Influence of Soil Structure on Permeability and Consolidation Settlement

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Abstract: Based on unidirectional analysis of node and soil permeability, undisturbed and remolded soil, the calculation method of soil permeability coefficient and vacuum ratio is put forward according to the characteristics of soil permeability. According to the experimental analysis of soil control characteristics and the structure of the soil, the calculation method of the introduction is given, especially when calculating the commitment coefficient, the influence of the structure should be considered. This method avoids the defects of the traditional design method, and can be calculated and verified by technical examples.

1. Introduction

1.1 Permeability of Soil

Permeability tests of undisturbed soil and remolded soil were carried out. The soil sample used in the test is soft soil of section K26+325 of Dazhai expressway, and the redesigned soil sample is prepared from the soil sample without interference. In addition to the conventional test, the instrument can also measure the lateral stable pressure, the source water pressure and the soil permeability coefficient of the same soil sample simultaneously. It has advantages that traditional institutions do not have. All soil samples were saturated by vacuum technique. Implement physical specifications for saturated, undisturbed, and remolded soils. The water head variable method should be used to measure the soil permeability coefficient and stability after deformation under various load levels. In order to study the influence of undisturbed soil structure on permeability, a comparative test of undisturbed soil and remolded soil should be conducted at the same time. The results are shown in Table 1.[1-4]

Table 1 Physical Indicators Of Undisturbed and Remolded Soils

Soil Sample Category	consistency	initial void ratio	moisture content	liquid limit	plasticity index	liquidity index	Degree of saturation
Reshaping the Earth	2.06	0.597	21.39	47.1	25.1	0.23	0.98
Original soil	1.93	0.910	36.64	47.2	26.1	0.27	0.99

The relationship between soil permeability coefficient k0 and pore ratio e is shown in figure 1: the relationship between soil permeability coefficient and pore ratio e is shown in figure 2.[5-7]

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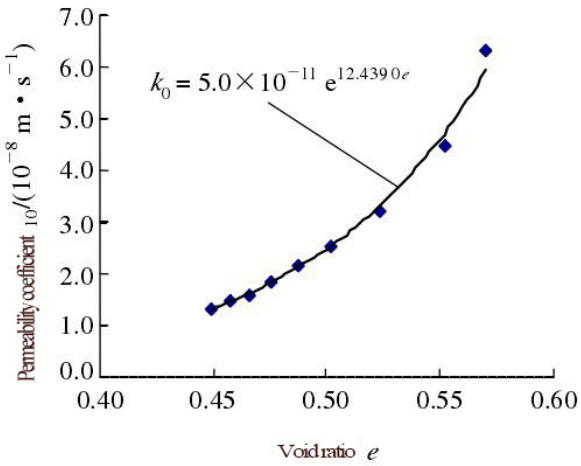

Fig .1 Relationship between Permeability Coefficient K0 and Porosity Ratio e Undisturbed Soil

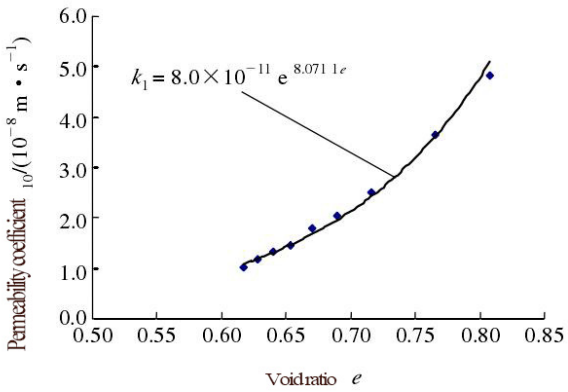

Fig .2 Relationship between Permeability Coefficient K1 and Pore Ratio e of Remolded Soil

The change trend of permeability coefficient of undisturbed soil and redesigned soil with vacuum ratio is further analyzed when the vacuum ratio c<1:0. The expressions of soil permeability coefficient $\mathbf{k_0}$ and vacuum ratio e are as follows:

$$\mathbf{k}_0 = me^{ne}$$

Formula: m,n are test parameters.

It can be seen from the test data of undisturbed soil and remolded soil that under different loads, the vacuum degree of reconstructed soil is higher than that of undisturbed soil, but the permeability coefficient of undisturbed soil is lower than that of undisturbed soil. The results show that under the same pressure condition, the release rate of water pressure of undisturbed soil resources is higher than that of supplementary soil, and the soil deformation required for time stability is smaller. The reason is that there is an air structure on the undisturbed ground, which forms a continuous permeable channel between the main resources and is highly permeable; while the soil particles formed again show irregular arrangement of space in the soil. Although the amount of resources is large, the poor connectivity makes the permeability coefficient small.[9-12]

Water head permeability tests were carried out on undisturbed soil and reclaimed soil. The relationship between permeability coefficient and hydraulic dip Angle is shown in Fig. 4. The permeability coefficient of both unaltered soil and remolded soil increases with the increase of hydraulic gradient, which is close to a linear relationship, indicating that the water resources flowing into the ground conform to Darcy's law roughly. However, under the same hydraulic inclination Angle, the permeability coefficient of undisturbed soil is higher than undisturbed soil, although the resource ratio is small, indicating that the resistance of resource water flowing into reclaimed soil is greater. This is mainly because the newly formed soil breaks the initial arrangement of soil particles, changes the form of resource allocation and increases the flow

resistance of water resources.

1.2 Soil Stress Characteristics

Under the action of external load, the untreated soil first plays a role, and the contact point between the soil particles and the welding material plays a role, that is, the structural strength of the soil plays a role. When the soil structure is completely destroyed, the compression curve of the undisturbed soil is similar to that of the remolded soil. According to the deformation mechanism of unaltered soil, the compression curve can be divided into three parts. The first part reflects that the structure of soil remains basically unchanged under the action of external load, with only a specific tire deformation under the action of load. The change of soil resources is small: in paragraph 2, if the stable pressure in the active soil is higher than the wind pressure before unification, the soil structure begins to change and the destruction is great. In addition to the collapse of the soil structure, it is accompanied by the sliding of soil particles. In the third part, the properties of soil are similar to those of reconstructed soil, and the slip of soil particles is the main reason for the deformation. Under the framework of load action, the degree of compression of remolded soil is undoubtedly related, and the elimination will lead to more contact points, thus improving the bearing capacity of soil. As can be seen from Figure 4, the voltage curve ratio is very high. Under the same constant pressure, the vertical gradient increases with the increase of stability. The change direction of the constant pressure of moving soil is about 500kPa, and the continuous pressure of soil is restored about 500kPa.

2. Calculation Method of Consolidation Settlement

2.1 Settlement Calculations

As shown in Figure 3,Under external load, the total settlement of foundation can be divided into three parts: instantaneous settlement, consolidation settlement and secondary settlement based on settlement deformation mechanism, that is $s = s_d + s_c + s_s$

The Sd is instantaneous settlement, the Sc is consolidation settlement, and the Ss is secondary consolidation settlement.Considering the undisturbed soil structure in the form of compression curve, the impact of this paper is divided into three stages deformation structure calculation, overload pressure in four stages in the current form, can be used as the first stage and the second phase, the separation point between the second and third line of separation between the point and its size shall prevail preconsolidation pressure, the second part of the curve in paragraph 5 of the corresponding linear position for consolidation pressure.

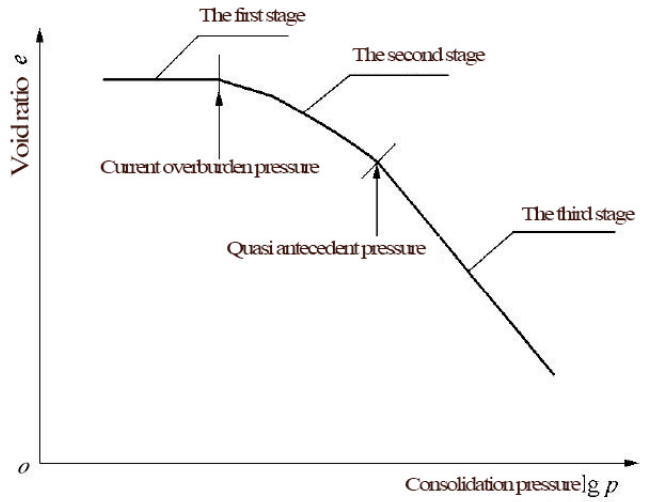

Fig.3 Schematic Diagram of Stage 3 Settlement Calculation

2.2 Conclusion the Analysis

Finally, when the consolidation pressure is greater than 200kPa, the embedding coefficient of both undisturbed soil and reclaimed soil increases with the increase of stable pressure, mainly due to the increase of constant pressure and the method of soil compaction. Second, although because of the influence of the structural, the smooth degree of the soil is relatively smaller than its resources, but the stability of a soil is greater than the soil reconstruction, in addition, the stability factor should be a turning point, the reason is that the first phase of deformation of consolidation of soil pressure in the rubber condensation stage, the soil structure is in complete condition, and when the consolidation pressure is greater than consolidation pressure, before gradually destroy soil structure, soil structure stability variation of soil skeleton collapse, resources structure collapse, change resource connection, water flow resistance increases sharply, therefore, embedding factor decreases gradually with the increase of consolidation pressure, embedding coefficient increases along with the change of soil unobstructed degree.

3. Conclusion

Through the calculation and analysis of engineering examples, the comprehensive layout calculation method based on the results of single line comprehensive test takes into account the structural effect which can better reflect the influence of the integrated soil structure of the structure on the consolidation of the house and draws the following conclusions,Check and compare the permeability of undisturbed soil and remolded soil respectively; The influence of soil structure on permeability coefficient is obtained, and the relationship between permeability coefficient and porosity ratio is given,The experimental analysis of the stress characteristics of soft soil structure should provide the calculation method of building deformation; Considering the structural characteristics.

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