RESEARCH ARTICLE

Brief Analysis of Engineering Geological Monitoring

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Abstract: The dynamic observation of various geological processes must be carried out on the basis of clarifying the geological conditions, so that the development conditions and the main factors affecting development can be identified based on the observation data, and the similar geological processes in areas with similar engineering geological conditions can be predicted based on the observation data dynamic.
Keywords: Geological monitoring; Rock and soil; Groundwater

Citation: Fangfang Wang. 2018. Brief Analysis of Engineering Geological Monitoring. *International Journal of Geology*, 3(1): 20-23. http://doi.org/10.26789/IJG.2018.01.005

1. Monitoring of Rock and Soil Properties and Conditions

On-site monitoring of rock and soil properties and conditions can be summarized into two aspects: observation of rock and soil deformation and observation of internal stress of rock and soil. If the engineering needs to monitor the rock and soil mass, the monitoring contents of the rock and soil mass should include the following three aspects: ① Convergence measurement of cavern or rock slope; ② Rebound measurement of deep foundation pit excavation: ③ Measurement of earth pressure or rock mass stress.

The monitoring of rock and soil properties is mainly applied to the monitoring of landslide and collapse deformation, the monitoring of surrounding rock deformation of caverns, the monitoring of land subsidence and goaf collapse, the monitoring of various construction projects during construction and operation and the monitoring of the environment.

1.1 Deformation Monitoring of Rock and Soil Mass

Deformation monitoring of rock and soil can be divided into ground displacement monitoring, cave wall displacement monitoring and internal displacement monitoring of rock and soil.

1.1.1 Monitoring of Ground Displacement and Deformation

The main methods are as follows: (1) Repeatedly observe the changes of direction, level and vertical distance of each measuring point with theodolite, level meter or photoelectric rangefinder, so as to judge the change of ground displacement vector with time. The measuring points can be arranged into observation lines and nets in different forms according to specific conditions and requirements, and generally, the positions with complex conditions and large displacement should be properly encrypted; ② Aerial photography or global satellite positioning system can also be used to monitor large-scale ground deformation; ③ Simple methods such as extensometer and inclinometer are used for monitoring; (4) use steel ruler or tape measure to observe the change of measuring points, or use stickers to know the opening of cracks. The monitoring results should be arranged into a relationship curve of displacement changing with time, so as to analyze the change and trend of displacement [2].

1.1.2 Monitoring of Displacement and Deformation of Tunnel Wall

The measurement of the distance change between two points on the surface of rock mass in cave walls is realized by convergence measurement, which is used to understand the relative deformation between cave walls and the development and change of tensile cracks on slopes, and then to evaluate the engineering stability trend and predict the failure time. The measuring method can be simply and directly measured with steel tape by using a special convergence meter. Convergence meters can be divided into vertical direction, horizontal direction and inclined direc-

tion, etc., and the deformation in vertical, horizontal and inclined direction is measured with tools respectively [3].

1.1.3 Monitoring of Internal Displacement and Deformation of Rock and Soil Mass

At present, pipe strain gauge, inclinometer and displacement meter are commonly used to accurately measure the internal displacement change of rock and soil mass, and all of them need to be monitored by drilling holes. Tubular strain gauge is a kind of resistance strain gauge attached to PVC pipe at a certain distance, and then embedded in the borehole, which is used to measure the deformation of the pipe caused by the internal displacement of rock and soil. Inclinometer is a device for measuring the bending of borehole, which fixes sensors at different positions of borehole to measure the deformation to a predetermined degree, so as to know the deformation of rock and soil at different depths. Displacement meter is a device to determine the deformation of rock and soil mass by measuring the elongation of metal wire. Generally, multi-layer displacement measurement is adopted, in which metal wire is fixed on rock and soil mass at different horizons, and its end is fixed on the deep immobile body, so as to measure the displacement and deformation of rock and soil mass at different depths with time.

1.2 Stress Monitoring Inside Rock and Soil Mass

Stress monitoring in rock and soil mass is realized by means of pressure sensor device, which is usually buried on the contact surface between structure and rock and soil mass or embedded in rock and soil mass. At present, most of the pressure sensors used in the world are pressure boxes, including hydraulic pressure type, pneumatic pressure type, steel string type and resistance strain type, among which the latter two are more commonly used. Since pressure observation is carried out during construction and operation, and there is mutual interference, it is necessary to prevent the measuring device from being damaged. In order to ensure the reliability of the measurement data, the pressure box should have sufficient strength and durability, and the compression and decompression lines are good, which can adapt to the changes of temperature and environment and remain stable. When burying, the disturbance to rock and soil should be avoided, and the properties of backfill should be consistent with the surrounding soil. Through regular monitoring, the data of rock and soil pressure changes with time can be obtained.

1.3 Monitoring of Adverse Geological Processes and Geological Disasters

In the process of engineering construction, due to various internal and external factors, such as landslide, collapse, debris flow, karst, etc., these adverse geological processes and geological disasters will directly affect the safety of the project and even the safety of people's lives and property. Therefore, it is indispensable to monitor the above-mentioned unfavorable geological processes and geological disasters in the current engineering construction.

The purpose of monitoring adverse geological processes and geological disasters is to correctly judge and evaluate the harmfulness of existing adverse geological processes and geological disasters, monitor their impacts on environment, buildings and people's property, and forecast the occurrence of disasters; The second is to provide scientific basis for disaster prevention and control; The third is to predict the occurrence and development trend of disasters and test the effects after remediation, so as to provide experience and lessons for future prevention and prediction.

According to different adverse geological effects and geological disasters, the monitoring contents of geological disasters should include the following aspects.

(1) The conditions that should be monitored for adverse geological effects and geological disasters are as follows: (1) When there are adverse geological effects or geological disasters in and around the site, which may endanger the safety or normal use of the project; (2) the construction and operation of the project may accelerate the development of adverse geological processes or cause geological disasters; ③ When the construction and operation of the project may have significant adverse effects on the nearby environment.

(2) The contents to be monitored in karst cave development area are: ① ground deformation; ② Dynamic change of groundwater level; (3) pumping conditions in and around the site; ④ Influence of groundwater level change on soil cave development and collapse.

(3) Landslide monitoring should include the following contents: ① Displacement of landslide body; ② Position and dislocation of sliding surface; ③ occurrence and development of landslide cracks; ④ underground water level, flow direction, spring water flow and pore water pressure in landslide zone; ⑤ The occurrence and development of displacement, deformation and cracks of retaining structure and other engineering facilities.

(4) When it is necessary to judge the stability of the collapsed exfoliated body or dangerous rock, the tensile