

Review on Treatment Methods of Soft Soil Subgrade

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Abstract: In China's coastal areas and inland plains and Intermountain basin are widely distributed in different types of soft soil and its main characteristics is the foundation bearing capacity is low, the load deformation larger, which for the highway construction brings many engineering problems. The formation mechanism of soft soil in different regions is different, the characteristics and nature of the different, the role of the road is also different. On the other hand, is being built or already repaired the high grade highway, due to various reasons the subgrade strength low, subgrade settlement, pavement slab or pavement deformation and other diseases, especially bridge, channel back to Taiwan and the junction of the subgrade to both settlement of different, direct influence of the road roughness, linear smoothness and pavement structure stability. In this paper, the treatment method of soft soil subgrade is reviewed.

Keywords: Soft soil subgrade; Treatment method; Review

1. Introduction

In China's coastal areas and inland plains and Intermountain basin are widely distributed in different types of soft soil and its main characteristics is the foundation bearing capacity is low, the load deformation larger, which for the highway construction brings many engineering problems. The formation mechanism of soft soil in different regions is different, the characteristics and nature of the different, the role of the road is also different. On the other hand, is being built or already repaired the high grade highway, due to various reasons the subgrade strength low, subgrade settlement, pavement slab or pavement deformation and other diseases, especially bridge, channel back to Taiwan and the junction of the subgrade to both settlement of different, direct influence of the road roughness, linear smoothness and pavement structure stability. For high-speed vehicles, the safety, economy, comfort are affected, reducing the practicality of the highway, while the maintenance department has also brought a lot of inconvenience. Therefore, it has become an important factor to ensure the quality of highway to select the appropriate soft roadbed treatment method.

2. Soft Soil Subgrade Treatment, Reinforcement Principle

The soil is a multiphase dispersion system composed of different sizes and different components of soil particles. In terms of the composition intensity, the soil belongs to the dispersion medium, and the strength of the soil body is determined by the connection strength between the soil particles. From the integral strength of soil, play a decisive role is the frictional resistance between the soil particles and the cohesive force between soil particles.

Usually case, soil mineral has different degree of hydrophilicity, water immersion to soil and water strong interactions occur, resulting in soil particles around with water film thickening, especially diffusion layer structure relaxation of water the increase caused by soil Expansion. The presence of water and lubrication, reducing the frictional resistance between the soil particles. A lot of water into the soil. The soil moisture and water to form discrete, collapse phenomenon, reduce the stability of soil.

There are many factors that affect the stability of soil, mainly include the dispersion degree, the composition of the soil, the nature of the soil in the soil and the compactness of the soil. The greater the density of the soil, the smaller the porosity, the water is not easy to be immersed in the soil, so the water stability is better. From the characteristics of the soil, it can be known that the strength and stability of the soil are greatly influenced by the water content and density, which is also the key to the strengthening treatment.

There are many ways to reinforce the soil, according to the technical measures can be divided into: mechanical method, physical method, additive method, heat treatment, electrochemical method, etc.. The various processes that occur during the consolidation of soil are very complex and varied, depending on the nature of the soil and the type of binding material. Can be roughly summed up into three cases of chemical, physical and chemical process and physical process, according to the different reinforcement method for each of the above process will be dominated, but the three processes in contact with each other, with each other and mutual promotion among. It is generally said that the strength and stability of the soil can be improved completely by the chemical and physical processes. The physical process is

to accelerate and ensure the full occurrence of chemical processes and physical and chemical processes.

3. Strengthening Method of Soft Soil Foundation

3.1. Change Fill Method

Soft soil foundation reinforcement and treatment method are many, according to the mechanism can be summarized for the fill method, drainage consolidation method, squeeze compaction method, chemical strengthening method, geotechnical fabric, reinforced drying method, structural adjustment method etc..

Replacement method is the foundation of the weak layer of all or part of the replacement of high strength, good permeability of the material, can improve the bearing capacity of the foundation, reduce the amount of settlement. It is an effective method in the time limit for a project with a tight, high quality material source. Can be divided into the cut and fill method, riprap method, blasting method, cushion method.

When the soft layer is thin, and the surface is in the surface, the drainage construction is convenient, and the method can be used for digging and filling. In this method, the soft layer is removed, and the suitable material is used to fill and compaction. General dig depth should not exceed 2m.

By not less than 30cm rubble, from embankment in the middle to both sides of the throwing stones, so that the mud or soft soil extrusion and stay riprap surfaced after the application of small stones packing pad, with heavy duty roller compaction. This method used in drainage difficulties of the depression, the soft layer in a flow state, thinner thickness, surface crust and convenient stone.

Blasting is the explosives buried in the soft layer in the explosion, the mud or soft soil to fill out, the permeable soft good material. The depth of change of blasting method is large, and the work efficiency is high. Suitable for soft layer, thick, thick, wide embankment and tight schedule.

3.2. Drainage consolidation method

In consistency larger weak layer on the surface, mats to sand, gravel, crushed stone, lime, soil and other materials, fully after compaction formation has a certain stability of crust layer. Cushion can improve the bearing capacity and reduce the settlement, accelerated the weak layer of drainage consolidation to prevent frost heave, eliminate swelling soil swelling shrinkage effect. Drainage consolidation method is based on the consolidation theory in soft soil in the setting of drainage channels, through the pressure drainage to promote consolidation settlement, increase the shear strength. Commonly used methods are sand cushion, gravel cushion, sand well, sand bag well,

plastic drainage plate, precipitation preloading, vacuum preloading, preloading method, etc..

Sand drain is used drilling, sank to the bottom of the pipe or high pressure water jetting hole is formed in the ground, and then poured into coarse, medium sand, sand wells, three to the drainage consolidation, on the plane to rectangular or plum shaped arrangement. Bagged sand drain is slender, coarse sand into polypropylene bag into advance into the wells, and ordinary sand well compared, small diameter, light weight, simple construction equipment and easy operation. Sand is a whole, continuity and compactness, reliable quality, and has certain anti sliding ability. The prefabricated plastic board is inserted into the soft soil to form a vertical drainage channel which is similar to the sand bag sand well, and the top surface is paved with sand cushion or the drainage system. Plastic plate light weight, simple and easy to implement, easy to operate.

3.3. Compaction method

Compaction method is by compaction of foundation, improve strength and reduce the contraction to achieve the purpose of reinforcing, or in the foundation hammer hammer, vibroflotation, blasting etc. method into the hole, in holes were filled with sand, gravel, lime soil, lime, etc. materials. After compaction formation of large diameter pile, and pile and compaction of the soil together to form composite foundation, improve the subgrade strength. Dynamic consolidation method and dynamic consolidation method. It is 8 ~ 12t hammer and 8 ~ 20m gap, on the surface of strong tamping, the use of shock wave and dynamic stress of foundation soil compacted.

According to the compaction mechanism of soil and the factors affecting the compaction effect, different compaction machines and different compaction methods should be adopted for different soils. Usually, the moisture content, the subgrade compaction work higher and higher density, the higher the degree of compaction. In the holes filled with lime piece is formed by lime pile and lime pile in strengthening soft soil foundation of mechanism is lime water reacts, in the reaction process of lime can absorb a large number of soil pore water, the pile surrounding soil moisture content is reduced. At the same time, because the ceiling lime water volume expansion will make the soil compaction, lime and soil occurs mainly in the exothermic reaction, ion exchange, gelation and hardening of the pile body. So that the physical, mechanical properties and structure of the soil can be improved, which can improve the bearing capacity of the soil.

3.4. Chemical reinforcement method

Chemical grouting method is the use of chemical solution or cementing agent, by injection or infusion of measures by filling soil void, ion exchange, hard reaction, soil and soil particle cemented together, to achieve the purpose of

reinforced soil. Lime and cement, fly ash, hydraulic expansion of powder, dried aluminum hydroxide powder with admixture buried, mixing and RCC, thereby forming a shell layer, processing depth is less than 1.5m.

In order to improve the bearing capacity, the lateral movement of the lateral displacement of the ground body and the seepage flow of the interception underground are formed by the special mixing machine in the formation of the inner edge of the mixing and pressing to send the binding material. Rotary spray method is developed on the basis of grouting method. Construction of drilling depth to the design, with high pressure pulse pump through installed below the Kelly special sprayers spray chemicals into the soil and in the jet and the drill pipe to a certain speed provided, high pressure jet make within a certain range of soil structure is damaged, forcing soil and chemical grout mixture, cement hardening in soil formation more uniform diameter cylinder. The whole strength of soil is improved.

4. Concluding Remarks

For soft soil foundation treatment methods adopted should be considered according to different geological conditions, construction conditions, soil physical and mechanical properties, should also consider the construction convenience, feasibility and economy.

In many cases, the construction method of the construction of the stage is still a successful way to deal with the soft soil subgrade. On the one hand, it can be complex strengthening processing changing method for processing method is simple, on the other hand, a longer construction period, the consolidation settlement is mostly complete, in the construction of the road embankment deformation is small even without deformation. Therefore, the phased construction is a more economical way to deal with it.

With the continuous development of science and technology, new materials, new technology development and for soft soil foundation treatment method will be more and more, more and more economic, convenient and effective will be more conducive to the treatment of high grade highway roadbed, Expressway into full play the superiority.

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