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IMPROVED CONSTRUCTION OF PLATFORM JOINT OF HOLLOW CORE SLABS OF FORMLESS MOLDING

ANDREI LAZOUSKI
Polotsk State University, Belarus

The improved joint design, in which the vertical pressing force is not transmitted over the entire area of supporting zone by the top of the wall, but «in points» – at the locations of the top working reinforcement, greatly increases the vertical compression of anchoring zone of the upper prestressed reinforcement.

The production of precast prestressed hollow-core slabs of formless molding on long benches has been launched recently in the Republic of Belarus. [1] The feature of the manufacturing processes of such panels is their reinforcement in the form of exceptionally longitudinal prestressed rods (or wire ropes) and the inability to install the shear reinforcement grids in shelves and embedded parts. In addition, the length of the stress transmission area on a concrete reinforcement typically exceeds the length of the site of their bearing on the wall. As a result, a negative bending moment is practically perceived only by a concrete cross-section [2]. It should be noted that during their design and experimental processes hollow core panels are presented as simple beared beam structures. It is not fair for application of the most common platform joints for multi-storey buildings with brick, block and paneled walls. In the bearing zone of slabs due to the entrapment a negative bending moment occurs. The above features of the design of panels in platform joints may result in the formation of shear and cracks with large opening in the bearing zone.

Modern regulations on the design of hollow core panels, in addition to avoiding possible negative bending moments with the help of some structural measures, take account of them in the design calculations [3, 4]. Known methods of structural mechanics calculations for linearly deformable materials without real work of reinforced concrete with cracks and knots compliance do not give reliable results. Therefore, obtaining the dependence «support bending moment – the angle of rotation» in the place of the platform joint is relevant for the account in the calculation of deformation features of hollow-core slabs of formless molding.

In order to increase strength and reduce compliance of anchoring of the top fixtures in the area of the platform joint there was developed the advanced design interface in which the vertical pressing is not transmitted over the entire area of the top supporting the wall, but «in points» – at the locations of the top of fixtures. For this purpose additional steel plates have been used, which were located on the upper ends of the locations of fixtures within its anchorage. In such a construction of platform joint the value of compression reinforcement anchorage zone is multiplied.

The purpose of the experimental study is to validate the proposed design of the platform joint, set the cracking pattern and eventual destruction scheme and establish the dependence «support bending moment – the angle of rotation» in the place of the platform joint.

Experimental research was performed on samples of special-fragments of platform joints, which are two pieces of hollow-core slabs beared as consoled at one end to the lower portion of the vertical wall and pressed in the place of their bearing portion of the top of the vertical wall.

On the upper bound of the plate over the locations of top fixtures on a cement sand mortar steel plates with dimensions of 50 × 100 × 5 mm are installed. The vertical pressing from the overlying floors is transmitted and distributed between the plates by means of distribution traverses with a width of 200 mm enhanced with transverse stiffeners , imitating the upper portion of the vertical wall. The design and dimensions of samples of platform joints, as well as the geometric dimensions and reinforcement of hollow-core slabs are presented in Figure 1.

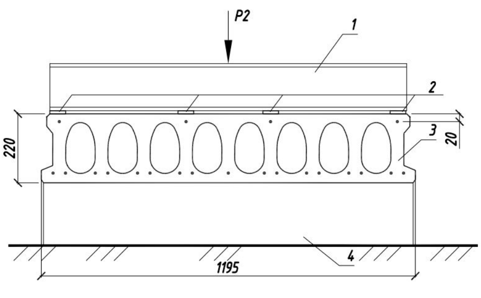


Fig. 1. The geometric dimensions and reinforcement of hollow-core slabs:
1 – distribution traverse; 2 – steel plate; 3 – hollow-core slabs; 4 – wall panel

The sample was tested on a joint platform cantilevered scheme. The plates at one end were supported by a fragment of a wall panel 200 mm thick and at the other – by the end of the lever from the rolling I-beam, which balanced the weight of the hollow-core slab. The distance from the axis of the platform joint of panels to the point of application of the vertical load was about 2 m. The scheme of a fragment of the experimental setup is shown in Figure 2.

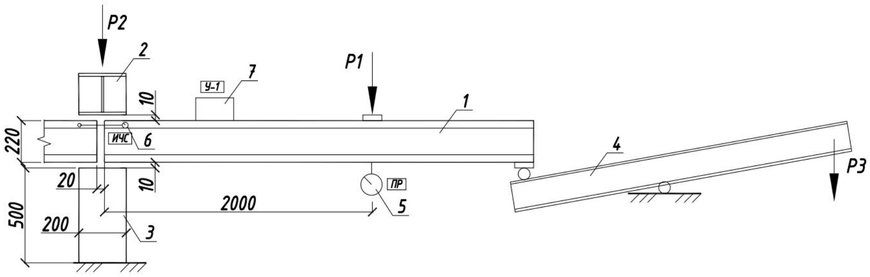


Fig. 2. Schematic of the test set: 1 – hollow-core slabs; 2 – distribution traverse; 3 – wall panel; 4 – Arm; 5 – deflectometer; 6 – the dial gauge; 7 – electronic inclinometer

Experimental research showed the performance of the proposed design of the platform joint. The maximum value of the negative bending moment was 30,7 kNm, which exceeds the value of the bending moment of formation of cracks which equals 22 kNm.

There was a feature noticed in the joint destruction in the local pressing of the anchoring zone of the working reinforcement, which consists in the broken outline of the crack on the upper bound of the plates in the joint area (see Fig. 3, a), as compared with the uniform pressing of the whole area of the upper bearing wall fragment (Fig. 3, b).

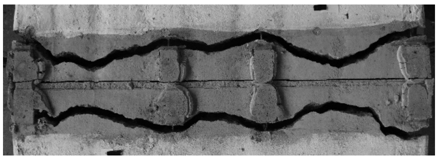
a) 
b) 

Fig. 3. Appearance of samples after the tests: a) improved joint platform; b) joint platform with uniform pressing

The experimentally obtained dependence «support bending moment – the angle of rotation» in the place of the platform joint allows the calculation of hollow floor slabs of formless molding with platform joints of the proposed design based on the actual scheme of their deformation. The experimental dependence «support bending moment – angle of rotation of the cross section» is shown in Figure 4.

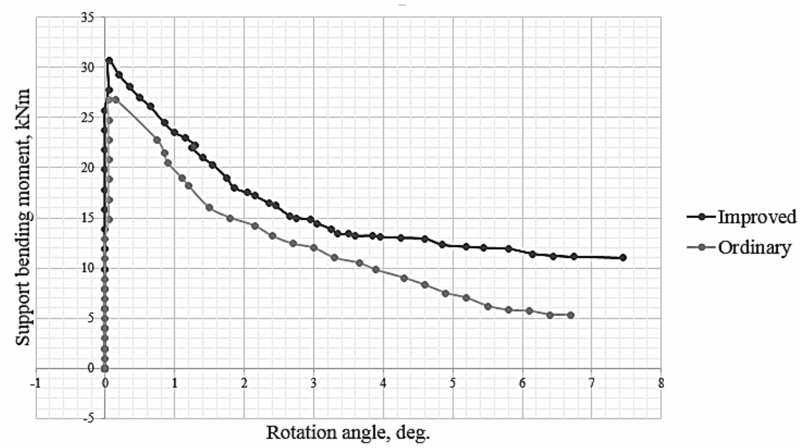


Fig. 4. Experimental dependence «support bending moment – angle of rotation of the cross section»

The improved joint design, in which the vertical pressing of slabs is not transmitted over the entire area of supporting the top of the wall, but «in points» – at the locations of the top working reinforcement, greatly increases the vertical compression zone of anchoring of the top working reinforcement plates.

The experimentally obtained dependence «support bending moment – the angle of rotation» in the place of the platform joint, allows the calculation of hollow-core floor slabs of formless molding based on the actual scheme of their deformation.

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TECHNICAL SOLUTIONS OF VENTILATION SCHEMES IN INHABITED AND PUBLIC BUILDINGS WITH EXTERNAL FENCES OF THE RAISED TIGHTNESS

VLADIMIR LIPKO, NINA KUNDRA
Polotsk State University, Belarus

In the work are presented possible variants of technological schemes for an effective utilization in systems of ventilation of high-rise buildings with external protecting designs of the raised tightness to which the preference is given systems combined heat and air delivery, combined with ventilation.

Currently, any building or structure shall be operated in compliance with all applicable technical regulations, and conformity with the principles of energy conservation. For energy efficiency use of modern technical solutions, technologies and materials [1]. In modern construction, increasingly are building with outer fences high tightness. For the design, construction and operation of such facilities should provide for measures to meet the required parameters of microclimate of buildings. To ensure the required parameters of internal air heating and ventilation systems are used.

For the buildings of the inhabited and public appointment having external fencings of raised tightness, three basic technological schemes of ventilation are possible [2, 3]:

- systems of exhaust ventilation with natural gravitational prompting and the organized inflow of external air for the account of infiltration through equivalent apertures, cracks, channels or ventblocks of the various design, arranged in external protecting designs;
- systems of forced-air and exhaust, general and local ventilation with natural and mechanical prompting;
- systems of ventilation combined with air heating of buildings.

In all considered variants wide use of regeneration means of warmth deleted from ventilated premises is possible. By the first variant of ventilation the delivery of external air in ventilated premises is carried out through artificial apertures in external protections under the influence of the natural gravitational prompting resulting in difference of pressure on either side of an external protection because of a difference of temperatures of external and internal air. The normalized temperature of internal air is supported in the set limits by the system of heating of buildings with which help the cores heat loss through external protections and additional losses of the warmth are compensated. A major loss of the building occurred through external enclosures: walls, windows, floors, above the basement or attic, roof. Additional losses are linked to the heating of the intake air through the ventilation openings in the outer fencings. Devices for air flow may vary in design, such as holes, valves, channels or ventblocks. All air shafts, ducts, and openings, whether for inlet or outlet of air, must be constructed so as to be easily cleaned out. The inlets must in addition be fitted with regulating valves for opening and closing them in varying degrees [4]. The general technological scheme of such ventilation of buildings with external protections of the raised tightness is represented by Figure 1.

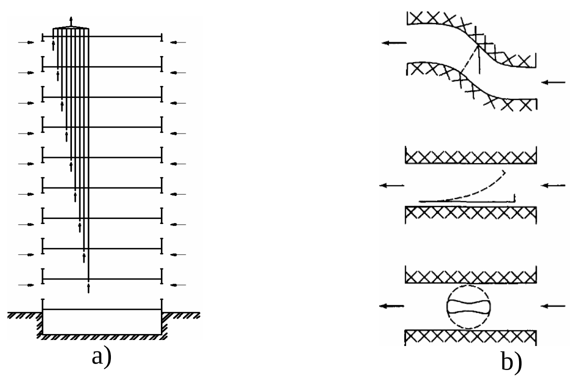

Fig. 1. The building with a natural extract and the organized inflow through apertures in external walls:
a) the scheme of movement of air streams; b) constructions of devices for air flow