

## Bearing capacity of square piles in weak clay soil

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The improvement of the existing theoretical methods of piles and pile foundations calculation is taking place for quite a long time now. This is associated with high material costs of experimental studies, as well as a large range of studies parameters.

Have to say that even various experimental research methods can give different values of pile bearing capacity in the same ground conditions. And therefore we have a lot imperfections of the pile bearing capacity determining methodology which is shown in our codes.

Thus, it is necessary to compare the data obtained by various practical methods, by different theoretical solutions and determine the effectiveness of their use on various construction sites which are situated in different parts of our country.

Initially the determination of the pile bearing capacity is carried out in accordance with the current Ukrainian standards with all its disadvantages. The next most popular method for determining pile bearing capacity is static penetration tests. This method of soils testing simulates pile work in soil. And in this case it gives results with less deviations in comparison with normative documents. However, it is also has some disadvantages like all readings should be recorded automatically, sensors should be calibrated before each test and for each individual soils, environmental conditions etc [1]. We can also determine and control pile bearing capacity during and after its jacking. Studies show that the comparison of pile bearing capacity results determined by dynamic tests was significantly lower than according to static load tests. Moreover, for piles driven into sands up to 2 times, and for piles in clay soils in 2-5 times [2].

The biggest disadvantage that huge variety of all methods have is that we can't build graphic  $S=f(P)$ , which we have after static load tests. A lot of scientists tried to study, choose and compare the most effective method. They are G.K. Klein, S.Y. Cymbal, O. Eide, A. Mohammed, R. Falah [3] and others.

So our main task is to compare pile bearing capacity in weak clay soils on given construction site determined by different methods, to choose the most rational or to develop existing theoretical method.

In the administrative sense the investigation site is located on the territory of Berezivka village of Kyiv Makariv district. In geomorphological structure the site belongs to Makariv moraine-outwash plain of the Kiev Polissya. Geological conditions of investigation site are represented by the various abrasions of clays and sandy soils in the upper part (fig. 1). Square concrete jacked pile (300x300 mm) 10 m long was used as experience.

At the beginning of research pile bearing capacity according to the Ukrainian standards using table values and static penetration tests was finding out. Also during jacking the amount of blows on each meter of pile penetration were calculated. This made it possible to determine pile bearing capacity immediately after jacking for every meter of pile driving. 20 days after diving additional jacking was done in series of three and five blows. This gave opportunity to define pile bearing capacity by dynamic tests after its rest. And of course vertical load test was

carried out in a term of 20 days after dynamic load tests. Pile bearing capacity calculated by various methods is shown in table 1.

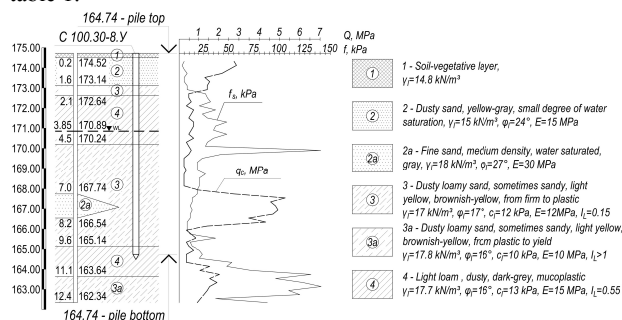


Fig. 1. Ground conditions of investigation site and depending  $H = f(Q)$  for toe and  $H = f(f)$  for shaft after static penetration tests

Table 1. Bearing capacity of pile determined by different methods

Type of pile bearing capacity determination	Ukrainian codes	Theoretical method KNUCA	Static penetration test	Dynamic tests during jacking	Dynamic test after pile rest	Static load test
Bearing capacity $F_d$ , kN	300	440	288	208	334	441
Deviation, %	0	+47	-4	-31	+11	+47

Pile bearing capacity determined according to Ukrainian codes, static penetration tests and dynamic testing after pile rest have deviation up to 11% in a comparison with each other. This mean that in given ground conditions they have almost the same efficiently. Dynamic tests during jacking has the biggest deviation up to 31% in a comparison with Ukrainian standards, and 112% in a comparison with static load test. This shows unsatisfactory dynamic test results and need carefully take into account results of dynamic testing during jacking.

It has been found that the pile bearing capacity determined according to static load test in 1.47 times higher than theoretical value determined according to Ukrainian codes.

The use of theoretical method developed in KNUCA and improved for given ground conditions in given area allows to construct a graph  $S = f(P)$ , which has satisfactory convergence with static field piles tests.

### References

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