Research on strength detection and reinforcement technology of concrete building structures

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Abstract: Reinforced concrete is needed in houses, tunnels, garden facilities and so on. The first requirement for buildings is safety. Therefore, no matter what the design concept of buildings and how the structure of buildings changes, concrete as a basic material is indispensable, and it is particularly important to pay attention to the safety of reinforced concrete building structures. Thus, the reinforcement technology of reinforced concrete is derived. In this paper, the method of strength detection of concrete building structure is given first, and on this basis, the reinforcement technology of concrete and soil is deeply studied.

1 Introduction

With people's increasingly high quality requirements for buildings, structural detection and reinforcement of buildings is one of the necessary projects in the construction industry. Reinforcement technology of concrete building refers to the use of scientific and reasonable reinforcement measures to improve the safety and durability of concrete building structures. It ensures the normal use of buildings and the extension of service life based on the verification and detection of original concrete building structures [1]. The reinforcement of building structure includes the reinforcement of the problems in the construction process, the modification and reinforcement of the original building performance, so as to prolong the service life of the building [2].

2 Necessity of reinforcement technology for concrete building structures

In the current industrial and civil buildings, there are many buildings which have been used for more than 30 years. In the background of the times, many factors restrict them, and many concrete buildings have different degrees of potential safety hazards. In addition, there are some buildings due to design, construction and engineering management quality problems, endangering building safety. When the following situations occur in a building, the building shall be inspected and strengthened in time. For example, the building structure is damaged and out of repair for a long time [3]. The building has suffered from man-made or natural disasters such as earthquake, tsunami, fire, debris flow and so on. There are problems of poor quality such as dew rib honeycomb in the renovation of the building. The design is

unreasonable and the geological and hydrological characteristics of the project are not fully understood [4]. The renovation of the renovated building is incorrect, and the wall is opened arbitrarily to change the load capacity of the building. The change of surroundings has been influenced by corrosive materials such as high temperature, acid and alkali for a long time, and the structure of buildings has been damaged. Timely detection and reinforcement of concrete building structure ensures the safety of the building, improves the strength, stability, rigidity and durability of the building to meet the normal use function of the building, and prolongs its service life.

3 Classification of reinforcement techniques for concrete building structures

Regarding concrete structure, no matter which method to reinforce, it should first consider the bearing capacity of the building to be strengthened, whether the parts in question can be strengthened, whether they can bear the newly strengthened things, whether the durability will meet the standards, and so on. It should consider the characteristics of different strengthening methods separately and confirm the feasibility before carrying out the reinforcement work [5]. If the damage of the target to be strengthened can no longer withstand the newly strengthened components, at this time, it is not enough to use the method of adding reinforcement only, and a more appropriate method can be used. That is the prestressing reinforcement method. In the face of some components that are not strong enough and have insufficient hardness, the method of adding multiple fulcrums can be used or its area can be enlarged. The characteristics of the method of increasing the cross section of reinforcing parts are as follows: using one kind of material to

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increase the cross section area of components and increase the bearing capacity of the building to be strengthened. This method is generally applicable to beams, floors, columns and some very common materials [6].

There is also a method of wrapping and pasting profiled steel outside the reinforcement site, but this method has certain limitations. Its members are limited by section size or need to greatly enhance the bearing capacity [7]. It also requires certain construction technology. Before reinforcement, the construction team should carefully read the design construction drawings. It is necessary to clean up the stains on the structural surface, as indicated by the design drawings. The grinding control line is measured and laid at the bonded steel position of concrete. When the grinding is finished, the bonded steel position line is added after the grinding is completed.

4 Testing methods of concrete building structures

To judge whether a building needs to be reinforced or not, it needs to be tested. The general testing methods include: core drilling method, rebound method, ultrasonic method, pull-out method and load test method. The pull-out method is simple to operate, easy to master and has high detection accuracy. Core drilling method is a direct method to detect the compressive strength of buildings. The results are very accurate, but this method is easy to cause damage to local structures of buildings. Non-destructive testing methods include concrete rebound method and ultrasonic rebound method. The detection accuracy of this method is not high. Generally, comprehensive testing method is used. That is to say, several methods are combined in two ways, such as drilling Core-Rebound method, rebound ultrasonic-pull-out method, rebound-drilling core method and so on. The final method is shown in Figure 1.

Figure 1. Drilling core testing method for concrete structure

There are two kinds of on-site detection methods for concrete structures, i.e. engineering quality detection and structural performance detection. There are certain conditions for which detection methods should be applied to the project, such as the following six conditions, which are suitable for concrete structure detection: 1. Insufficient inspection of engineering quality specimens and pipeline materials; 2. Unqualified spot check of building entity structure quality; 3. Objection to the quality of building entity structure; 4. Simultaneous formulation of engineering safety

accidents; 5. Relevant standards for third-party inspection of the project; 6. When relevant inspection departments require third-party inspection of the project quality. In addition, there are four kinds of suitable testing methods for structural performance: 1. When the concrete structure changes; 2. When the service life of the building is reached; 3. When the concrete structure suffers natural and man-made disasters; 4. When the reliability of the concrete structure needs to be appraised.

5 Common reinforcement techniques for concrete building structures

5.1 Reinforcement technology of encased steel

The reinforcement technology of wrapped steel is to use latex cement and epoxy resin material to reinforce the wrapped steel around the beam and column by grouting. It can also implement the reinforcement technology by welding the wrapped steel around the beam and column. According to the different construction methods, this reinforcement technology can be divided into dry and wet outer packing methods. The wrapping steel method can make the building structure more compact, increase the stiffness and stability performance of the building structure, enhance the bearing capacity of the building structure and improve the service performance. Some details should be paid attention to when using the enclosed steel reinforcement technology, such as giving priority to the use of low-strength steel for reinforcement. The application of low-strength steel will not produce great stress on the reinforcement components, and can realize the reinforcement of building components without negative impact on the reinforcement components. The figure of encased steel is shown in Figure 2.

Figure 2. Construction effect of encased steel reinforcement

At the same time, in order to ensure the combination and integration of Baotou Steel and building structures, the use performance of cement and concrete should be strictly required. Concrete should have micro-shrinkage and micro-expansion, so as to ensure that no new cracks will appear in building structures after reinforcement and reduce the reinforcement effect. In addition, the admixtures in concrete should be strictly controlled and used to a certain extent. In order to improve the workability of concrete and reduce the collapse of concrete, the admixtures which have little influence on the shrinkage of concrete and can improve the aging resistance of concrete should be selected.

5.2 Bonded steel reinforcement method

The steel-bonded reinforcement method is to strengthen the flexural and shear capacity of the structure under the combined action of the adhesive on the construction of the external bonded steel plate. It is mainly used in normal humidity to strengthen the flexural members under static load and improve the safety performance of building structures. This method has the advantages of convenient construction, rust removal and unloading according to the requirements, less wet operation on site, less reinforcing time, and can continue to be used after one day without affecting the original clearance. The material price is cheap, which can increase the bearing capacity of the construction. However, there are also some shortcomings. The level of construction technology and the quality of adhesives can determine the reinforcement effect. If empty drum is found after reinforcement, it will be too late to remedy. Therefore, this method should be used with caution.

5.3 Increasing Section Reinforcement Technology

Reinforcement technology of enlarging section is to pour cast-in-place concrete layer in load-bearing area of concrete flexural structure. It can expand the bearing area of building structure and improve the effective height of bearing section. It can strengthen the flexural capacity of the normal section of the building structure, improve the shear capacity of the inclined section, and maintain the stability of the building structure. In the tension area of the cross-section of the building, the concrete sheath can increase the stress section of the building structure, enhance the stress limit of the building components, improve the use function and increase the bearing capacity. This kind of reinforcement technology is simple and has been developed for a long time, and its technology is more mature, so that it can be effectively controlled during construction. This reinforcement technology is widely used in the reinforcement of beams, slabs, walls and other main building structures, and has obvious effect. The figure of Increasing Section is shown in Figure 3.

Figure 3. Construction effect of increasing section reinforcement

5.4 Prestressing reinforcement method

Prestressing reinforcement method is to increase the bearing capacity of the original structure, and to increase the prestressing structure in the original construction to share part of the load to be borne by the original structure. At present, external prestressing reinforcement method is widely used, which can better reinforce building components and increase the overall bearing capacity of the structure. However, it will also affect the appearance of the building, and need to prevent the phenomenon of steel rust. This method is suitable for the reinforcement of long-term high-stress and high-strain concrete members and the reinforcement technology of long-span and heavy-duty structures.

5.5 Adding fulcrum reinforcement method

Additional fulcrum refers to adding several fulcrums in the middle of the building beams to convert multi-span simply supported beams into continuous beams. This reinforcement method can reduce the calculation of bending moment and strengthen the bearing capacity of building structure. It has the advantages of simplicity, convenience and considerable effect. In addition, it also has some shortcomings, that is, large workload, easy to damage the appearance and use function of buildings. In addition to the five common reinforcement technologies mentioned above, there are welding reinforcement, planting reinforcement, shotcrete reinforcement and chemical grouting repair technology. Each of these methods has its own characteristics and advantages as well as its application scope. In a word, in the process of construction, it should consider all kinds of factors in combination with structural characteristics; flexibly use all kinds of reinforcement technology, to ensure the safety of buildings, to achieve the purpose of strengthening buildings, and to extend their service life.

6 Conclusion

The use of reinforced concrete is a great leap in the history of human society. It has got rid of the construction difficulties and serious shortcomings of consumables. It has made great progress in fire prevention, earthquake prevention and disaster prevention. It has got rid of the limitation of human resources. Nowadays, the use of new materials and technologies in building has made great progress in durability, but this does not mean that the building will not lose. After the long-term use of buildings, the components in some common parts will be worn out, and there will be some potential safety hazards over time. At this time, it is necessary to reinforce the damaged parts of buildings. Several methods mentioned above are aimed at the damaged buildings, different problems and different parts to reinforce, which also reduces the demolition of old buildings to a certain extent. The loss of money in building new buildings shows that the development and application of concrete structure

reinforcement technology in civil construction is very common nowadays.

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