STRIP FOUNDATIONS BASES ANCHORING METHOD IN RECONSTRUCTION

METHODE DE FIXAGE DES BASES DE FONDEMENTS LEANDE PENDANT LA RECONSTRUCTION

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Strip foundations bases anchoring technological method when using the pneumatic drifters is dwelt upon. The experimental models results as well as the new foundation-base-compressed lauger system model theoretical researches through the final elements method are depicted.

The operations to anchor the bases or strengthen foundations are held in cases when the building and constructions are added by some more floors and are under the reconstruction while the loads increasing. The current method and anchoring ways are as a rule very labour-consuming and rather expensive. For some years the Perm Polytechnical Institute holds the complicated experimantal-theoretical researches to obtain the new simple and effective bases anchoring method in building reconstructions. To realize this method into practice one should use the highly productive technology for the trenchless underground communication laying. Simultaneously, the following tasks were set up and solved. The new foundations bases anchoring method technology was developed through the formation of the compressed ground layer under the base. Experiments were carried upon the models to prove qualitatively if it is possible to imply the horizontal reinforcing members and the reinforcing scheme was selected. The foundation-base-compressed layer system calculated scheme consisting of the environment and the device models was drawn. The programme for the digital solution by the final elements method (FEM) was made up and test. The field (Large-scale) experiment was carried out to test the system model stability. Using the computer graphics the base stress deformated state with the compressed ground layer and without it was analized. The engineering method to define the optimal parametres of the compressed layer was developed and the faot was the decrease of the foundation settlement each time under the minimal wastes by the use of the reinforcing members.

The new method essence falls into the following steps to be undertaken. The compressed ground layer consists of the horizontal reinforcing elements being placed parallel to each other under the foundation base. The distance between the reinforcing members is 3 d where d is a diameter of the member under the round crossing and the breadth under the rectangular one. Many studies of such an elements' position (e.g.piles) show the mutual work of the member and intermember area of the compressed ground zone. The latter fact enables to conclude that the ground layer should have to be look like the uniform single slab and when the plane problem is solved by FEM these slab layers acquire intermediate characteristics. That's why the rein forcing member formation in the compressed ground layer should intensify the intermember area compressing. To achieve this effect, different devices and mechanisms are used to drift the wells into the ground or ready-made parts with the compressed ground zone around them are supposed to be used as well. E.g., the highly productive low-powered shock machines, pneumatic drifters. While using them one can drive the steel pipes sections under the foundation base. These sections are filled by various cement materials or ready-made reinforcing materials (Fig. 1). Under the definite ground conditions the wells can be driven by the pneumatic drifter going through the ground and afterwards these wells are filled with some cement solution.

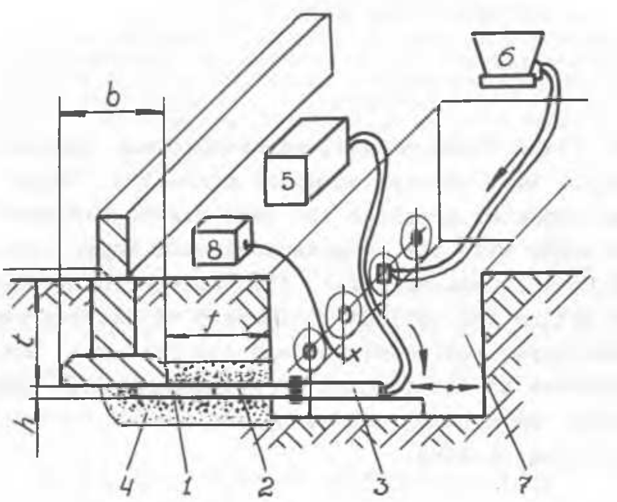

Fig. 1. Realization Method Scheme. 1 - the first section of the pipe with a pin; 2 - the second section of the pipe; 3 - pneumatic drifter; 4 - compressed ground zone; 5 - compressor; 6 - device to deliver the cement solution; 7 - technological pit; 8 - welding set to weld pipes section

In the complicated situations including the base foundations anchoring by many underground communications and in other inadmissible cases one can use more productive pneumatic drifters with the controlled movement trajectory. And the authors of the pneumatic drifters, constructions anchoring methods are patented.

To clear out qualitative duration of the processing taking place in the reinforcing bases models were used. The model tests were carried on with the compressing load in 1.5-2.0 times as much. At the same time the reinforcing members driving into the position under the foundation load and members compressing was to be modelled. In both cases the sample was settled when the member was inserted under the base. Judging from both cases we come to the conclusion that the base and foundation vibration is due to the weakened soft ground zone load having been arisen before the member point. Under the largescale conditions we carried out the other experiments to see what are the scale factor influences like. The largescale experiment was made to test if the given calculation foundation-base-compressed layer system scheme is the appropriate one. The results are shown by the Fig. 2.

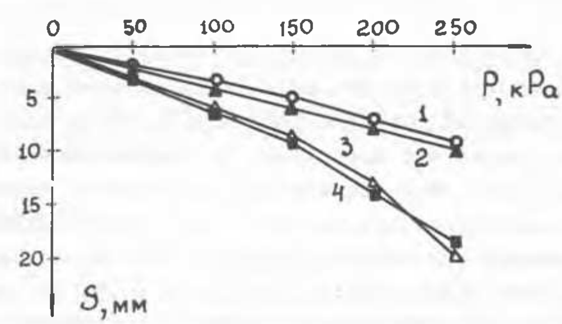

Fig. 2. Digital Design and Experimental Data Comparison (E = 10 MPa). 1 - experimental data reinforcing; 2 - digital design FEM reinforcing; 3 - experimental data not reinforcing; 4 - digital design FEM not reinforcing

Judging from the diagrams one can draw the conclusion that the proposed compressed layer model resembling a slab with effectively deformated parametres should be designed when there are compressing zones around the reinforcing members and the environment has non-linear properties (ideally, that is a hardplastic environment model). The data obtained satisfied the experimentators and might be used in the digital research of SDS and engineering calculation.

The data were proved to satisfy the authors when they have tested the members driving to influence upon the foundation settlement. Under the pressure up to 100 kPa there was no settlement and under 200 kPa the settlement from the single bar drifting was 0.4 mm. Thus, the amount is low and the settlement is uniformed. The effect does not influence the method realization. But the additional studies should be taken up. These are the following practical recommendations. Under the load of more than 100 kPa it's necessary to carry out the experiment driving to define the exact parametres of the reinforcing members and drifting machines. The settlement decreases when using the low-productive pneumatic drifters and if the wells diameter is minimal.

The digital research of stressed deformed state (SDS) was carried out under the following ground conditions. Groundload with the deformation module of E from 5 up to 10 MPa, Poisson's ratio is ν = 0.35 and yield index I_L = 0.6, the unit weight γ = 18.4 kH/m^3. The foundation base breadth b = 2 m, the foundation depth t = 1.5 m, h - the compressed layer height is in the range of 0.15 - 0.25 m, the layer outcome f from the foundation edge is in the range of 1 - 3 m. Using the "Geomechanics" programme and the pack of the applied graphic programmes the isolines σ_x, σ_y, τ_{xy} (normal stress and shear stress) and foundation layers were obtained. Let us consider the SDS bases without compressing under the pressure P=200 kPa, i.e. the load increased two times as muoh (Fig. 3). In the given example the base is uniformed (E = 7.5 MPa, I_L = 0.6, f = b, h = 0.1b). The settlement under pressure P=200 kPa - S=89 mm, and under P=100 kPa the base without compressing is S = 108 mm.

The base stresses under the compressed ground layer are distributed upon the larger massive amount both in width and depth than in the bases withour reinforcing. In spite of the load has been increased twice the compressed foundation settlement is decreased and the stress becomes lower under the compressing layer.This justifies the safety factor. The same for σ_x, τ_{xy}.

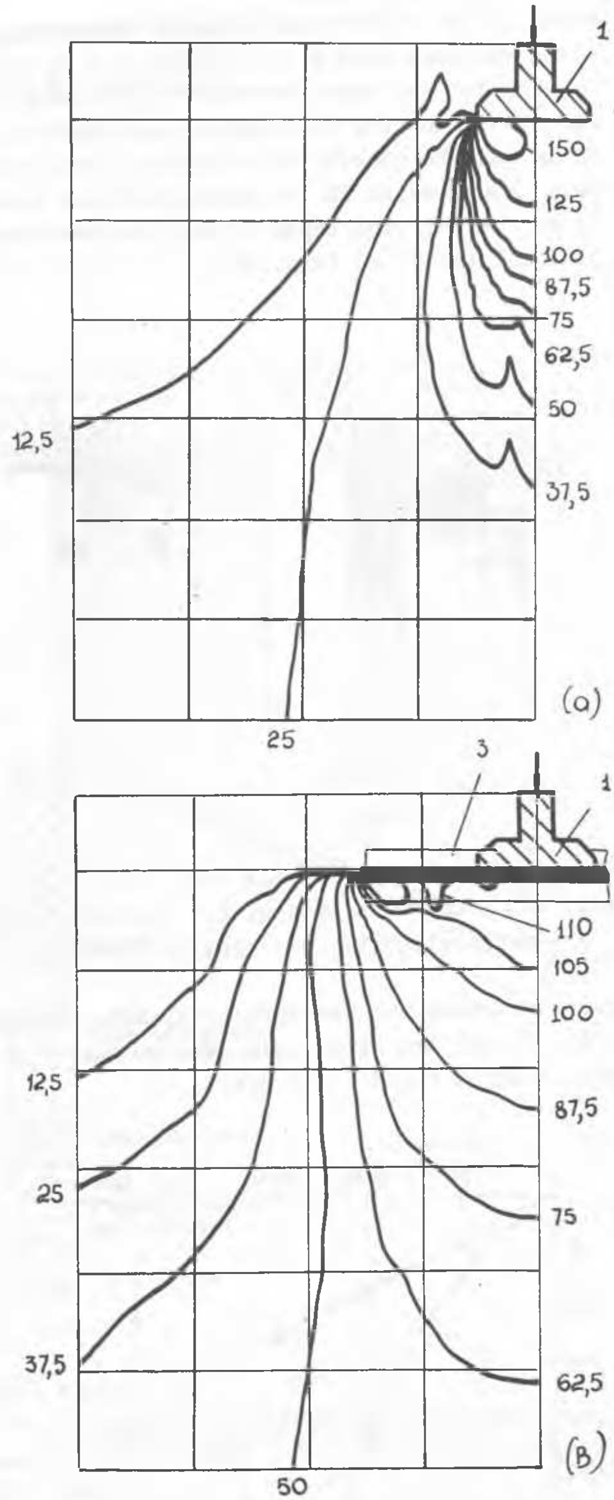

Fig. 3. The Stresses Isolines σ_y (kPa). (a) - P=100 kPa, (b) - P=200 kPa. 1 - foundation, 2 - reinforoing member, 3 - compressing

The base stresses under the compressed layer are removed and distributed on the layer area, hence is the significant plastic deformation zones decrease when E = 0.75 MPa, f = b, h = 0.1 b under the same pressure P = 150 kPa in the base with compressed settlement made up 62 mm and the plastic zone appears. When there is no compressing in the base practical waste is of the carrying capacity and the settlement is equal to 257 mm (Fig. 4).

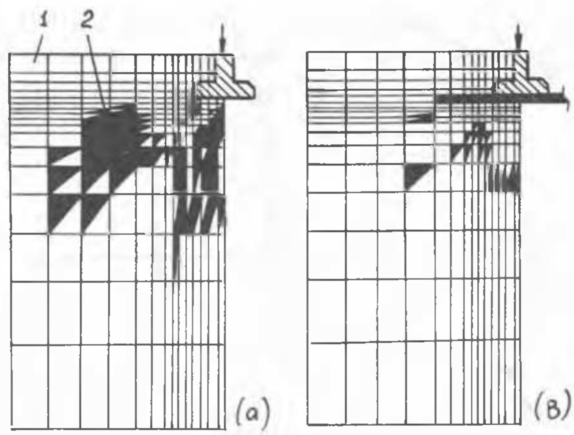

Fig. 4. Plastic Deformation Zones at P = 150 kPa: (a) - not reinforcing, (b) - reinforcing. 1 - elastic elements, 2 - plastic elements

Let's consider the pressure-settlement diagram (Fig. 5) for the given case. The load-settlement diagram for E = 7.5 MPa.

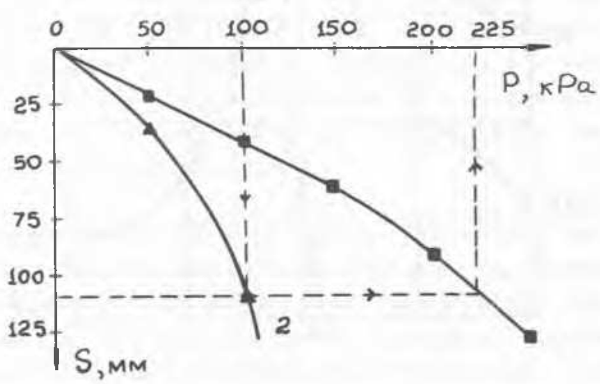

Fig. 5. Pressure-settlement diagram for E = 7.5 MPa. 1 - reinforcing, 2 - not reinforcing

If we know the load of the present construction we shall define the settlement by the diagram. E.g. the pressure P = 100 kPa, settlement S = 108 mm that is equal to the limited settlement. We draw the line parallel to the axis P up to the crossing section with the curving line 1 of the base with compressing and define completely the suitable load increase so as to decrease the settlement. We'll get P = 225 kPa, i.e. the carrying capacity may be increased 2.25 times as much.

The given engineering calculation method enables us to foresee the base anchoring settlement up to 10 - 15 %. Judging from the data obtained, the new method enables to increase the carrying capacity of the reconstructed building 1.5 - 2.0 times as much.

References Examples

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