UDC 538.21.3

Determination of strength STALEFIBROBETONNYH PIPES TAKING INTO ACCOUNT Elastic WORK Stretched ZONE

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In the article the proposals for calculating the strength stalefibrobetonnyh pipes and evaluation of the stress-strain state rectangular fiber concretes elements based on Prandtl diagram.

Strength, element, reinforcement, basalt, fiber.

Problem. The high complexity of manufacturing concrete pipes associated with the installation of dual core frameworks necessary to understand the double bending moments.

Analysis of recent research. Difficulty ensure the required concrete cover thickness working armature, low linear load at fracture toughness compared to linear stress strength and reducing operating life of concrete pipes [1] are aiming to manufacture pipes Ø 400-600 mm (Fig. 1) of stalefibrobetonu without reinforcing rod [2]. Past studies [2] have shown a fairly even distribution of steel fibers in terms of concrete wall in turn stalefibrobetonnoyi pipe.

The purpose of research. Here are suggestions for calculating the strength stalefibrobetonnyh pipes and evaluation of the stress-strain state rectangular fiber concretes elements based on Prandtl diagram.

Fig. 1. Production of pipes Ø 400 mm by vertical vibropressing; stalefibrobetonna pipe Ø 400 mmAfter dialing strength.

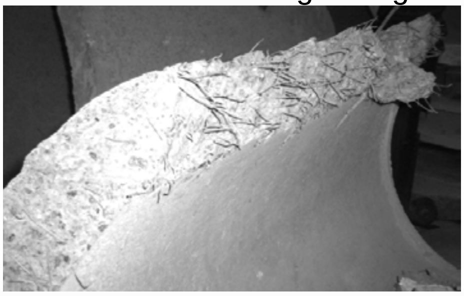

Fig. 2. Uniform distribution of steel fibers in terms of concrete wall in turn stalefibrobetonnoy pipe.

Research results indicate that during deformation in the stretched zone stalefibrobetonnyh elastic plastic pipes occur properties of the material until fracture [2, 3].

Therefore, the method of calculating the cross sections of fiber concretes elements normal to the longitudinal axis of the element should take into account the development of plastic deformation in Fibre. Existing methods of calculating regulatory strength concrete elements and fiber concretes circular cross section using a rectangular stress distribution of force by section element, allowing unlimited plasticity of concrete and fiber concrete in the boundary condition, which leads to an overestimation of carrying capacity, overrun concrete and fiber [4, 5].

Calculated dependence of the stress-strain state and carrying capacity of noncentral compressed (bending) fiber concretes elements of rectangular section are based on the assumptions described in [6] the most important of which are:

- The relationship between stresses and strains in the fiber concrete compressed zone is taken as elastic charts;
- The relationship between stresses and strains fiber concrete in the tension zone is taken as a chart Prandtl.

Use the preconditions laid equivalent stresses in the adoption of diagrams Fibre stretched zone calculation section at a time prior to destruction, in the form of a rectangular trapezoid with height plot constant stress equal to $\lambda_{cftu.} \cdot (d-x)$Where λ_{cftu} - Coefficient of fiber-reinforced concrete plasticity; stress in the plastic zone roughly equal to the limit value f_{cftd}.

If,

$$\varepsilon_{cft} = \varepsilon_{cftu}\,, \lambda_{cft} = \lambda_{cftu} = 1 - \frac{f_{cftd}}{\varepsilon_{cftu} \cdot E_{cftu}}\,. \qquad (1)$$

The height of the section, which is roughly in the plastic stage:

$$x_t = \lambda_{cftu} \cdot (d - x), \qquad (2)$$

- resistance stalefibrobetonu tensile stresses are presented, *fcfd*, distributed according to trapetsiyidalnoy diagrams stresses in the stretched zone stalefibrobetonu;

- resistance stalefibrobetonu compressive stresses are presented *fcfd*, Distributed under the triangular diagram of stresses in the compressed area stalefibrobetonu;

A criterion exhaustion section bearing capacity is taken:

- loss of balance between internal and external efforts (peaking diagrams "moment - curvature" or "load - deflection");

- stretched fiber concrete fracture occurs at achieving fiber deformation limit values (Ecftu).

Estimated resistance stalefibrobetonu fsfd compression is given by [7]:

$$f_{cfd} = f_{cd} + (k_n^2 \cdot \varphi_f \cdot \mu_{fv} \cdot R_f), \qquad (3)$$

where fcd - estimated resistance of the concrete matrix axial compression; kn - coefficient accounting work in the fiber cross section perpendicular to the direction of the external compressive force; φf - efficiency ratio of indirect reinforcement fiber:

$$\varphi_f = \frac{5 + L}{1 + 4.5L} \text{ Where } L = \frac{k^2 \cdot \mu_{fv} \cdot f_f}{f_{fc}},$$

Estimated stalefibrobetonu tensile resistance fcftd if a certain amount of fiber breakage and pulling other (at lf, an <0.5 lf, the first time) is given by [7]:

$$f_{cftd} = m_1 \left[K_r \cdot k_{or}^2 \cdot \mu_{fv} \cdot f_{fc} \left(1 - \frac{l_{fan}}{l_f} \right) + 0.1 f_{fc} \left(0.8 - \sqrt{2\mu_{fv} - 0.005} \right) \right], \qquad (4)$$

Estimated resistance stalefibrobetonu stretching fcftd when pulling out of concrete suspended all fiber (at lf, an> 0.5 lf, the second case), determined in accordance with [7]:

$$f_{cftd} = m_2 \cdot f_{fc} \left(K_T \cdot \frac{k_{or}^2 \cdot \mu_{fv} \cdot l_f}{8\eta_f \cdot d_{fred}} + 0.08 - 0.5\mu_{fv} \right), \qquad (5)$$

where m1, m2 - coefficient of working conditions that are assumed to be equal to 1.1 fiber wire; *lf, an* - Length of laying fiber in concrete; kor - coefficient of fiber orientation in the volume element; μfv - fibreboard reinforcement ratio by volume; *Kr*= $\sqrt{1 - (1.2 - 80 \cdot \mu_{fv})}$; df, red - given the diameter of the fiber used, mm; ff k - regulatory resistance stretching fiber, MPa; η f - coefficient accounting for anchoring fibers to be adopted for fiber with steel wire: η f = 0,7-0,9.

Based on these preconditions strength normal rectangular bending fiber concretes items, check the condition (6), Fig. 3:

$$M \leq f_{cftd} \cdot b \cdot X_t^2 \; \frac{1+\lambda_{cftu} - 0{,}5\lambda_{cftu}^2}{3} - \\ - 0{,}5 \cdot \frac{\varepsilon_{cftu} \cdot E_{cf} \cdot bX^2}{X_t}\left(d - \frac{x}{3}\right) , \qquad (6)$$

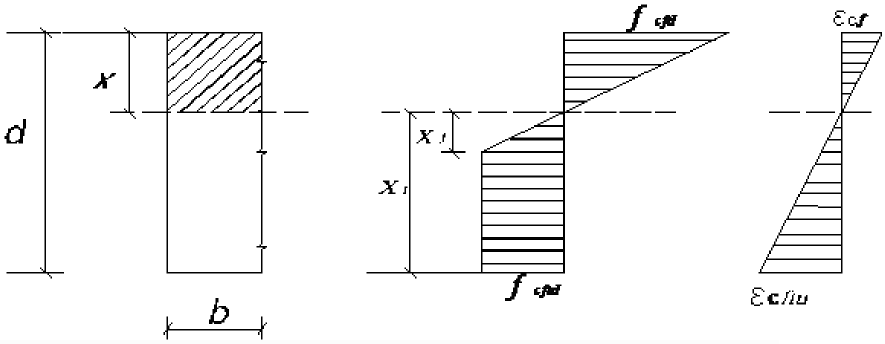

Fig. 3. Diagram stalefybrobetonnoho rectangular element.

The height of the compressed zone check the condition:

$$0{,}5 f_{cftd} \cdot \left(1+\lambda_{cftu}\right) \cdot b \cdot X_t - 0.5 \frac{\varepsilon_{cftu} \cdot E_{cf} \cdot bX^2}{X_t} = 0 , \qquad (7)$$

The procedure for calculating the normal sections of fiber concretes elements for deformation model:

- set the initial values of extreme strain stretched fibers εsft, curvature χ values and calculate the height of the compressed zone x fiber concretes element;
- calculate the coefficient of fiber-reinforced concrete plasticity:
- check the condition of equality to zero effort in compressed and stretched rectangular area (7); If this condition is not satisfied, we accept the new value, calculate x and repeat the calculation for as long as the condition (7) is not executed with the required accuracy.
- check inequality (6) - condition of strength section.

Conclusion. The above method of calculating the deformation of rectangular cross-section fiber concretes elements can more accurately calculate the strength of cross sections and more cost waste concrete and reinforcing fiber dispersion.

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In Article pryvedenы proposals for calculating prochnosty stalefybrobetonnыh pipes and evaluation of stress-deformyrovannoe STATUS pryamouholnыh Széchenyi fybrobetonnыh elements based on Prandtl dyahrammы.

Prochnost, element, armyrovanyya, basalt, Fibro.

The paper presents suggestions for calculating strength steel fiber-reinforced pipes and evaluation of stress-strain state of rectangular sections fiber concretes elements based on Prandtl chart.

Strength, element, reinforcement, basalt, fiber.

UDC 630.56.7

QUALITY STEEL
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The effect of non-metallic inclusions in steel structure morphology. Past studies of mechanical properties and microstructure of steels with REM. The optimal concentration of cerium in steel.

Model, property, steel alloying.