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How to Improve Seismic Strength of Concrete Structure in Civil Engineering

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***Abstract*:** Earthquake is one of the most serious natural disasters that people encounter today. Strong earthquake can produce huge energy and cause serious damage to buildings on the ground. After seismic design of civil engineering buildings, the stability of structural performance is increased and the loss rate is reduced. As the most sensitive component of seismic design, the seismic design of concrete structure is essential. Nowadays, seismic design has become an important part of civil engineering building design. Improving the seismic strength is related to the service life and structural performance of the whole building, so as to ensure the safety of people's life and property. The seismic design of buildings is very important, which can enhance the stability of concrete structure to resist the huge energy brought by earthquake. This paper first introduces the importance of seismic design in concrete structure, puts forward the basic requirements of seismic design, and points out several factors affecting the performance of seismic structure, and finally, it analyzes the measures to improve the seismic strength.

***Keywords*:** Concrete Structure; Earthquake Resistance; Measures

China is located in the Pacific rim and Eurasia between the two major seismic zones, which is a country with frequent earthquakes, so in the civil engineering construction, the seismic design is often regarded as an important part of the design. According to the design principle of building anti-seismic, buildings should meet the design principle of "small earthquake is not bad, medium earthquake can be repaired, and large earthquake cannot collapse", so as to minimize the damage caused by earthquake. The safety performance of building structure must be guaranteed. In the construction of some public buildings such as schools, shopping malls, hospitals and other high-grade buildings, the seismic design level is higher than that of ordinary buildings. According to the division of seismic zones in China, the seismic design code is formulated. In the design of civil engineering buildings, the code must be strictly implemented to improve the seismic capacity of buildings.

1. The importance of earthquake resistance to concrete structure

Earthquake is the most frequent natural disaster in the world, and once it happens, the damage is serious. China has also experienced two super large earthquakes: the Tangshan earthquake in 1976 and the Wenchuan earthquake in 2008, which caused a lot of casualties and losses to our people. Therefore, it is very important to improve the seismic performance of buildings. Concrete structure is the main component of building materials, from production to finished products, seismic design parameters must be used, especially during the construction period, the construction method and construction technology should be strictly reviewed, the quality of construction personnel should be improved, no carelessness during the construction period, otherwise it will become a huge disaster. Nowadays, with the rise of the construction industry, the seismic design requirements of concrete structures are stricter, which is also the main direction of designers. In the future development, the seismic design will be more perfect, and constantly improve the seismic capacity of buildings, which is of great significance to save lives and reduce property losses.

2. Basic requirements of seismic design

First of all, the seismic design should meet the seismic calculation and structural measures of concrete structure, and at the same time, the cost should be reasonable. According to the anti-seismic design concept, the irregular architectural design scheme

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should be abandoned as far as possible, and when calculating the internal and external forces of the building, the symmetrical setting should be reasonable as far as possible, so that the building structure has a good integrity. The stiffness of building structure should not be changed too much, and it should meet the requirements of bearing capacity. In addition, in the calculation of seismic grade, many factors of the region should be considered, such as seismic fortification category, fortification intensity, structure type, etc. For some key parts of the building, such as the concrete structure and local structure, the key analysis and control are done to meet the minimum basic seismic requirements. For complex structures, construction simulation analysis should be carried out, and the analysis data should be sorted out to meet the requirements of basic seismic fortification objectives.

3. Factors affecting seismic performance

3.1 Impact of construction site

China has a vast territory, and the seismic fortification intensity and category of each area are not the same. The building location should be combined with geological exploration data. If it is selected in multiple seismic zones, the seismic fortification level should be improved. As the target of priority selection, the construction site should be well planned, fully understand the hydrogeological conditions, and determine the types of buildings to be built. Blind site selection is not allowed. If these conditions are ignored, irreparable damage will be caused. The influence of construction site on earthquake resistance is first and very important, which directly determines whether the later buildings can exist stably for a long time.

3.2 Influence of concrete materials

The quality of concrete directly affects the quality of the whole construction project. According to the requirements of relevant specifications in China, the principles of design, quality and effectiveness should be adhered to in the process of concrete production. Concrete materials are mainly composed of coarse and fine aggregates, cementitious materials, water and some admixtures. The quality and mix proportion of these materials will also affect the structural performance of concrete. Whether it can meet the requirements, in addition to the design parameters, also depends on the construction technology. If the component is damaged in an earthquake, it is necessary to check whether all the concrete materials meet the requirements of the design standard, which is the disaster responsibility of the materials.

3.3 Influence of building structure shape and height

In order to meet people's sense of consciousness, the design of some buildings is reflected in the unique shape, and belongs to super high-rise buildings, such buildings have strict requirements for seismic design. The shape of the building will affect the distribution of structural stress. At the same time, the higher the height, the greater the seismic influence coefficient, the lower the safety of the building. In the seismic design, we should not blindly pursue the shape and height, but also pay attention to the internal stress of the structure itself, according to the strict seismic design requirements.

3.4 Influence of uneven stress on seismic design

The reason why a building will not collapse is that its stressed members are evenly distributed. When the uniformity of vertical force design is ignored in seismic design, the external pressure will have a negative impact. Once encountering an earthquake, it can collapse instantly. The stress of the building structure is the basic guarantee to meet the long-term stability of the building. The seismic internal force design of the structure should meet the principle of stress balance, and ensure the safety of the overall seismic structure.

4. Measures to improve seismic strength

4.1 Reasonable selection of building site

When choosing the construction site, it is necessary to consider comprehensively according to the planning of the government, the division of the earthquake area and the relevant address materials. For dangerous sections or sections with unfavorable seismic resistance, an analysis report shall be made. After comprehensive consideration, whether to avoid it or not shall be determined. When it is impossible to avoid it, effective measures shall be taken to prevent and control it. In general, the same structure of the building should not be set on the foundation of different geological environment, if necessary, the pile foundation should be used, and corresponding measures should be taken according to the stress transmission situation. When the selected site is in the seismic zone, and the foundation soil is soft soil or liquefied soil, the design calculation should be carried out, and corresponding measures should be taken to prevent adverse effects.

4.2 Reasonable selection of concrete materials

According to the requirements of construction design, strictly optimize the varieties, specifications and categories of materials

to meet the requirements of seismic design of buildings. The materials entering the site shall be put on record, numbered and recorded in batches, and the corresponding quantity of materials shall be selected for test. According to the test data, the materials entering the site for construction shall meet the quality requirements, and the materials that cannot meet the requirements shall be resolutely returned. The selection of concrete materials is the fundamental guarantee to meet the seismic requirements of the whole building structure, which cannot be ignored by any relevant units and management personnel.

4.3 Reasonable design of building shape

Seismic design work is mainly implemented by the design unit, according to the requirements of the owners, the shape and structure of the building are designed reasonably. When the building rigid structure is large, it is necessary to do a good job of yielding mechanism to avoid damage to components and reduce earthquake damage. Seismic design must strictly follow the principle of strong column and weak beam, strong section and weak member, strong shear and weak bending. For important and complex buildings, it is better to carry out seismic simulation test to obtain relevant seismic parameters, so as to ensure the safety of design.

4.4 Setting up isolation and energy dissipation devices

In the lower part of the building, by setting some isolation bearings and dampers and other structural components, the isolation layer is formed by reducing the seismic energy. When the earthquake is formed, the isolation layer of the building can extend its natural vibration period, increase the damping coefficient, and achieve the effect of earthquake prevention. At the same time, energy dissipation can also be used to slow down the seismic energy, that is, a device is set inside the building structure to offset the seismic energy, and the damping is increased at the local deformation and section mutation, so as to eliminate the destructive energy brought by the earthquake and achieve the purpose of energy dissipation.

5. Conclusion

With the development of society and the progress of science and technology, the seismic design will be more optimized, which will not only guarantee the quality of the building structure, but also ensure the safety of people's lives and property. Based on the advantages and disadvantages of concrete structure, from the raw material mix proportion, mixing quality, construction technology, pouring scheme, maintenance degree and other aspects, constantly improve the seismic strength requirements of civil engineering concrete structure. Due to the serious impact of natural disasters on buildings, human beings are still relatively vulnerable in the face of disasters. Only by preventing in advance and constantly overcoming, can the seismic performance of building structures be brought into full play. In order to improve the safety awareness of construction engineering and meet the seismic requirements of buildings, the concrete structure will cause enough attention.

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