

Problems and Countermeasures in Geotechnical Engineering Investigation and Foundation Design in Building Engineering

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Abstract: For the construction of all building projects, geotechnical engineering investigation and foundation structural design are directly related to the safety and stability of buildings, and have a significant impact on their quality and service life. This paper starts from the main difficulties in actual building projects, analyzes countermeasures, adjusts design measures according to the actual situation, increases the efforts in design and investigation, and improves the accuracy of design through information technology means. It aims to eliminate difficulties in investigation and design as much as possible, ensure the stability of building foundations, enable long-term operation of buildings, and reduce later repairs and safety hazards.

1. Introduction

In building engineering, the underground part is called an "underground lifeline", and it is a core component of building engineering, including geotechnical engineering investigation, foundation design. It is also the core connection of the whole construction project from design, planning to construction. But now, some building engineering items disregard exploration and design in the development or even ignore it, and end up with the geology is distorted plan data, drawing according to drawings but not able to be implemented. It raises the cost of building engineering construction and increases the risk of uneven settlement, structural damage or even collapse. Incomplete information and the inability to well implement technical standards cause the foundation not only unable but also inconsistently being a backer. This paper, therefore, analyzes the technical difficulties in building investigation and foundation design, analyzes the factors that lead to such problems, and puts forward corresponding solutions to standardize different procedures of investigation and specification for foundation design among large construction projects of building engineering, improve management systems for drillers and builders with preliminary action not inhale (having an effect on later stage work), so as to strengthen the construction quality in early critical path of building engineering.

2. Problems in Geotechnical Engineering Investigation and Foundation Design in Building Engineering

2.1 Inadequate Preparation

Sheisen that the degree of effect on the final construction results between different types and depths of engineering projects. Data collection and organization must be done in due process, or the overall execution effect will not be good at the later stage ^[1]. Consequently, investigators need to have sufficient preparations and arrangements in the early stage to obtain key geological data as well as determine definite target scopes for a targeted response to an emergency ^[2]. In addition, during the preliminary data collection stage, we must inspect the outside environment as well climate conditions to relevant laws in order that this will not affect further projects.

2.2 Insufficient Professional Competence of Staff

In general, the technician with the professional competence is the key to geological investigation work. But nowadays also, some geological engineers do not achieve high work ethics and fail to

have great skills. Findings suggest that some employees work too long, while others cling to past project experiences and do not quickly translate new tech and successes into every day practice. Consequently, the acquired data may not appropriately fulfil project needs ^[3]. Moreover, some staff members are not highly professional and ethical or lack the requisite rigor and diligence to conduct geological survey work ^[4]. Some employees lack the ability to process data efficiently, and certain deviations in the analysis of its data affect the momentum of the following stage of work and even lead to structure or safety hazards in buildings ^[5].

2.3 Lack of Coordination between Geotechnical Engineering Investigation and Foundation Design

In many projects, the department of geotechnical investigation does not have a communication interface with the foundation design department, which also prevents joint work between these two departments. In practice, during construction geologists may not know the bearing capacity of structures: first, overestimation will extend exploration time and drive up costs while resulting in invisible resource waste; second, underestimation means investigation results do not meet construction requirements and re-investigation is required ^[6]. If the two sides are not reasonably cooperative, efficient construction cannot be achieved, and waste of manpower and material resources will occur. Hence the good coordination between two is necessary for smooth process of and operation of the project ^[7].

2.4 Unscientific Investigation Methods

How scientific the methods of those investigating cases, is a key contributor to what conclusions are reached in an investigation. The problem is that some (extremely simplistic exploration methods). The research is mainly completed by drilling methods, and it cannot be carried out in certain links in the experimental process. It often limits later experimental methods because many exploration units and personnel still only use drilling methods, resulting in an inaccurate assessment of actual measured data in geological exploration ^[8]. At the same time, if foundation design can only be designed based on qualitative data surveys and past experience, it is not only to make geological investigation work in vain but also makes foundation design benign, rough, imprecise and unscientific leading to adversely affected by the normal progress of building engineering projects ^[9].

3. Countermeasures for Geotechnical Engineering Investigation and Foundation Design in Building Engineering

3.1 Adequate Preparation

To avoid potential difficulties in foundation design and geotechnical engineering investigation, staff should make thorough preparations, including:

The outline of a scientific geotechnical engineering investigation plan should be developed first. Geotechnical Engineering InvestigationA geotechnical study typically involves staff from that relevant department researching data, including: local engineering conditions/characteristics surrounding terrain, etc., utilizing the most applicable investigation methods. Based on this, it should be a basis for an understanding of knowledge related to foundation design and to use foundation design as the guiding ideology for geotechnical engineering investigation work so that the final result can satisfy the construction of foundations and ring-underlay in relation to it, which lays the initial purpose for improving foundation construction quality and protecting its performance.

Second, a detailed outline of the geological investigation and foundation design should be prepared. The content should be more accurate and effective, improvement of inspection on implementation regulations and standards for geological engineering investigation. In addition to this, relevant laws and norms for geotechnical investigation should be improved and standardized as much as possible so that ordinary errors and accidents caused by non-compliance with the

procedure for carrying out investigations would not occur. Foundation Structure Investigation Report (listed in the outline) Submit to other inspectors according to evaluation criteria, standardized individual behavior to ensure that investigation work can be carried out smoothly and finally obtain scientific, accurate, and reliable data as the main basis for foundation structure design.

3.2 Improve the Professional Quality of Staff

As for how to improve the technical level and quality of investigation and design personnel, in general, it can be summarized into two points: employees themselves; Employee recruiting social channel. In the case of current employee group, different companies are to further up-skilling in order to have better work execution & ability. They also can enhance exchanges with normal colleges and universities setting up geology and surveying specialities to offer students applied practice opportunities. Meanwhile, they can take the initiative to invite higher education institutions to open courses in the company from time to time, which enables employees to learn relevant theoretical knowledge and enhance their theoretical level as well. Based on this, companies should also set an appropriate reward and punishment mechanism to encourage employees to train as needed. For instance, a company could make financial rewards for employees who satisfy the criteria; if an employee satisfies the criteria every time they can be put up for promotion.

Secondly, when hiring, companies should conduct a comprehensive assessment of candidates for investigation positions from the perspectives of knowledge accumulation and professional skills. For new blood of investigation employees, the human resources department should deposit corporate culture after they enter into the company, so that they can develop good professional behavior habits and take the initiative cause abilities in their daily works to guarantee the successful finish of investigation project.

3.3 Coordinate Geotechnical Engineering Investigation and Foundation Design

When the two important processes in the same project (foundation design and geotechnical engineering investigation) are relatively simultaneously conducted with consistency, each other should be made. It should be fair and shared so that the two can connect effectively. These two tasks are related by the nature of their work, so they should be combined, and cooperation between them should also be promoted to drive the project forward. The key to effective coordination between geotechnical engineering investigation and foundation designing work is breaking the information barriers of both sides, initiating a higher level of technology application and program connection to meet stability requirements for foundations while ensuring project cost efficiency.

A preliminary work framework should be set to make clear responsibilities. In the early stages of the project, a project workgroup consisting of investigation units, design units, owners and supervisors should be established to clarify responsibilities for the transfer of investigation data and design response or problem-solving requirements as well as time frames. In the early investigation work, designers should put forward a "list of investigation requirements", and at the same time, special on-site conditions such as groundwater level, soft soil layer distribution and ground stress values should be paid attention to avoid blindness in investigation work.

Second, over the process, increasing communication and working together eliminates pain points at connection points. In the process of exploration, a professional technical team shall be sent to important nodes in the design process (e.g.: pile driving inspection and sampling observation) so that site conditions can be timely understood and requirements on this basis also adjusted. If any of it is interpreted as abnormal phenomena such as cracks or hyper-compaction soil layers! the investigation enterprise should immediately inform designers. When the preliminary design draft is completed, it should set up a special investigation-design meeting, and the research team can make a comprehensive analysis on whether the scientific nature and geological adaptability of the design is appropriate or not, and those designs that do not meet the suitability of actual site conditions are required to be modified.

Lastly, the information technology means must be completely utilized for data sharing and instant updating. Various and different studies/experiments need to be connected in such a way as to share knowledge among each other, this should consider the goal of across developing shared

understanding by replicating knowledge (learning by sharing both original investigation data and test results with the model that used for design). This could enable the designer to directly input design parameters from the investigation data for verification and calculation, thus avoiding repeated input cause errors. During construction, if the actual stratum is significantly different from what was investigated, feedback can be quickly fed back to investigation and design personnel with the network platform, and realize rapid formulation of re-investigation measurement and design adjustment plan. If conditions allow, the third party review can be introduced to supervise and manage issues in a more collaborative manner, to check whether there are deficiencies or errors in the investigation content, whether the design and investigation report data is consistent with each other, whether the designed can adequately and effectively utilize the investigated data and whether it has prevented geological risks at site; all of these would give both parties attention to coordination work area.

3.4 Standardize the Investigation Process

In order to better complete the investigation work of foundation buildings, based on ensuring that geotechnical engineering investigation work can play a role in its own should require related units according to China's corresponding investigation work specifications, strictly regulate for relevant foundation building engineering construction projects of the geotechnical engineering investigation and staff arrangements.

Develop a complete construction plan based on foundation design principles and combined with specific construction site conditions, strictly adhere to the basic requirements of energy conservation and environmental protection so that the project can use it effectively. To avoid measurement errors, staff should approach the investigation of building geotechnical engineering foundations with strictness. To avoid feeding back for optimizing foundation design, various factors are discretely identified to generally examine and compare approaches about foundation optimization design methods; meanwhile, emphasis on theoretical analysis by at least one kind of applicable method in design provides some insight into the whole work. The principles to be followed include, First, the foundation of the project design should meet safety requirements; Second, the foundation design must give sufficient consideration on how much time it takes to complete construction this way protects effectiveness and logic for the ultimate plan; Thirdly when planning an actual examination led over all equipment at that construction site making certain Actual on-site conditions are going to have real data with anticipated plan ahead Fourth environmental securities factor taken into account through designs would protect against polluting or damaging in thorough progress. Second, staff who conduct the geology and foundation must be well aware of the investigation step classification standards in order to guide subsequent engineering construction quality. They should also take the time to thoroughly and precisely research and analyze the data and information relating to how buildings are actually constructed. 3. Relevant personnel shall prepare investigation result reports according to the information and data analyzed, and lift it to the foundation design personnel, providing basic data for relevant construction works.

4. Conclusion

In summary, geotechnical engineering investigation is an important component of the foundation of building. In order to avoid the problems of previous construction processes, and to improve the quality of construction work, a certain amount of preparation should be made in advance by the construction unit. Investigation-related design work needs to be better coordinated, improving the professional ability of investigation personnel, standardizing and promoting a more complete and scientific investigation process so that it is sufficient to meet the corresponding requirements associated with buildings while simultaneously meeting standards related to geological research; this ensures longevity as well as durability between many aspects regarding building engineering.

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