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Denis Chemezov
Vladimir Polytechnic College
MEng, Honorary Worker of the Education Field of the Russian Federation, Academician of International
Academy of Theoretical and Applied Sciences, Lecturer, Russian Federation
https://orcid.org/0000-0002-2747-552X
vpc-science@yandex.ru

Grigoriy Klimenko
Vladimir Polytechnic College
Student, Russian Federation

Vladislav Markin
Vladimir Polytechnic College
Student, Russian Federation

Rodion Yurenko
Vladimir Polytechnic College
Student, Russian Federation

Marina Danina
Vladimir Polytechnic College
Student, Russian Federation

Aleksandr Popov
Vladimir Polytechnic College
Student, Russian Federation

Nikita Rybin
Vladimir Polytechnic College
Student, Russian Federation

Abubakr Khasanov
Vladimir Polytechnic College
Student, Russian Federation

Kirill Gureev
Vladimir Polytechnic College
Student, Russian Federation

ASSESSMENT OF THE DISPLACEMENT OF A CLAY LAYER DURING GEOTECHNICAL WORKS

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Abstract*: The displacement of a clay layer in the zone of plane vertical loading and within 5 meters from the loading zone was graphically presented in the article. The results of the study will be useful to engineers when performing geotechnical works.*

Key words*: a layer of clay, displacement, pressure, model.*

Language*: English*

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Introduction

Many engineers face the problem of a shallow clay layer when performing various geotechnical works. Clay is an elastic-perfectly plastic material [1-4]. The Mohr-Coulomb yield condition is used to calculate the compression deformation of the clay layer [5-7]. The reaction can be studied based on the associated or nonassociated flow rules of clay [8-10]. Thus, using this knowledge and powerful tools of computer engineering analysis, it is possible to determine the loads during the collapse of clay under the influence of compressive deformation on it.

Materials and methods

The method of determining the state of the clay layer in the plane loading zone consisted in creating a model of the clay layer with a length of more than 7 m and a depth of more than 3.5 m and subsequent loading with a vertical force. At the same time, the force on the clay layer model was applied at a length of 1.5 m. The reliability of the computer simulation results was ensured by setting the real properties of the clay layer model (Young's modulus – 207 MPa, Poisson's ratio – 0.3, cohesion – 0.069 MPa and angle of internal friction – 20 degrees). The calculation of the displacement of the clay layer under the action of a vertical load was carried out in a stationary mode for the loading zone and within 5 meters from the loading zone.

Results and discussion

The deformed model of the clay layer was measured in the direction of the load action. The measurement results were presented graphically in the Fig. 1. The first graph shows the dependences of the displacement of the clay layer on the applied load. The second graph shows the dependences of the displacement of the clay layer within 5 meters from the loading zone. Each dependence (highlighted in a different color) is linear.

With an increase in the vertical load from 0 to 1000 kPa, each subsequent dependence has a larger range of values for the displacement of the clay layer. The maximum displacement of the clay layer is 32 mm. The range of displacement of the clay layer at 500 kPa is more than three times less than at 1000 kPa. At the same time, the clay layer within 5 meters from the loading zone shifts with a lower intensity (up to 10 mm when exposed to a force of 1000 kPa in the adjacent zone).
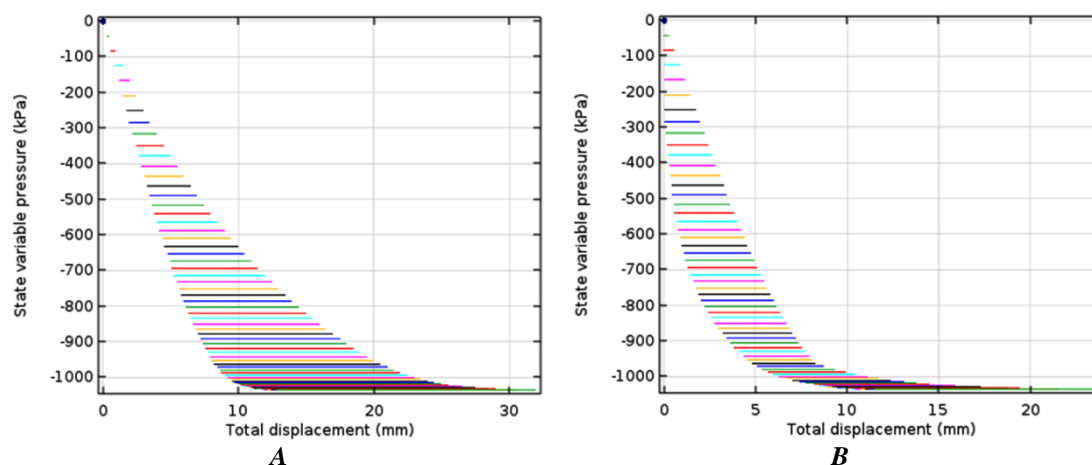

| A | B |

Figure 1. The dependences of the displacement of the clay layer on the effective pressure: *A* – in the action zone of the vertical load; *B* – within 5 meters from the loading zone.

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Conclusion

Based on the analysis of the experimental results, the following conclusions can be drawn:

1. In the zone of the load application from 0 to 1000 kPa, the displacement of the clay layer reaches 32 mm. Within 5 meters from the loading zone, the displacement range of the clay layer varies from 26 to 0 mm.

2. The largest range of total displacement of the clay layer from the minimum to the maximum values is observed at the highest pressure.

3. The dependences of the displacement of the clay layer in the load application zone are more proportional than the dependences of the displacement of the clay layer within 5 meters from the loading zone.

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