Comparison of the critical normal stress bending plates/

Numerical experiments have been made on the calculation of the critical stress bending plates with different aspect ratio, thickness, and support conditions. The critical buckling stresses were also counted by current standards (see [1], [2]), and the formulas proposed by Timoshenko [3]. Data are presented in Table 2.

Table 2 – Comparison of the results of the critical normal stress for rectangular plates from the bending moment

Geom. Parameters of plates (В×Ш×Т) mm	EN 1993-1-5 MPa	СНИП II-23-81* MPa	Analytical solution MPa	FEM (free support) MPa	FEM (rigidly fixed edges) MPa
1000×500×6	166.6	216	166.95	161,3	351.6
1000×670×6	166.6	216	155.87	152,1	332.1
1000×800×6	166.6	216	159.1	157,2	326.8
1000×1000×6	166.6	216	166.95	163,4	298.2
1000×1500×6	166.6	216	156.66	155,5	277.4
1000×2000×6	166.6	216	155.87	154,1	269.0
800×500×6	184.9	337.5	244.16	239.2	511.6
800×670×6	184.9	337.5	252.198	251.0	500.4
800×800×6	184.9	337.5	260.852	256.5	466.9
800×1000×6	184.9	337.5	252.816	241.3	447,8
800×1500×6	184.9	337.5	244.162	241.9	423,6
1200×670×6	150.6	150	112.4	107,2	247,1
1200×800×6	150.6	150	108.2	105,3	231,7
1200×1000×6	150.6	150	112.4	110,2	222,4
1200×1500×6	150.6	150	112.4	106,7	199,0
1200×2000×6	150.6	150	113.7	109,8	190,2

Analyzing the results, one can draw the following conclusions:

1) Stability of the plates under the action of the bending moment is practically independent of the presence and the distance between the ribs. This fact is taken into account not only the existing standards but also confirmed by analytical solutions. This is due to the fact that the plate with a large ratio of h / d curve for several half-waves and the energy of deformation increases slightly.

2) The greatest influence on the resistance to buckling of plates has a ratio of height to thickness (t / h).

A large range of values using different methods can be explained by the difference in the expected conditions of consolidation. If belts and fins considered stiff enough, the area in which the possible buckling of the plate is reduced and it behaves like a smaller plate. Also, the area adjacent to the upper belt compressive stresses which are maximized, is excluded from the deformed region, increasing the resistance to buckling.

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INVESTIGATING THE BEHAVIOR OF AXIALLY LOADED BORED PILES EMBEDDED IN SOIL USEDING FINITE ELEMENTS METHOD

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This comparative study is performed on bored piles by varying the basic problem parameters that are expected to affect pile carrying capacity and comparing the obtained results with those of the original basic problems, in order to get more knowledge about the behavior of bored piles under compressive load, and to include the best design for future pile construction.

The advancement of digital computers makes possible the development of sophisticated numerical solution techniques such as (F.E.M) for solving boundary value problems in geotechnical engineering. The advantages of the (F.E.M) is that it can be systematically programmed to accommodate such complex and default material properties usually accruing in soils such as, non-homogenous, anisotropic, non-linear, time dependent and difficult boundary conditions. Many investigations have employed the (F.E.M) to analyze the behavior of the pile–soil system.

The major objective of this study is to extend the application of the (F.E.M) to analyze the behavior of axially loaded bored piles embedded in soil.

Methodology

The basic problem was analyzed in nine stages of construction including two stages of excavation, two stages of concrete casting and five stages of incremental loading.

To assess the effects of changing construction sequence three different cases of construction are adopted:

– First case consists of five stages of loading only; there are no excavation and filling stages.

– Second case consists of one stage of excavation in natural soil then followed by one stage of concrete casting and five loading stages.

– Third case consists of four stages of excavation and concrete casting and five stages of loading.

Results

The load–displacement curves of the basic problem (nine stages of construction) is shown in Fig.1 together with other different cases of simulation. It is clear that construction simulation has a very limited effect on the load–settlement behavior.

The vertical displacements of ground surface are shown in Fig.2, and the lateral displacements for interface elements are shown in Fig.3. It is obvious that construction simulation has a very limited effect on the vertical and lateral displacements.

Fig. 4 shows the simulation of the failed elements at the last increment of each case of construction. These figures indicate that the number of failed elements increases as a result of decreasing the number of stages. The elements have failed gradually throughout the incremental loading.

Fig. 5 shows the effect of construction simulation on the shear stresses generated in the surrounding soil. It can be seen that the effect is very limited.

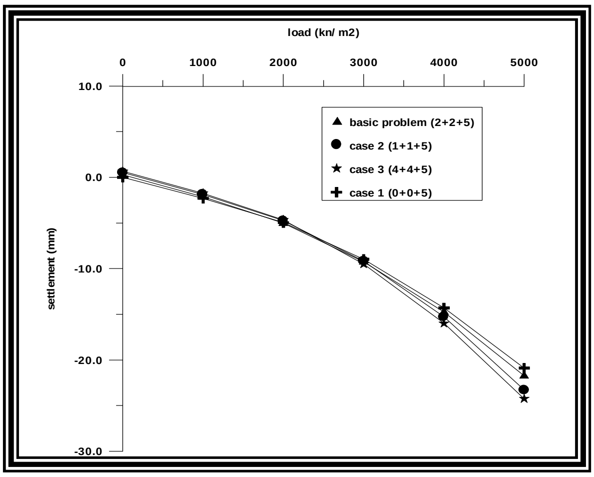

Fig. 1. Effect of construction simulation on load –displacement relationship

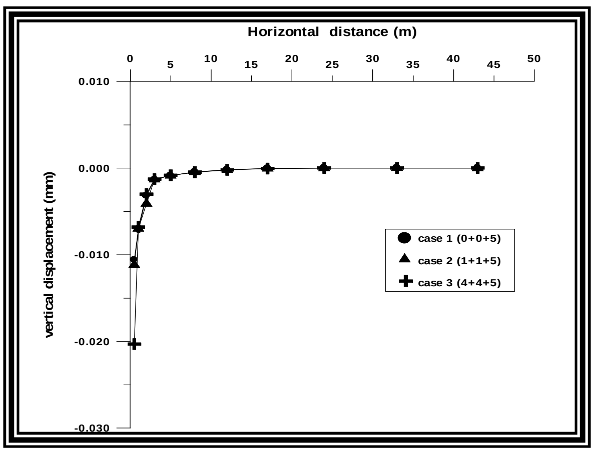

Fig. 2. Effect of construction simulation on vertical displacements of ground surface

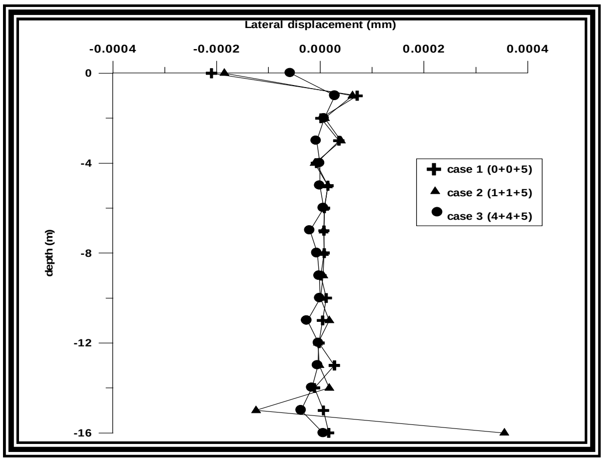

Fig. 3. Effect of construction simulation on lateral displacements of interface

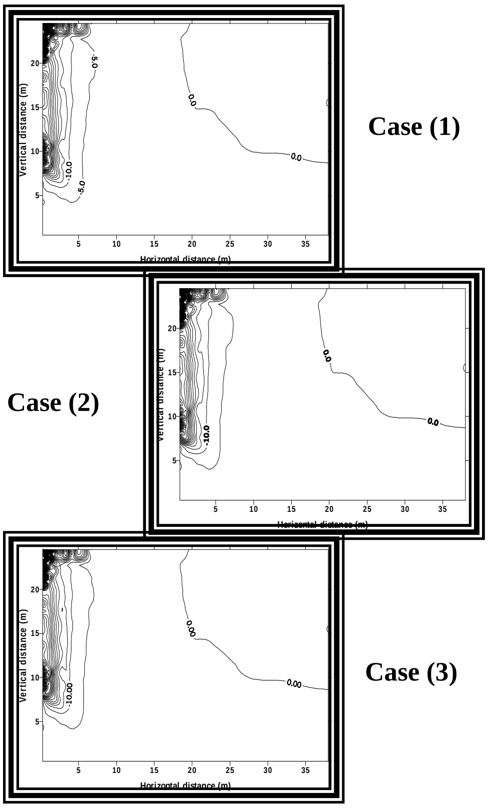

Fig. 4. Effect of construction simulation on the propagation of failure zone around pile

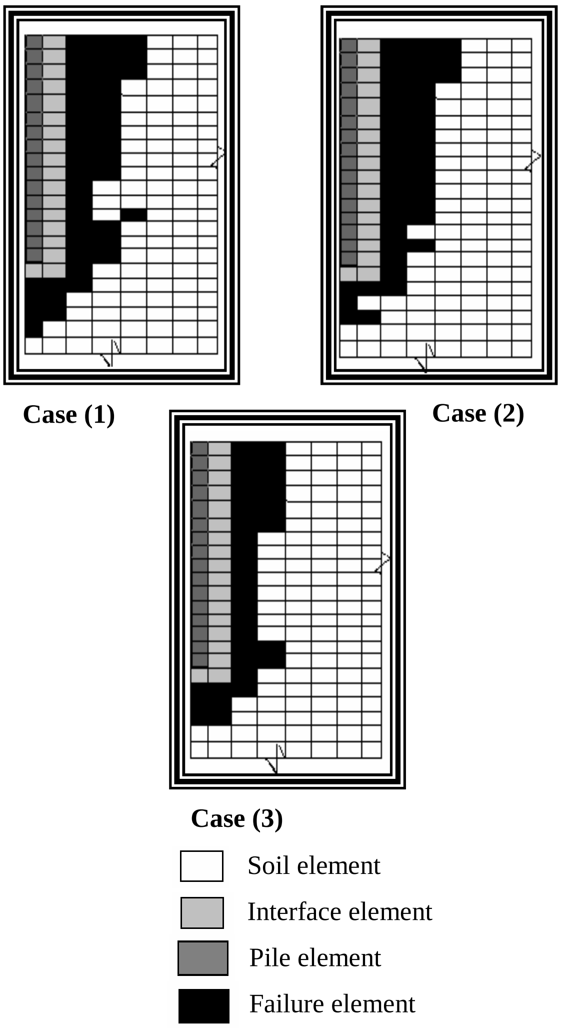

Fig. 5. Effect of construction simulation on shear stresses in soil around pile

Conclusions

From the results and the parametric study; the following conclusions can be drown:

1. First of all the importance of interface elements was shown. Especially for the shaft resistance the results of a calculation without interface elements were heavily mesh dependant. When using interface elements

the mesh dependency is negligible. For the base resistance, one needs at least two or three elements at the pile tip to get rid of the mesh dependency.

2. The best results of load-displacement curve are obtained by using the non linear behavior for both soil and interface elements.

3. The construction simulation has a very limited effect on the load- displacement curve and has a similar effect on the shear stresses, while the number of failed elements is very sensitive to construction simulation, its increase as a result of decreasing the number of stages.

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ON THE USE OF COMPOSITE STRUCTURES IN THE CONTEXT OF NEW CONSTRUCTION AND RECONSTRUCTION

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The relevance of use of composite structures in modern construction is considered. Composite structures are closely connected with the questions of strength and reliability of concrete seams. Concrete seams are formed both in new construction (monolithic construction, precast construction and composite construction) and in reconstruction.

Nowadays all over the world the question of the use of composite structures is of high relevance due to the fact that these constructions are used both in timber construction, and in metal construction, as well as in plastic construction. Moreover they find the application in other fields of science such as medicine, biology, geology, etc. The most significant task to be solved is the contact seams problem. The most popular material in modern construction nowadays is reinforced concrete. Thus we will investigate the problem of the strength and reliability of contact seam regarding current material.

Today composite structures are used both in new construction, and in reconstruction in Belarus. According to the technique of construction modern reinforced concrete constructions are classified into monolithic construction, precast construction and composite construction [1]. Buildings and structures are frequently subjected to monolithing by reinforcements when reconstruction (a build-up, a shoulder, a case) is being held. A very important task combines all of the types of these constructions both in new construction and in reconstruction. The task is to provide constructions with a monolithic character. The task of no small importance is to provide a composite action for layers of reinforced concrete composite structures. In addition the properties of the layers can be initially different. The composite action of construction and its reliability in use depend on contact seam practice and quality, on concreting procedure, on concrete mix of an 'old' and 'new' concrete.

In a general way contact seam of reinforced concrete composite structures in construction can be conditionally classified as follows [1; 2]:

Contact seam classification

Composite construction	Monolithic construction	Reconstruction
– filled with concrete or mortar seams between precast elements	– seams in cast-in-situ elements	– seams in braced with "new" concrete structures
– seams between a "new" concrete and a precast element	– seams with retained form	– seams in the "new" concrete
– seams in cast-in-situ elements	– seams after long-termed break in construction	