Research on the Importance of Hydrogeological Problems in Engineering Geological Exploration

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Abstract: Hydrogeology is an important factor affecting engineering quality. Groundwater undergoes physical or chemical reactions on soil and rock, and changes in groundwater level can also affect soil and rock structure and geological environment.To ensure the quality of engineering survey, it is necessary to carry out hydrogeological survey work, analyze the impact of groundwater on rock, soil and construction engineering, and at the same time, develop prevention and control plans.The analysis of hydrogeological problems can provide hydrogeological data for engineering geological design and construction, while avoiding hydrogeological hazards.This article analyzes the important significance of hydrogeological exploration in engineering geological exploration, and specifically discusses the impact of hydrogeology on engineering from the perspectives of groundwater level changes, rock physical properties, water pressure, and groundwater quality.

Keywords: Engineering survey; Hydrogeology; Geological survey; Impact research

In engineering geological exploration, hydrogeological issues are an important aspect, but they are also often overlooked.It is not uncommon for inadequate hydrogeological surveys to lead to groundwater hazards in geotechnical engineering.The damage caused by groundwater in construction projects has the characteristics of diversity, complexity, universality, and severity, leading to the harm caused by groundwater in construction projects.Therefore, conducting hydrogeological surveys on geotechnical engineering and evaluating the impact of groundwater on geotechnical engineering can provide necessary hydrogeological data for engineering design and construction, avoiding the impact of groundwater on geotechnical engineering.

I. Content of hydrogeological evaluation

1. Hydrogeological evaluation content in engineering geological survey

Engineering survey needs to be combined with engineering design and construction to carry out overall design. It is not uncommon for inadequate survey to cause sinking of engineering foundations and cracking of buildings.Organizing relevant engineering reports and analyzing them can summarize rich experiences and lessons learned.The evaluation of hydrogeological issues in engineering exploration should be coordinated in three aspects: first, analyze the role and impact of groundwater on geotechnical engineering, evaluate potential hazards of geotechnical engineering, and propose corresponding prevention strategies.Secondly, based on the design drawings of the engineering building and the type of foundation, relevant hydrogeological data should be organized.Thirdly, connect with the construction situation of the project, analyze the effects and impacts of groundwater on the project under different conditions, and analyze possible geological problems that may occur under various conditions, such as the corrosion effect of groundwater on the underground part of the project;An analysis was conducted on the application environment of rock and soil materials with weak resistance to corrosion and erosion, and the degree of influence of groundwater activity on the softening, disintegration, and expansion of the aforementioned rock and soil was evaluated;An analysis was conducted on the possibility of groundwater induced erosion, sand flow, and piping in the silty soil within the range of the foundation compression layer;Calculation and evaluation of the impact effect of pressurized water during excavation of foundation pits;Excavation of foundation pits below groundwater level, evaluation of groundwater permeability and water richness, and assessment of the likelihood and degree of soil freezing settlement and slope instability under artificial precipitation environment.

2. Hydrophysical properties of soil and rock

The hydraulic properties of soil and rock refer to the various properties exhibited by soil and rock under the influence of groundwater. In engineering geological properties, both the physical and hydraulic properties of rock and soil are important properties.The hydraulic properties of soil and rock are important influencing factors on the strength of soil and rock, and therefore are also important factors affecting the stability of buildings.In the past, engineering geological survey work focused on testing the physical and mechanical properties of rock and soil, while water properties testing was not given enough attention, which led to an unscientific evaluation of the geological properties of rock and soil engineering.

Due to the fact that the water physical properties of soil and rock are manifested by the interaction between soil and groundwater, it is necessary to first analyze the occurrence form of groundwater in soil and rock to clarify what kind of impact soil and rock will be affected.

Groundwater can be divided into three types based on its occurrence in soil and rock: bound water, capillary water, and gravity water.

This article selects several typical methods to conduct a detailed analysis of the hydraulic properties of rock and soil, and introduces their research and testing methods.

The main water physical properties of rock and soil are softening properties;Permeability, disintegration, water supply, expansion and contraction, etc.This article analyzes these five properties as examples.Softening refers to the softening effect of groundwater on rock and soil, which reduces the mechanical strength of the rock. Softening is represented by the softening coefficient and is an indicator of

the rock's water resistance.The softening coefficient of cohesive soil layers, mudstones, shale, and mudstone sandstone is relatively high, and they belong to easily softened rock layers.The easily softened rock layers in the rock layer form weak interlayers under the softening effect of groundwater.Permeability refers to the ability of water to penetrate into the interior of rock and soil under the influence of gravity. The looser the rock and soil structure, the coarser the particles, and the stronger the permeability.Rock cracking and karst development are important factors for enhancing rock permeability.The permeability is expressed by the permeability coefficient, which is generally measured by pumping tests to determine the permeability of rocks;Collapsibility refers to the characteristics of rock and soil collapse and disintegration caused by the softening and infiltration of groundwater, which leads to the destruction of the internal structure of rocks, a decrease in the viscosity and attraction between particles.The disintegration of soil and rock is usually strongly related to factors such as particle size, mineral composition, and internal structure.For example, the residual soil in Guangdong region usually disintegrates for 5 to 24 hours, with a disintegration amount of 1.79 to 34. The disintegration methods include split disintegration and scattered disintegration, such as montmorillonite, hydromica, kaolin, etc., which are scattered disintegration, while quartzite is mostly split disintegration.Water content refers to the ability of rocks to absorb water freely from the soil due to the action of gravity, usually expressed as water content. The water yield can serve as an important performance reference index for aquifers, directly affecting the drainage time of the site.Swelling and contraction refer to the expansion and contraction properties of rocks that increase in volume after absorbing water and decrease in volume after losing water. This expansion and contraction is caused by the thickening of water molecules on the surface of rocks that absorb water and lose it.The expansion and contraction of rock mass is one of the main factors causing ground cracks and excavation uplift, which directly affects the deformation of the foundation and the stability of the soil slope surface. The shrinkage can be expressed by expansion rate, free expansion rate, volume shrinkage rate, shrinkage coefficient, etc.The water physical properties of rock and soil also include water holding capacity, water solubility, capillary properties, plasticity, etc., which will not be elaborated here.

II. The Impact of Groundwater on Engineering Geological Hazards

There are four main causes of the destructive effect of groundwater on geotechnical engineering: first, the fluctuation of groundwater level; second, the dynamic water pressure of groundwater; third, the impact of groundwater pressure on geotechnical engineering; and fourth, the impact of groundwater quality on geotechnical engineering.

1. The impact of groundwater level fluctuations on geotechnical engineering

In surveying, attention should be paid to the changes in groundwater conditions and the rise and fall of its water level.In natural conditions, groundwater has a seasonal variation characteristic, with groundwater levels rising during the rainy season and decreasing during the dry season.The natural changes of groundwater have regional characteristics, with similar changes within certain regions and significant differences between different regions.However, in recent years, human activities have caused increasing fluctuations in local groundwater levels, and the magnitude of changes caused by human activities is much greater than that of natural changes.(1) The destructive effects of elevated groundwater level on geotechnical engineering are as follows.The soil shows a trend of swampification and salinization, and the soil and groundwater strengthen the erosion of buildings;Landslides, collapses, and other adverse geological phenomena occur in rocks and soil such as slopes and bank slopes;Some rock and soil structures with special properties have undergone damage, with reduced strength and softening;Causing phenomena such as saturated liquefaction of silt and silt, and producing flowing sand piping;The underground cavern is flooded, the foundation is floating, and the building is unstable.There are many factors that can cause the water level to rise, including geological factors such as aquifer structure and rock mass properties;The impact of hydrological and meteorological factors such as precipitation and temperature, as well as human activities such as irrigation and construction, is often a combination of multiple factors in some cases.An increase in diving level can also cause displacement of the foundation of a building, or cause internal deviation of the building, or lead to cracks in the walls of the building.(2) The impact of groundwater subsidence on geotechnical engineering: it can cause geological disasters such as ground fissures, collapses, and also lead to ecological problems such as depletion of groundwater sources and deterioration of water quality, posing a great threat to the stability of soil, buildings, and the living environment of residents.The main reasons for the decrease in groundwater are: large-scale exploitation of groundwater, sediment discharge caused by mining activities, and upstream dam construction and reservoir blocking the recharge of downstream groundwater.The harm of construction projects to production and domestic water consumption is very high. Some mining areas drain groundwater for mineral extraction, and upstream dams impound water, causing insufficient replenishment of downstream groundwater, all of which can lead to a decrease in groundwater level.Excessive decrease in groundwater can cause surface cracking, subsidence, and collapse in construction areas. In addition, a decrease in groundwater level can lead to difficulties in water intake and deterioration of water quality, resulting in poor stability of construction projects and deteriorating production and living conditions.

In short, diving positions are very important for construction projects.In the process of engineering construction, hydrogeological problems often lead to construction interruptions, thereby affecting the efficiency and quality of engineering construction.To solve this problem, corresponding measures must be taken.

2. The influence of groundwater on the physical and mechanical properties of rocks

The fluctuation of groundwater level can lead to non-uniform expansion and contraction deformation of expansive rock and soil. Once cracking occurs, it can cause harm to buildings, especially low rise or lightweight buildings.When the groundwater level fluctuates significantly or is high.It not only causes repeated expansion and contraction deformation of the soil, but also increases the expansion and

contraction rate of the soil.Therefore, when conducting engineering surveys in the expansion zone, it is necessary to pay attention to the study of the hydrogeological conditions of the above-mentioned areas, especially the fluctuation law of groundwater, which has important guiding significance for clarifying the groundwater level and its range of change.

In construction projects, if the groundwater depth at the bottom of the foundation pit's compressed layer changes, it will have a direct impact on the stability of the building.When the water level rises in the compression zone, the foundation soil will soften, thereby reducing its strength and compressibility, leading to significant settlement of the building.

Above the groundwater level, in the groundwater level fluctuation zone, and below the groundwater level, there are variations in the natural moisture content, porosity from small to small, compressive modulus, and bearing capacity of soil from top to bottom. This is because, under the long-term leaching of groundwater, a large amount of iron and aluminum components accumulate in the soil, cementing and filling the soil, increasing the bonding force between the soil, often forming a "hard shell layer". As a result, under the active replacement of groundwater, the iron and aluminum components in the soil are lost, the soil becomes loose, the water content and porosity increase, and the compression modulus and bearing capacity decrease.

For certain soft rocks, weathered residual soil, and clay of various origins, the changes in their strength characteristics are closely related to the action of groundwater.It can be said that groundwater is the main factor affecting the changes in the physical and mechanical properties of rock masses.

3. The influence of hydrodynamic water pressure on geotechnical engineering

Under natural conditions, the dynamic water pressure of groundwater is relatively weak, but under the influence of human engineering activities, the dynamic balance of groundwater itself is disrupted. Under specific dynamic water pressure, it often leads to a series of geotechnical engineering disasters, such as sand surging, pipe surging, and foundation pit water inrush.In engineering construction, due to the lack of detailed analysis and investigation of hydrogeological conditions, a large amount of quicksand is generated during construction, or a large amount of groundwater gushing is common. Both of these changes can cause damage to the surface structure, and appropriate remedial measures must be taken. Both will increase project costs and reduce enterprise profits.

4. The impact of groundwater quality on geotechnical engineering

Groundwater may have been contaminated without people's awareness, and groundwater pollution will continue to affect the development of engineering.The excessively acidic or alkaline chemicals generated in polluted groundwater can cause acid-base reactions in soil, stones, structures, etc., thereby shortening their service life and seriously threatening the safety of construction projects.

Epilogue

Hydrogeological issues are an important part of geotechnical engineering exploration. Identifying groundwater levels and evaluating hydrogeological issues can not only provide more reliable hydrogeological data for design and construction, but also more efficiently apply the potential capabilities of rock and soil.Therefore, in order to ensure the quality of engineering survey, it is necessary to identify hydrogeological issues related to geotechnical engineering, in order to eliminate the harm of groundwater to geotechnical engineering. With the development of engineering survey and the increasing level of engineering and technology maturity in the future, hydrogeological issues will inevitably receive more and more attention.

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