Analysis on Design Risk Factors of Water Structure Engineering

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Keywords: Building, Water structure, Waterproof design, Risk analysis

Abstract: In the process of construction, leakage often occurs due to the design defects of water structure engineering, which involves the reason of design risks. The first is the defects in the engineering design itself and the second is construction without meeting the design requirements or poor quality of waterproof engineering. In view of these two reasons, this paper proposes to improve the waterproof design of water structure from five aspects, and strengthen the construction supervision of building waterproof engineering to render waterproof engineering design scientific, accurate and rational. For water structure, waterproof concrete construction should be done well, with emphasis on the selection and scientific application of waterproof materials.

1. Introduction

Because the risks caused by the design of building water structure engineering often happen, designers of water structure engineering need to meet higher requirements, but it is obviously not realistic to completely avoid risks by design. The design and construction of water structure engineering is a coherent process, so it is still necessary to participate in the later construction after the design is completed, especially for the situation of substandard construction, unscientific construction and substandard purchased materials, it is necessary to fully communicate with the supervisor and the construction party, so as to ensure the smooth progress of the construction project. From the risk factors of water structure engineering design, it is a comprehensive subject.

2. Overview of Design Risk of Building Water Structure

The design risk of water structure engineering in construction is a concern of construction enterprises, because the design of water structure engineering is irreversible and once finished, its repairing and transforming will cost more. What’s worse, it will seriously affect the cost of construction units. In particular, buildings related to people's livelihood are of high social concern. If there is a problem in the design of water structure, it will affect the safety of the building itself and cause a hidden danger to the life of residents. Therefore, it is of great practical significance to strengthen the research on the design risk of water structure engineering. With the development of building, people pay more and more attention to its comfort and safety. In particular, the safety of residential buildings is related to the safety of people's lives and property, gradually attracting the attention of researchers and front-line construction personnel. People try to take positive measures to ensure the quality of building. In this process, people pay attention to the importance of waterproof measures. So how to design and make waterproof measures more scientific and reasonable is the key to ensure the safety of building.

3. Analysis on the Causes of Building Water Structure Leakage

3.1 Engineering Design Defects Lead to Occurrence of Risks

Engineering design defects lead to the leakage of building water structure. From the perspective of engineering design, it mainly involves the following aspects: First, the underground reinforced concrete structure design does not meet the waterproof requirements; Second, the impermeability of water structure is not fully considered in the design so that the importance of this design is ignored, which accelerates the corrosion of reinforcement and easily causes structural cracks; Third, the

  DOI: 10.25236/ic3ec.2020.003

design of basement facade ignores the situation of non-natural conditions. For example, in the rainy season, the groundwater level is often higher than the positive value. The prevention of rainfall increase caused by the change of different seasons is not considered in the design; Fourth, the designers usually use theoretical analysis data to judge in the design of elevation drawings without going to the site for evaluation, so they have little understanding of the climate change in the area where the buildings are located. Fifth, the application of design materials is unreasonable. Some materials fail to meet the requirements of anti-seepage of high-water mark parts. Sixth, the interior angle of the joint between the basement wall and the baseplate is designed in terms of the right angle. Compared with arc angle and slope angle, the right angle is easy to seep. These are some reasons for the leakage of building water structure.

3.2 The Quality of Waterproof Engineering is Substandard

In addition to the defects in engineering construction and engineering design, the substandard waterproof engineering is also related to the fact that the waterproof construction unit of water structure fails to construct according to the design requirements of the designer, which leads to a big difference between the designer and the constructor. Some construction parties catch time limit or fail to carry out different scientific constructions in different seasons, so that the final results are irreversible in terms of conventional construction method. In particular, some construction parties ignore some details proposed by their design party in the water structure construction, which are often ignored by the construction party. In the process of construction, they don’t pay attention to the waterproof quality of the water structure project, nor take corresponding protection measures according to the characteristics and requirements of the water structure project. For example, before the concrete pouring, some workers did not determine the corresponding conveying speed according to the construction requirements. Because of the insufficient material supply, the workers can't pour water continuously. This will allow the cold joints between the pre and post cast concrete to produce leakage channels.

4. Risk Prevention Measures of Building Water Structure Waterproof Engineering

4.1 Strengthen the Design and Construction Supervision of Waterproof Engineering

Strengthen the construction supervision of waterproof engineering, carry out comprehensive research and judgment from the stage of design, use artificial digital technology to analyze the rationality and scientificity of waterproof measures of building water structure, and invite experts and supervisors to the site for supervision. This requires that the construction unit should set up an independent design and construction supervision department to carry out comprehensive and systematic supervision on the design and construction of project and find out the problems in the process of construction timely. In the engineering design, the supervisor should do the following: First, the design content and drawings should be carefully examined; Second, the rationality and scientificity of the waterproof function of the water structure design should be questioned; Third, the waterproof material should be tested scientifically. Fourth, the waterproof structure design of the basement must be focused on because the waterproof structure of the basement is very important and the excellent waterproof effect of the basement must be ensured. Fifth, it is whether the waterproof performance is unified and coherent with the anti-seepage ability of the building itself and the whole building. The main measures are:

(1) The supervisor shall timely point out the design defects whether the water structure design meets the waterproof requirements and also supervise the construction process to ensure the quality of the waterproof project to meet the corresponding requirements. The special parts of the building are the key of the supervision work. The engineering quality of the special parts of the building often determines the waterproof efficiency of the building. For example, construction joint is the important reason for the leakage of high-rise buildings.

(2) The supervisor shall strictly control the design and construction quality of the water structure parts, and strictly follow the design and construction standards of the building water structure. For

the unreasonable components in the design, it is also required that the construction personnel can timely discover, and report and communicate. Meanwhile, the construction party shall also strictly follow the requirements of the design party to carry out necessary prevention and control measures for various possible risks to avoid the occurrence of construction problems. For example, when there must be a connection between the retaining plate and the wall, the supervisor shall supervise whether to adopt appropriate measures such as water stop by steel plate for improvement.

4.2 Guarantee the Scientificity and Accuracy of Waterproof Engineering Design

In order to ensure the scientific and accurate design of water structure waterproof engineering, scientific and effective design work is the premise of improving the waterproof performance of building water structure. From this point of view, the waterproof design of building water structure needs to take into account its scientificity and accuracy, emphasize the impermeability level and standardization, and must be carried out strictly in accordance with the construction standards; secondly, the requirements for waterproof materials in building water structure must be chosen in accordance with the national standards, and be adjusted according to different regions at the same time, which is helpful to optimize the design. The safety and stability of water structure should be considered in the design of water structure waterproof engineering, so the principle of multi-layer fortification is the basic guarantee. In order to guarantee the construction schedule and control the cost, some units adopt the single-layer waterproof system, which does not meet the design requirements, resulting in poor effect and failing to play a good anti-seepage effect. At the same time, there are also designers who design without obeying the principle of multi-layer fortification, or lack experience in the composition of multi-layer waterproof system. Therefore, for the design of water structure, it is necessary to conduct joint examination and communicate through meetings to solve the shortages and defects of design caused by designers without enough experience.

4.3 Do the Construction Work of Waterproof Concrete Well

It is a continuous process from design to construction. The designer should pay attention to centralized concrete mixing, avoiding casting time, and ensuring the integrity of concrete. The designer shall keep in touch with the construction personnel and urge them to optimize the concrete mix proportion. When the mix proportion is determined, it should be comprehensively evaluated from design strength, standardization, impermeability requirements, material types and other related factors. For example, the water cement ratio shall be controlled below 0.55 to ensure that the interval between each layer of pouring is less than the initial setting time of cement; After initial set of concrete, it shall be kept for no less than 2 weeks.

4.4 Pay Attention to the Selection and Application of Waterproof Materials

For the material requirements and standard of water structure design, the construction personnel should do the following: First, understand the requirements of designers for different materials and performance, using conditions and requirements of these waterproof materials. In this case, the construction personnel can't make a claim without permission. If the materials can't be in place, it is necessary to communicate with the supervisor and the designer to replace the materials. Second, according to the requirements of the construction site, we can put forward our own suggestions on the selection of different waterproof materials to ensure the safety and stability of the water structure. Third, when purchasing waterproof materials, the construction personnel shall strictly control the quality of materials to provide good materials for the construction of waterproof projects. Fourth, the construction personnel should check the material factory certificate and permit, and carry out sampling inspection. Fifth, waterproof materials shall be protected and stored according to relevant requirements after procurement. Moreover, timely classifying and keeping these materials conducive to ensuring the quality of materials and improve the waterproof efficiency of buildings.

5. Conclusion

The design defects of building water structure are easy to lead to leakage and other problems,

which causes troubles to the users of the building. From the research of this paper, if we can effectively supervise the design link, and do well in the application, storage and procurement of materials in the construction process, the design risk of building water structure must be able to minimize under the common maintenance of the designer, the constructor and the supervisor.

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