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Connecting The Elements Of Reinforced Concrete Structures Protection Of Reinforced Concrete Coverings

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ABSTRACT

The article provides information on the characteristics of the design of reinforcement of flat-surface structures and welded welded rod structures in seismic areas. Recommendations with optimal solutions in problem solving are given.

KEYWORDS

Design Of Reinforced Concrete Structures, Plane Structures, Bar Structures, Features Of Reinforcement, Connection Of Elements.

INTRODUCTION

The joints of reinforced concrete structures must ensure reliable transmission of forces and the joint work of reinforced concrete elements; they should be located in places where the least effort is applied.

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MATERIALS, DESIGNS AND PROTOTYPING

At 9 points, it is not allowed to use reinforcing ropes and rod reinforcement with a diameter of more than 28 mm without special anchors (since this is not economically viable due to the long anchoring length).

The angle of fracture of the axes of rod reinforcement of classes A500, A600, B500 and A400 (grade 25G2S) with a diameter of up to 40 mm, made by arc welding, should not exceed 6°, and for other types of welding – 3°In the meshes, it is allowed not to accidentally weld no more than 2% of the intersections of the rods, and in the frames all intersections must be welded. Cutting the ends of the rods with an electric arc during the assembly of structures or cutting the edges of the rods is not allowed [1].

It should be noted that the replacement of conventional precast concrete products (most often floor slabs or columns) with prestressed ones has almost no effect on the seismic resistance of the structure and can be justified where there are restrictions on deflections or crack opening (should not be confused with technologies such as preliminary compression of the building as a whole or prefabricated floors of the entire floor with a ring cable).

EXPERIMENTAL RESEARCH TECHNIQUE

In prestressed structures, it is not allowed to use reinforcement for which the relative elongation after rupture is less than 2%. When designing rod structures (beams, columns), according to recent publications, it is recommended to take into account the following features:

a) Longitudinal reinforcement must have a cross-sectional area of at least 0.1% of the element's cross-sectional area;
b) Transverse reinforcement in sections of the element with a length of 2h (where h is the height of the element section) adjacent to the rigid corners of the frames must meet the following requirements (where d is the diameter of the longitudinal reinforcement): - the step of the clamps should be no more than: - at 7 points - 1 / 2h, 15d, 150mm; - at 8 points - 1 / 3h, 12d, 100 mm; - with 9 points - 1 / 4h, 10d, 65 mm; - the diameter of the transverse reinforcement must be at least 8 mm [2,3,4.].

Figure 1. - Construction scrap: longitudinal reinforcement is broken; longitudinal and transverse reinforcement are not interconnected; longitudinal reinforcement has a bending stiffness greater than the concrete cover

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c) Welded and mechanical joints of longitudinal reinforcement can be performed in any section, and overlapping joints should be located outside the zone of action of the maximum moments;

d) For welded and mechanical joints of longitudinal reinforcement in each section, no more than every second bar should be connected, while the distance between the joints along the length of the element must be at least 100 mm (Figure 2), and if the bars are joined with eccentricity, then install additional transverse reinforcement in the joint area;

e) When connecting with an overlap in the bypass zone, frequent clamps should be installed with a pitch of at least h / 4, 8d and 100 mm;

f) The ends of the knitted transverse reinforcement clamps must be bent around the longitudinal reinforcement bar and inserted into the concrete core for a length of at least 6 dsw;

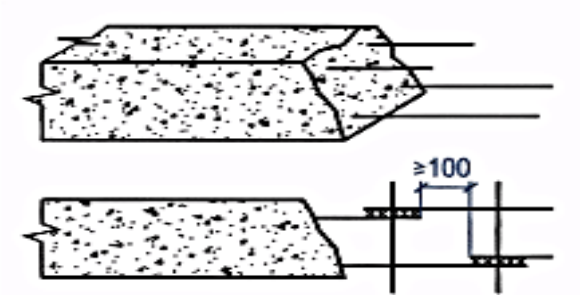
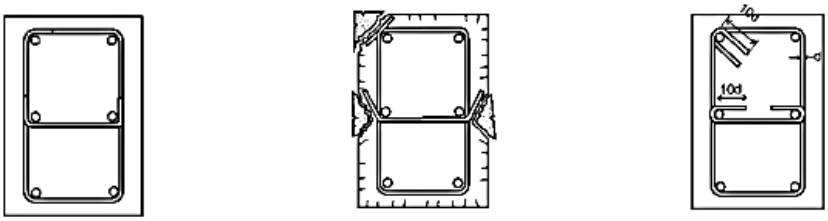


Figure 2. – Connection longitudinal reinforcement

g) The ends are not brought into the concrete core; subsequent seismic failure; correct location of the clamps (Figure 3.)



The ends are not routed inside the concrete core

Subsequent seismic destruction

Correct arrangement of clamps

Figure 3. - Connection of transverse reinforcement

h) the length of welded seams and bypass of reinforcement when overlapping is recommended to be taken 30% more than that established by the joint venture

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"Concrete and Reinforced Concrete Structures" [5,6,8].

When designing planar structures (walls, diaphragms), it is recommended to take into account the following features:

- Along the edges of load-bearing wall elements, concentrated longitudinal vertical reinforcement with a cross-sectional area of at least 0.05% of the cross-sectional area of the wall should be provided;
- Along the field of the wall at both side faces, horizontal reinforcement with a total cross-sectional area of at least 0.1% of the area of the corresponding cross-section of the wall element should be provided;
- The reinforcement distributed along the lateral sides of the wall must be secured against buckling by means of special transverse rods;
- At the intersections of walls, in places of sharp changes in wall thickness and at the edges of openings, constructive reinforcement should be provided;
- In the butt joints of wall elements, it is necessary to provide for the installation of reinforcing or other steel ties, securely behind the anchor ones in concrete.

With a seismicity of 9 points for buildings with a height of 5 floors and higher, the cross-section of steel ties is taken to be at least 1 cm^2 per 1 running meter. m of the joint, and at 7–8 points - not less than 0.5 cm^2.

Figure 4. - Example of reinforcement columns for the perception of seismic loads.

Figure 5. - Lack of reinforcement in a reinforced concrete structure

The axial compressive strength class of concrete for external and internal load-bearing walls is established taking into account the strength requirements for the main

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combination of loads, ensuring operational properties, conditions for stripping, transportation and installation, but should not be less than the values specified in Table 1.

Table 1 - Minimum classes of concrete for load-bearing walls of earthquake-resistant buildings

Wall type	Number of storeys	Minimum class of concrete at design seismicity, points		
		7	8	9
Internal	1–14	B12,5	B15	B15
Outdoor	1–5	B3,5	B5	B7,5
single layer	6–14	B5	B5	B7,5
Load-bearing layers of multi-layer walls	1–14	B12,5	B12,5	B15

It is recommended to apply the following structural solutions for floors made of precast concrete slabs with a corrugated or keyed surface on the side faces, and reinforcement outlets or embedded parts on the ends (Figure 6).

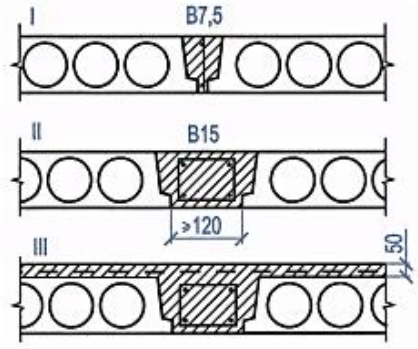

Figure 6. - Types of precast concrete slabs.

CONCLUSION

Type 1. Seams between slabs are filled with cement or polymer-cement mortar, or fine-grained concrete of class B 7.5 or higher. The slabs are anchored into anti-seismic belts, reinforced concrete straps or girders.

At the level of supporting the hollow-core panels, reinforced concrete straps are arranged on the crossbars of rectangular cross-section, reinforced along the intermediate frames with flat frames, and along the extreme end rows - with spatial frames.

When supporting hollow-core panels on the top of the crossbars, they must be provided with connections in the form of vertical outlets of reinforcement with a diameter of at least 16 mm with a step of 300-400 mm.

Type 2. Anchoring of slabs is provided in the same way as for type I. Floor slabs are laid with a distance of at least 120 mm.

Between the slabs, a reinforcement cage is installed with four longitudinal reinforcement rods with a diameter of 8 mm, which are anchored into antiseismic belts 35 or

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reinforced concrete straps. Monolithic concrete, fine-grained class B 15.

Type 3. Structural solutions for anchoring and embedding slabs are the same as for type 2, but, in addition, a 50 mm layer of fine-grained concrete of class B 15 or higher, reinforced with a mesh of reinforcement with a diameter of 4 mm with a cell of 500, is provided on the top of the floor. mm [7].

The support of floor slabs, depending on the type of supporting structures, should be taken at least: - on brick and stone walls - 120 mm; - on walls made of vibrated brick blocks - 90 mm; - for precast reinforced concrete girders - 80 mm; - on the walls of large-panel buildings: - when supported along the contour or on three sides - 60 mm; - when supported on two opposite sides - 90 mm; - on walls (diaphragms) made of monolithic reinforced concrete - 90 mm.

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