

Study on Control Methods of Subgrade Deformation in the Yellow River Delta Area

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Abstract: The paper expounds and analyzes the control method of Subgrade deformation in the Yellow River delta area, points out that the source control of Subgrade deformation can effectively solve the subgrade deformation problem, and summarizes the source control method of Subgrade deformation.

Keywords: Yellow River Delta; Subgrade; Deformation control

1. Introduction

The Yellow River Delta region is located in the northern part of Shandong Province, near the Bohai Sea, the terrain is flat, the soil is mostly impacted by the diversion of the Yellow River, due to agricultural irrigation and seawater immersion, the coastal saline soil is widely distributed in this area, which belongs to the weak soil layer. Coastal saline soil contains a large amount of soluble salts, which mainly contain chloride, carbonate and so on. With the evaporation of water, the crystallization of salt precipitates, resulting in volumetric expansion of soil, damage to soil structure, salt expansion, resulting in irregular deformation of subgrade and pavement, seriously endangering the normal operation of the road safety; The dissolution of salt in soil leads to the formation of pore micro holes. Under the influence of gravity, the pore micro cavity decreases, and the soil structure is integrally sunken, resulting in Subsidence. Due to seasonal temperature changes, the formation of ice, ice crystal and ice freezing winter soil water, water ice volume increased, soil particles caused by relative displacement, leading to soil volume expansion in different degree, which causes the roadbed deformation.

In view of the deformation, transmission and final influence of road subgrade deformation in the Yellow River Delta area, based on the deformation whole process control theory, the deformation of subgrade is effectively prevented and controlled.

2. The Whole Process Control Theory Of Subgrade Deformation

The subgrade deformation system consists of three elements: deformation source, propagation path and target control[1]. The deformation of subgrade

excavation unloading caused by subgrade retaining structure to the retaining structure deformation caused by the displacement of soil and soil loss, and gradually transfer to the more distant from the soil subgrade, settlement in a certain period of time passed to the ground and buildings caused by ground and buildings[2]. The three components of subgrade deformation system constitute the whole process control method of subgrade deformation, that is, the source control of deformation, the control of deformation transfer process, and the individual control and control of target deformation. Subgrade deformation begins at the source of deformation. As long as the source of deformation is controlled, the subgrade deformation can not be generated and developed, thus effectively solving the deformation problem of subgrade, thus achieving the purpose of effective protection of Subgrade Engineering.

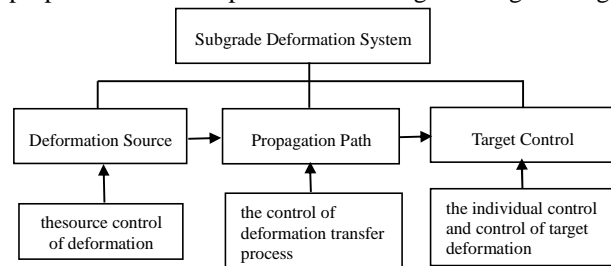


Figure 1. Subgrade Deformation System.

3. Control Method Of Subgrade Deformation Source

3.1. Space-Time Effect Construction Method

The deformation of retaining wall and the rebound deformation of subgrade are the source of soil deformation around the subgrade. Therefore, the key to control the deformation of a project is to control the

deformation of subgrade surrounding walls and the rebound of soil at the base of the road.

The Binzhou section of Jinan-Dongyinghighway is located in the Yellow River delta area, in order to avoid the support exposure time of the subgrade retaining wall exposed by excavation, in the process of roadbed excavation and filling, it is necessary to reduce the space size of each step excavation, improve the excavation speed, shorten the excavation time, give full play to the potential of soil body's resistance and deformation, and realize the interaction effect of time and space to control subgrade deformation. The main characteristics of this method are as follows: According to the main construction parameters selected by Subgrade Engineering design, the construction procedure and construction parameters of the excavation and support in detail can be put forward in accordance with the roadbed scale, geometrical size, support form, excavation depth, filling height and foundation reinforcement condition [3]. The excavation process and the basic support is developed according to the stratification, step by step, symmetry and balance principle, the construction of the most important parameter is the number of layers, each layer of the layered excavation depth, excavation and each layer of subgrade retaining wall soil in the passive area, did not support before the exposed wall width and exposure time and height. In the large soft soil subgrade, subgrade filling construction techniques and support: filling and pouring structure segments according to a certain length, each section of excavation in layers, each layer is divided into short to filling and supporting, filling and supporting the basic support at the same time, applying pre-stress, finish the construction time limit of excavation and support each section in a certain range

Both theory and practice show that along with the increase of subgrade filling height, the development of plastic zone around subgrade and the deformation rate of subgrade will increase correspondingly. So for the soft soil roadbed, along with the exposure time without support of foundation pit retaining wall space size, increase the filling depth should be properly reduced in each step of backfilling to reduce each filling exposed, in strict accordance with the principle of time-space effect organization construction, avoiding over digging and long shelving

3.2. Pressure Grouting In Passive Zone

Passive zone pressure grouting, refers to the roadbed and its surrounding environment deformation or deformation rate to reach or exceed the warning value, in the roadbed passive region from the wall closer to the area, the implementation of one or more double liquid stratified grouting, when the grout is injected into the soil, the pore water pressure in the soil is increased, the excess pore water pressure is produced, the soil pressure of the

passive zone of the wall will increase with the increase of the excess pore water pressure, and the wall will be pushed out of the hole. In addition, the slurry that flees to the wall will also squeeze the wall. The general wall is immediately moved outside the pit, and the displacement is determined by the grouting parameters [4]. The rebound of the wall will squeeze the soil, the porosity of the soil decreases and the density of the soil increases. After Grouting is finished, the pore water pressure will decay slowly over time, and the strength of the rapid-clotting grout is increased, which can limit the wall to the hole in the displacement, and if the retaining wall deformation has not been restored in the note slurry position or in the vicinity of the grouting, retaining wall will be back to the pit displacement, that can effectively control the displacement of the underground wall. Fig.2 shows the Sketch of pressure grouting in passive zone.

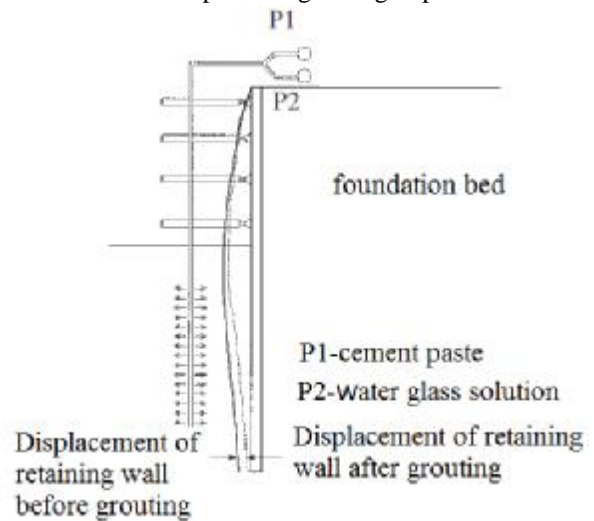


Figure 2. Sketch Of Pressure Grouting In Passive Zone.

The key of this method is the pressure effect of grouting on the retaining wall. In the concrete implementation, it is necessary to continuously adjust the grouting scheme according to the reflection of the retaining wall, and the local curvature of the retaining wall can not be destroyed because of the excessive pressure. Reflected in the design is the unit depth of injection, too much too small can not achieve the desired effect, before the construction, should use a small amount of grouting to do on-site test, through the monitoring Data Feedback analysis optimization parameters [5]. The position distance of grouting hole is generally between 1.5-2.0m, the pressure of grouting in soft soil in the Yellow River delta area is 0.4-0.6MPa. Because of the displacement of the retaining wall after grouting, we should pay attention to the additional support axial force after grouting to ensure the grouting effect.

2.3. Reinforcement Of Subgrade Foundation

The Roadbed Foundation reinforcement technology has been widely used in construction, road engineering and bridge engineering soft soil Foundation reinforcement, and has achieved good results. The reinforcement technology can not only strengthen the strength and stability of subgrade, but also shorten the construction period and reduce the investment of engineering by careful organization and strict management.

Through the roadbed reinforcement technology to the roadbed treatment, its action mechanism roughly has the soil substitution, soil improvement, soil reinforcement three categories, of which, the replacement of the soil, as the name implies, is to replace soft soil layers such as good quality soil, such as sand cushion layer; Soil improvement is based on the original roadbed through electricity, heat, mechanics, chemistry and other means, make roadbed soil consolidation, or increase the density of subgrade soil; the reinforcement of soil is to strengthen and improve the shearing characteristic of subgrade soil, and to use rope net, thin film, plank pile to restrain the roadbed soil, Or in the soil into the high tensile strength of the reinforcing material to form a composite roadbed, which greatly enhanced the strength of the roadbed [5].

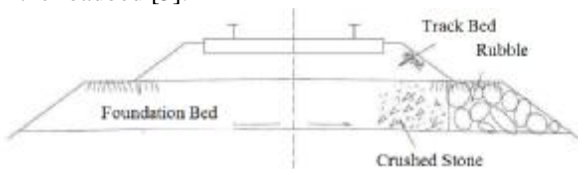


Figure 3. Surface Replacement Of Foundation Bed.

The salinity of soil layer in the Yellow River delta area is high, and the salinity is serious, which causes great damage to subgrade bearing capacity and deformation stability. In the concrete construction process, many uses

the soil replacement method to carry on the processing, simultaneously uses the organic improver to the soil improvement treatment, such as gypsum, the desulfurization stone and so on, has obviously improved the soil condition, from the source effective control roadbed deformation production and the development.

4. Conclusion

In the Yellow River delta area, the distribution of the weak soil layer and the saline soil layer has put forward higher requirements for the filling and construction of highway subgrade in this area, and the effective control of subgrade deformation is a common problem in many problems. Based on the whole process control theory of subgrade deformation, this paper expounds and analyzes the measures and methods of subgrade deformation, and the control of subgrade deformation source is very important to the prevention and control of Subgrade deformation.

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