

# *Research on Engineering Geological Survey of Water Conservancy and Hydropower and Geotechnical Engineering Survey of Buildings*

Can Deng\*

*Design Department, Shenzhen Shenshui Water Consulting Co., Ltd., Shenzhen, China  
hp607818@163.com*

*\*Corresponding author*

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**Abstract:** Firstly, the research objects and contents of engineering geology and geotechnical engineering are compared. Secondly, the contents and methods of water conservancy and Hydropower Engineering Geological Survey and architectural geotechnical engineering survey are described. Finally, the differences in various aspects between the two projects are introduced. From this, it is concluded that there is an essential distinction between water conservancy and Hydropower Engineering Geological Survey and building geotechnical engineering survey.

## **1. Introduction**

In the early 1950s, China was faced with the problem of development. Therefore, China learned and absorbed the theories and methods of the Soviet Union in engineering geology, at the same time, integrated them, continued to practice and innovate in methods and theories, and finally formed engineering geology with Chinese characteristics. Especially in the water conservancy and hydropower industry [1], China's engineering geology is in the leading position in the world. The geotechnical engineering in China developed continuously with the "third line construction" in the 1960s and 1970s.

This paper will introduce the research objects and contents of engineering geology and geotechnical engineering, describe the contents and methods of water conservancy and Hydropower Engineering Geological Survey and architectural geotechnical engineering survey, and introduce the differences in geotechnical and soil quality between the two projects, so as to draw the essential distinction between the two.

## **2. Research Objects of Engineering Geology and Geotechnical Engineering**

The discipline of engineering geology mainly reveals the interaction between engineering construction and various geological bodies related to human activities. Therefore, for engineering geology, its research object is a variety of engineering geological problems. [2] Generally speaking, engineering geological problems are related geological problems caused by human engineering

activities. By discussing the geological conditions and conditions of these problems and finding their internal development laws, people can correctly treat and treat these problems, further avoid the negative effects of these geological problems in advance, and finally provide accurate and objective geological data and information for human beings, Make human beings better live in harmony with nature.

Geotechnical engineering is a branch of civil engineering, which mainly uses a series of disciplines such as engineering geology to solve some engineering problems about rock and soil in various projects. Its research object is about the engineering problems of rock mass and soil mass. With the continuous growth of the world population and the faster and faster urbanization process, people will find new living space for survival and development, and the discipline of geotechnical engineering will have better development to help people constantly develop new living space.

Through the introduction of the research objects of engineering geology and geotechnical engineering, it can be found that the research objects of engineering geology are more extensive, far more than geotechnical engineering.

### **3. Research Contents of Engineering Geology and Geotechnical Engineering**

Engineering geology is an applied discipline, and its main task is to solve various geological problems in engineering construction, so as to ensure the smooth completion of the project. [3] The specific research contents are as follows:

(1) Understand and master the structures of various projects, understand their importance, understand the requirements of these projects and the geological requirements in the construction process, and select the site suitable for engineering construction from the perspective of professional geology.

(2) Study and understand the interaction and development law of various projects with geological and geographical environment in the process of construction and maintenance, and make corresponding predictions as soon as possible for various adverse geological problems that may occur, and put forward reasonable solutions.

(3) It can observe the evolution of various geological processes in the process of human activities, so as to come up with corresponding protection and transformation countermeasures.

The main research contents of geotechnical engineering are as follows:

(1) Solving various geotechnical engineering problems caused by the utilization and development of underground space can make efficient and reasonable use of underground space.

(2) Aiming at the engineering of slope and foundation pit, the theory and practice are applied.

(3) For the foundation engineering related to the foundation, the model and parameters are studied.

Through the introduction of the research contents of engineering geology and geotechnical engineering, it can be found that geotechnical engineering belongs to a branch of engineering geology.

## **4. Contents and Methods of Geological Investigation of Water Conservancy and Hydropower Projects**

### **4.1. Contents of water Conservancy and Hydropower Engineering Geological Survey**

#### **4.1.1. Carry Out Groundwater Detection and Hydrogeological Survey**

As a part of the geological environment, the change of groundwater level and pressure will directly affect the stability and durability of the foundation of water conservancy and hydropower

projects. When the groundwater level continues to rise, geological pressure will also continue to rise; when the water level of groundwater continues to decline, the geological pressure will also continue to decline; the frequent fluctuation of groundwater level will cause the geological pressure to fluctuate back and forth. This will eventually lead to crustal deformation, accompanied by changes in the geological environment. Changes in the environment will cause the deformation and collapse of buildings on the surface, so the detection of groundwater should be carried out.

Hydrogeological survey is mainly to investigate some geological and geomorphic features; Understand how groundwater is distributed, and grasp the relationship between groundwater and surface runoff; Fully study the role and impact of groundwater on water conservancy and hydropower projects; It can predict and protect some water conservancy and hydropower projects in time. Therefore, if hydrogeological survey is ignored by people, it will seriously threaten the safety of water conservancy and hydropower projects.

#### **4.1.2. Engineering Geological Mapping**

Engineering geological surveying and mapping is a basic work in water conservancy and hydropower engineering geological survey. It is to analyze the engineering geological process and its possible impact on the project through geological surveying and mapping. Generally, after field investigation, combined with the terrain, landform and hydrological conditions, the comprehensive application of relevant geological knowledge, and geological mapping in the target area.

#### **4.1.3. Long Term Observation**

In the construction process of water conservancy and hydropower projects, the geographical and geological conditions will change with the change of time and environment. For safety, it is necessary to carry out long-term observation on the construction of water conservancy and hydropower projects, and conduct corresponding analysis after observation, so as to draw a conclusion. The purpose of observation is to ensure the safety of water conservancy and hydropower projects and provide authoritative data for future water conservancy and hydropower projects.

### **4.2. Methods of Geological Investigation of Water Conservancy and Hydropower Projects**

#### **4.2.1. Adopt GPS Technology**

With the continuous progress of science and technology, GPS has been widely used in water conservancy and hydropower engineering geological survey. By using GPS technology, people can accurately determine the coordinates of observation points; compared with traditional measurement methods, GPS has the characteristics of convenient operation; at the same time, GPS can carry out survey work accurately for a long time; Finally, GPS technology can be directly connected with computers to transmit and analyze data through computers. In order to ensure the construction of high-quality water conservancy and hydropower projects, operators should master GPS technology.

#### **4.2.2. Adopt RS Technology**

RS technology is remote sensing technology. The characteristics of remote sensing technology are rich information resources, super three-dimensional sense, broad field of vision and the advantages of rapid data collection. [4] In view of the above advantages of RS technology, RS technology is often used in the construction of water conservancy and hydropower projects. Through RS technology, the staff can collect many basic geological information. After collecting

and analyzing the information, the staff can grasp and control the overall geological conditions, so as to ensure the smooth implementation of the project. According to the information provided by RS, it can ensure the quality of water conservancy and hydropower projects in real time and accurately and also provide information guarantee for the later maintenance of the project.

#### **4.2.3. Using GIS Technology**

GIS technology is geographic information system, which can not only collect and store geographic information, but also analyze, display and describe the data of geographic information. In the geological survey of water conservancy and hydropower projects, the staff can use GIS to depict relevant engineering geological images, and can also analyze the collected information in real time.

#### **4.2.4. Engineering Geophysical Exploration Technology**

The foundation of engineering geophysical exploration technology is to use observation instruments and geological theories to process and analyze the collected information. In the construction process of water conservancy and hydropower projects, Zhang uses this technology to obtain extremely high data accuracy. Engineering geophysical exploration technology can determine the geological structure and attributes of the construction site of water conservancy and hydropower projects.

### **5. Contents and Methods of Building Geotechnical Engineering Investigation**

#### **5.1. Contents of Building Geotechnical Engineering Investigation**

##### **5.1.1. Make Initial Preparations**

When carrying out the survey of building geotechnical engineering, the initial preparation is very necessary. Whether the initial preparation is sufficient or not will affect the quality of the whole building geotechnical engineering survey to a certain extent, and can also have a significant impact on the quality of the project. Therefore, before carrying out the survey task, the relevant survey staff must formulate the corresponding survey plan and relevant task plan, and collect and summarize a variety of data in a timely manner in all aspects and fields, so as to make the engineering survey work proceed smoothly. The survey staff should conduct extensive and profound research and Discussion on the design drawings, and timely and effective communication with relevant design units, so as to correctly grasp the actual situation of building geotechnical engineering. And the staff should also conduct a comprehensive investigation and investigation on the site of the project implementation to reduce the impact caused by external factors.

##### **5.1.2. Set reasonable Drilling Distance**

In the geotechnical investigation of buildings, it is particularly important to set a reasonable drilling spacing. Because the length of drilling distances will directly affect the stability of the structure of the building. For this reason, the survey staff should constantly adjust according to the corresponding national construction standards and the actual survey results during the specific implementation of the project, and finally ensure that the spacing of boreholes meets the relevant national standards and requirements.

### **5.1.3. Ensure the Stability of Hole Depth**

In the geotechnical investigation of buildings, the stability of the drilling depth is also the focus of the investigation work. For example, in a residential area, the decline of the foundation of a house that has been built for many years has led to a whole building leaning on one side, and the walls of residents' homes have also cracked to varying degrees. In view of this, the staff carried out the later investigation work. Through the investigation, the staff found that the decline was precisely due to the shallow bearing layer of the hole depth. In order to avoid this situation, before the construction of the building, it is necessary to put forward requirements for the maximum bearing capacity of the hole depth according to the structure of the corresponding building geotechnical investigation. In general, the depth of the hole should be between five meters and eight meters below the bearing stratum, so as to prevent the adverse impact of geology on the bearing stratum where the pile end is located.

## **5.2. Methods of Building Geotechnical Engineering Investigation**

### **5.2.1. Engineering Geological Drilling Technology**

Using engineering geological drilling technology in specific geological exploration work, the staff can help the investigators effectively detect and analyze the geological and geographical conditions of the engineering construction area. [5] Using geological drilling technology in the construction of the project, the survey staff can comprehensively collect the data information of the underground rock and soil layer in the relevant construction field, and then combine it with the relevant physical parameters, so as to analyze the conditions of the rock and soil layer, and record it at the same time, and provide data reference for the design and implementation of the project according to the recorded information.

### **5.2.2. Sampling Technology**

In the relevant construction geotechnical investigation work, the staff must carry out the important step of sampling. In the investigation work, there are also high requirements for the staff's sampling technology, and it is necessary to ensure the integrity of the sample structure. In the process of sampling experiment, the operator should operate in strict accordance with the specified sampling standards. The corresponding sampling conditions are mainly divided into undisturbed conditions and completely disturbed conditions. The operator should avoid the first condition to the greatest extent. At the same time, sampling technology also has high requirements for containers and tools, so we should choose appropriate containers and tools according to local conditions for related operations and experiments.

### **5.2.3. Using Computer Related Technology**

With the continuous improvement and development of computer technology, this technology is gradually applied in all aspects of the social field. People use computer technology in the construction geotechnical engineering survey, which can greatly improve the collection and processing speed of geotechnical information. The first step of the survey staff is to collect the geographical location information and data of the area surveyed. When carrying out this work, we can combine 3S technology to carry out a simple analysis of geographical and geological conditions. At the same time, we can use GPS and RS technology to obtain more relevant data, and then continue to carry out experiments and analysis to obtain accurate data, so as to ensure the smooth progress of the follow-up work. After obtaining the relevant data, the obtained data should be

analyzed and made into corresponding tables, such as geological condition analysis. The implementation of this work is to ensure that the staff can make reference in the process of subsequent project construction. In the process of making tables, excel tools should be used to assist, and the analysis and statistics of building geotechnical data should be carried out at the same time. When the data statistics are complete, the staff will carry out the construction geotechnical engineering geological mapping, use the relevant computer software and technology, input instructions, and execute the program. In this process, appropriate sections or histograms should be selected according to the specific requirements of building geotechnical engineering. There are many styles of bar charts for staff to choose. When carrying out the mapping work, we should try our best to complete the mapping work at one time, so as to avoid data errors as much as possible. However, in the process of drawing the profile, it is necessary to select the profile first. In this process, we can not only select one-time drawing, but also classify and then draw according to the actual situation of the project. It should be noted that when drawing the profile, the staff usually need to use various curves to supplement the key content in the drawing process, which requires the survey staff to remember to strongly reconcile and mark the critical data in the software when drawing for the first time, which can avoid the data loss or deviation caused by human operation to the greatest extent.

## **6. Differences between Water Conservancy and Hydropower Engineering and Building Geotechnical Engineering**

### **6.1. Geotechnical / Geological Standard Differences**

In terms of quantity alone, the standards of geotechnical engineering related to water conservancy and hydropower projects are quite different from those of building geotechnical engineering. There are more than 130 standards of building geotechnical engineering, while there are only 41 standards of water conservancy and hydropower projects, but there are 9 international codes, which are comparable to building geotechnical engineering, and many of them are related to rock and soil. These relevant standards have the following characteristics: 1. the construction of water conservancy and hydropower projects in China has a certain position in the world, such as the famous Three Gorges dam water control project. In order to build these grand projects, we must set ultra-high standards and requirements for rock, soil and geology. Therefore, when carrying out the construction of water conservancy and hydropower projects, we must constantly summarize the existing practical experience and achievements according to the actual situation, so as to continuously improve the level of rock geological standards and strive to be in a leading position. 2. The application of water conservancy and hydropower engineering standards and technologies in China is the earliest. It is the synthetic materials used in civil engineering in water conservancy and hydropower engineering. Therefore, in order to better promote and adopt new technologies, a relatively complete international industry standard has been established; at the same time, it is also the earliest time to introduce relevant standards in the experiment. At present, these standards have become a necessary test work in the investigation of various projects; it was the first to adopt the FIDIC clause, and this clause has now been used as a basic management standard in engineering construction in China; In the process of engineering investigation, ASTM soil classification standard was first adopted. 3. It has super authority in the classification of rock and soil and the indoor test standard system. [6] 3. In the process of construction of water conservancy and hydropower projects, there are also non special requirements for geological conditions, so the corresponding matching standards also have characteristics. 5. At present, the river embankment project has been the focus of water conservancy projects. In order to ensure the high quality of the project, China has formulated many complete relevant geological survey and construction

specifications. Although there are many standard systems and quantities of building geotechnical, if the geological conditions of the construction site are relatively simple, there is only one point related to it in the end. The construction sites of water conservancy and hydropower projects are generally in valleys or valleys. A project is basically a hub, which includes dams, hydropower stations, reservoirs, sluice gates and other projects. The general survey work of construction engineering is mainly to investigate the quality of Geology and the bearing capacity of soil, and drilling is often used for survey work. The geological survey of water conservancy and hydropower is quite complex, involving many conditions, such as geological structure and geological conditions, which requires staff to adopt a variety of methods to carry out the survey according to the corresponding specifications and requirements.

In building geotechnical engineering, geotechnical standards are a relatively large system of geological standards. This standard system has the following characteristics: 1. these standards are applicable to a wide range of buildings, including municipal government buildings, industrial buildings and civil buildings. 2. The standard specifies both normative and comprehensive, and the corresponding content is both systematic and extensive. There are not only standards for the whole stage of the project, but also corresponding geological survey standards. [7] 3. these standards are often compiled by professionals in departments subordinate to the national construction department, which are authoritative and progressiveness.

## 6.2. Differences in compilation of Geological Survey Report

There are essential differences between water conservancy and hydropower projects and building geotechnical engineering in the compilation of geological survey reports. After the comprehensive and systematic investigation work carried out by the investigators, it should be strictly reviewed by the relevant competent construction department. After passing the review, the corresponding geotechnical investigation report can be prepared, and then each region will prepare detailed standards for the preparation of engineering investigation reports according to this report. Up to now, this work has been highly standardized, so a considerable number of projects have used relevant software to compile reports, and these software have reached an advanced level. For the survey report of water conservancy and hydropower projects, there is only one management specification for survey data. There is no unified standard in terms of format, and only some simple chapter sequences need to be followed. Each region has its own geological conditions, so the investigators should write chapters according to the local actual situation when analyzing and combing, and attach pictures and charts for further explanation. From the geological survey report written, people can not only see the professional ability and professional quality of the surveyors, but also see the attitude of the surveyors when writing.

## 7. Summary

By introducing the research objects and contents of engineering geology and geotechnical engineering, and at the same time describing the contents and methods of water conservancy and Hydropower Engineering Geological Survey and architectural geotechnical engineering survey, finally introducing the differences between the two projects in geotechnical and soil quality and geological survey report writing, it is concluded that there are differences between the two.

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