FFS-1.1 and FFS-1.2). Calculations of the useful load for reinforced concrete formwork slabs of the floor indicate that an appropriate additional load can be applied to these slabs during the concreting of a monolithic floor on them from non-autoclaved foam concrete, workers and tools, using them as a fixed formwork.

Based on the results of experimental studies of reinforced concrete formwork floor slabs FF-1.1, FF-1.2, FF-2.1, FF-2.2, FFS-1.1 and FFS-1.2, diagrams of the relative longitudinal deformations of the upper compressed and lower tensile longitudinal reinforcement bars along the middle of the span of the test samples were constructed (Figs. 8, 9) [7-9].

Analyzing the above results of experimental studies (Fig. 7), it is worth noting a significant difference between the tensile deformations of the lower longitudinal reinforcements of slabs FF-1.1, FF-1.2, FF-2.1 and FF-2.2. This situation can be explained by the fact that these plates had different diameters of the lower longitudinal reinforcement: 8 mm (for slabs FF-1.1 and FF-1.2) and 10 mm (for slabs FF-2.1 and FF-2.2). Moreover, there was also a different step of the structural transverse reinforcement, which connected the rods of the lower longitudinal reinforcement.

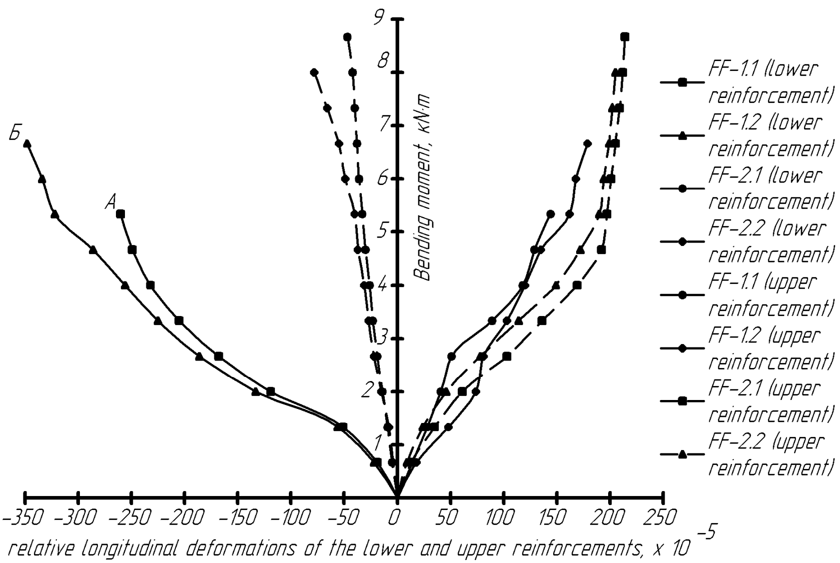

Figure 8. Diagrams of the relative longitudinal deformations of the lowermost longitudinal reinforcement and the upper compressed reinforcement in the middle of the span of the slab FF-1.1, FF-1.2, FF-2.1 and FF-2.2

The compressive and tensile deformations of the lower and upper longitudinal reinforcement bars in slabs FFS-1.1 and FFS-1.2 were practically identical (Fig. 7), which indicated the uniform operation of the entire structure along the cross-section height.

The values of the relative longitudinal deformations at the corresponding experimental bending moment are given in Table 5.

Table 5

Experimental values of relative deformations of longitudinal reinforcement bars of the spatial frame of reinforced concrete formwork floor slabs

The test samples	N_u, kN	M_u, kN·m	Lower tensile reinforcement	Upper compressive reinforcement
			ε_s, x10^{-5}	ε_s, x10^{-5}
FF-1.1	8	5.33	-260	144
FF-1.2	10	6.67	-348	179
FF-2.1	13	8.67	-47	214
FF-2.2	12	8	-78	208
FFS-1.1	16	5.07	-89	129
FFS-1.2	18	5.7	-116	147

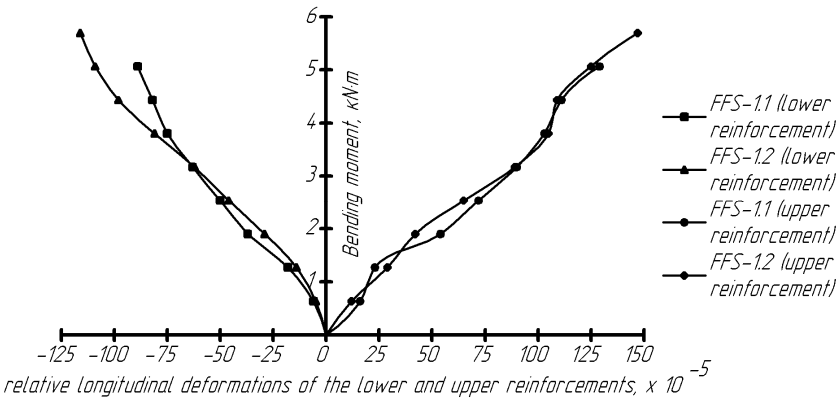

Figure 9. Diagrams of the relative longitudinal deformations of the lowermost longitudinal reinforcement and the upper compressed reinforcement in the middle of the span of the slab FFS-1.1 and FFS-1.2

Analyzing the above experimental diagrams, we can conclude that:

– the cross-section in the experimental reinforced concrete formwork slabs of the floor was completely in the tensile zone, except for slabs FF-2.1 and FF-2.2;

– he formation of the first cracks took place on the lower face of the concrete slab. The development of these cracks and the step of their propagation coincided with the step of the structural transverse reinforcement, which connected the lower longitudinal reinforcing bars of the space frame;

– since in the slab FF-1.2, before conducting experimental studies at a distance of 1/4 of the span from the support, the inclined transverse bars were excluded accordingly, the loss of stability of the bar of the upper longitudinal reinforcement took place in this place, that is, we believe that it is impossible to allow the formation of defects in the spatial reinforcing frame during the manufacture and transportation of slabs;

– the destruction of the slab FFS-1.1 occurred as a result of the destruction of the weld connecting the upper longitudinal reinforcement and the inclined transverse reinforcement, therefore, we consider that it is worth improving the method of welding longitudinal and transverse rods to each other and controlling the quality of welding;

– we experimentally determined that the step of the inclined transverse reinforcement should not exceed 300 mm because when it increased, the reinforced concrete formwork floor slab collapses due to the loss of stability of the rod of the upper longitudinal reinforcement (on the example of the slab FF-1.2);

– increasing the diameter of the lower longitudinal reinforcement in slabs FF-2.1 and FF-2.2 made it possible to reduce tensile deformations and reduce the width of crack opening and the magnitude of deflections while lowering the step and location of inclined transverse reinforcement in these slabs made it possible to increase the value of the destructive force;

– the useful load on the floor for reinforced concrete formwork floor slabs FF-1.1. FF-1.2, FF-2.1 and FF-2.2 were 3.95 kN/m^2, 5.29 kN/m^2, 7.28 kN/m^2, and 6.61 kN/m^2, respectively; and for slabs FFS-1.1 and FFS-1.2 useful loads were 18.43 kN/m^2 and 21.24 kN/m^2;

– after installing reinforced concrete formwork floor slabs in the design position as a structural part of composite reinforced concrete-foam concrete floor slabs, we suggest installing temporary mounting supports to prevent the formation of additional technological deflections.

4. Conclusions

Based on the presented material, the following conclusions can be drawn, and practical recommendations can be made for the use of reinforced concrete formwork floor slabs as a fixed formwork for composite reinforced concrete-foam concrete floor slabs:

1. The destruction of experimental reinforced concrete formwork floor slabs occurred due to the loss of stability of the upper compressed working reinforcement, namely for slabs FF-1.1, FF-2.1, FF-2.2, FFS-1.1, FFS-1.2 – in the middle of the span, and for slabs of the FF-1.2 – in places where inclined transverse bars were excluded from work before the experiment, that is, at a distance of 1/4 of the span from the support. Based on this, the maximum useful loads on reinforced concrete formwork slabs during the installation of the floor must be 3.95...7.28 kN/m^2(for slabs with length 4.2 m) and 18.43...21.24 kN/m^2 (for slabs with length 2.1 m).

2. We suggest welding the rods of the transverse reinforcement of the spatial reinforcement frame to the upper working reinforcement rod in such a way as to prevent the destruction of the plate structure along the weld seam. It is advisable to weld the bars of the transverse reinforcement to the metal plate, which must be located under the upper working reinforcement, during the production of the spatial reinforcing frame of the floor slabs.

3. It is necessary to transport reinforced concrete formwork floor slabs to the installation site in conductors, preventing the formation of cracks in them during transportation.

4. After installing the reinforced concrete formwork slabs of the floor in the design position, it is necessary to combine them by connecting the upper longitudinal reinforcements with additional reinforcing bars before concreting with foam concrete.

5. During the installation and concreting of reinforced concrete formwork slabs by a layer of non-autoclaved foam concrete, we suggest installing one temporary support if the span of the floor is up to 4 m and two additional supports if the span of the floor is up to 6 m. These additional supports are dismantled after the layer of non-autoclaved foam concrete has reached the design strength.

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