

Influence of Collapsible Loess on Foundation and its Treatment Strategy

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Abstract: The properties of collapsible loess are complex. The self-gravity of overlying soil, self-gravity stress and additional stress act together, which will damage the soil structure and lead to the deformation of the soil structure. Collapsible loess is widely distributed in Northwest and Northeast China. A series of problems caused by its structural characteristics will affect the quality of foundation construction. Therefore, construction enterprises need to deeply study the foundation treatment measures of collapsible loess, so as to avoid the uneven settlement after the construction of collapsible yellow soil foundation. This paper analyzes from the judgment and classification of collapsible loess, studies the impact of collapsible loess on building foundation construction, and explores the specific construction treatment measures of collapsible loess, in order to promote the effective application of foundation construction.

Keywords: Collapsible loess; Foundation construction; Processing strategy; Constructional engineering

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1. Introduction

Collapsible loess is a kind of soil with special properties. When not subjected to the wetting action of water, the collapsible loess has higher strength and smaller compressibility, which can meet the requirements of construction. However, if the collapsible loess is soaked by water, the structure of the soil will suffer serious damage, resulting in the rapid reduction of the strength of the soil, it will inevitably cause a certain impact on the foundation construction of the construction project. Considering the construction characteristics of collapsible loess, construction enterprises should be very careful when carrying out project construction in the collapsible loess area. According to the relevant regulations, comprehensive treatment measures should be taken for the foundation construction to prevent the safety of the building from falling due to the water intrusion. Based on the characteristics of collapsible loess, construction enterprises can study the construction measures to deal with the structural change of collapsible loess in detail, so as to provide safety guarantee for the subsequent operation of buildings.

2. Judgment and classification of collapsible loess

From a geological point of view, the classification of collapsible loess is based on the classification standard of the collapsible coefficient. The symbol of subsidence coefficient δ_s refers to the situation that the collapsible loess layer of unit thickness will collapse under the action of corresponding pressure after being invaded by water. Technicians express it in numerical way, which is the symbol of subsidence coefficient. When technical personnel carry out loess collapsibility detection, if the collapsibility coefficient is greater than 0.015, it can be judged that the soil in the region belongs to collapsible loess. Collapsible loess can be detailed divided self-weight collapsing loess and non self-weight collapsing loess. The collapsible value of self-weight collapsible loess is more than 0.07m, and the measured value of non self-weight collapsible

loess is less than 0.07m. If the construction project cannot keep away from the collapsible loess area, the foundation must be built in the collapsible loess area to complete the construction task, then the technicians should also select the non self-weight collapsing loess area as the location of foundation construction as far as possible, which can relatively optimize the foundation construction quality of buildings. At present, relevant departments in China have formulated the construction code on collapsible loess, that is, the content of “Building Code for Collapsible Loess Areas” (GB50025-2004), in which, the collapsible loess collapsible grade is divided into three grades, the collapsibility of the first stage is in the range of 0.05-0.15; The collapsibility of the second stage is in the range of 0.15-0.35; the collapsibility of the third stage is in greater than 0.35. According to the requirements in the document “Building Code for Collapsible Loess Areas,” construction enterprises can accurately determine the level of collapsible loess according to the soil quality measurement in the construction area, and then formulate scientific countermeasures ^[1].

3. Influence of collapsible loess on foundation

In the collapsible loess paper construction foundation, the main influence is the stability of structure and foundation stability. Because the structural characteristics of collapsible loess are very obvious, belonging to the water physical properties of the cementing material, mainly composed by powder, and the surface of the powder attached to the material, the structural framework of collapsible loess is not stable. Or because of gravity factors, friction factors and other conditions, the larger grain size of the sand in the collapsible loess will continue to rise. After the erosion of water, collapsible loess intermediate workers of the soluble material will gradually soften until finally dissolved, the original stable structure will be destroyed, collapsible loess itself gravity and external pressure will form a joint action, resulting in collapsible loess structure deformation. Externally, the subsidence of collapsible loess will lead to the subsidence of the foundation of the construction project, and the instability of the foundation will affect the overall construction quality of the construction project, and may seriously lead to the collapse of the building ^[2].

4. Treatment measures of collapsible loess to foundation

4.1. Treatment of collapsible loess foundation in investigation stage

The research on collapsible loess in modern construction industry has sorted out a set of relatively effective treatment methods, which have been applied in Northern Shaanxi and other places. Even in collapsible loess areas, beautiful and safe buildings can be built after effective treatment. Technicians should pay attention to the stability construction of foundation from the survey and design stage in the early stage of construction, Take necessary treatment measures according to the actual situation. Before construction, geological survey must be carried out to provide information reference for subsequent construction drawing design. As a prerequisite for foundation construction, construction enterprises should study the engineering characteristics of buildings according to the geological conditions of foundation engineering, actively make use of the characteristics of foundation soil, carry out effective politics and transformation, put forward practical and feasible schemes, and then evaluate the economy rationality. In daily work, most of the foundation construction is based on theory and practical experience. Therefore, construction enterprises should abide by the construction supervision specifications of the industry, compare a variety of construction schemes to obtain the most appropriate construction plan, so as to achieve the goal of effective investigation ^[3].

4.2. Treatment of collapsible loess foundation in design stage

The construction of buildings shall be based on accurate geological survey report, draw relevant conclusions according to many information presented in the geological survey report, design construction drawings that meet industry specifications and building engineering needs, select foundation types and

foundation treatment methods that meet construction requirements, and further clarify the foundation structure of foundation part, and draw effective construction drawings. Technical personnel in the process of drawing design, can use the past successful experience, to strengthen the details of the drawing processing. For example, the basement floor of the foundation part of the building adopts the water-resistant plate, which does not follow the raft design idea. The thickness of the floor should be more than 300 mm, and the width of the reinforcement and its cracks may be squeezed due to the reaction force of the foundation, so the design width should be less than 0.2 m. The pile foundation of the foundation part needs to carry out the necessary testing of its own quality and the bearing capacity of a single pile foundation. The technical personnel should accurately describe the measurement method and quantity in the drawings, and not only explain the content of such and such specification document, but also express the detection method accurately and in detail in the drawings. When designing drawings, technicians need to ask more experienced old technicians or department leaders to deal with collapsible loess. Combined with the successful collapsible loess treatment scheme, the successful experience is summarized ^[4].

4.3. Treatment of collapsible loess foundation in construction stage

The treatment methods of technicians for the construction of collapsible loess foundation include cushion method, lime-soil compaction pile method and dynamic compaction method. These treatment methods are also different according to different construction requirements.

4.3.1. Cushion

Technicians need to remove the collapsible loess under the foundation, and then use plain soil and ash to backfill. Layered rolling can be used to consolidate the coating layer, replace the original part of the collapsible loess, and enhance the stability of the foundation. It can reduce the collapsibility of the collapsible loess, control the deformation index of the foundation, further enhance the load force of the foundation, maintain the stability of the water in the original foundation, and do a good job in the treatment of the whole soil cushion.

4.3.2. Time-soil compaction piles method

This method is more applicable to the collapsible loess area with groundwater content of 14% - 25%. The depth of the pile body is between 5-13m. The technicians use the method of impact and pipe sinking to make the building foundation surface arranged orderly, and then fill the pile holes with lime soil. After layers compacted and squeezed in, the collapsible loess soil structure around the pile body has changed. After the construction, the technicians checked the samples and found that the compaction degree of the soil and the strength of the pile had been significantly improved. However, technicians need to pay special attention to the quality of lime soil cushion, otherwise foundation collapse accidents are easy to occur.

4.3.3. Dynamic compaction method

Dynamic compaction method uses the impact force generated by the free-falling process of gravity hammer to tamp the collapsible loess structure and enhance the strength of collapsible loess. It has been widely used in the treatment of collapsible loess because of its fast treatment speed, low investment and convenient construction method. After being hit by heavy hammer, the collapsibility of collapsible loess itself is reduced. The collapsibility coefficient will also be significantly reduced to achieve the effect of consolidating the foundation.

5. Conclusion

With the development of modern society, the demand for buildings is increasing, and the construction operation will inevitably encounter the problem of collapsible loess. Construction enterprises should have the ability to deal with collapsible loess, summarize the treatment measures of collapsible loess, maintain the stability of foundation engineering construction, and formulate a treatment plan suitable for the situation

of collapsible loess in this area based on the survey results, so as to comprehensively reduce the collapsibility of collapsible loess and achieve the ideal construction goal.

Disclosure statement

The author declares no conflict of interest.

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