Research on earthquake resistance of super high-rise buildings

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Abstract

With the rapid development of China's economy, the domestic construction market has become increasingly prosperous. A large number of high-rise buildings and super high-rise buildings rise up on the ground. However, as the plane layout of buildings becomes more and more complex and the vertical shape becomes more and more irregular, a higher challenge is put forward for structural specialty. As an important part of structural design, the elastic-plastic analysis of buildings is put on the agenda of structural designers. This article briefly introduces the structural characteristics of high-rise buildings and the advantages of high strength concrete and giant concrete-filled steel tube column in seismic performance. In the seismic design process of super high-rise concrete building structure, in order to ensure the consistency of the overall displacement of concrete and obtain the minimum and maximum displacement structural stiffness, the vertical and lateral forces of the building should be protected to improve the role of torsion force.

Keywords

Structure; seismic; shear; concrete.

1. Design feature of super-high-rise- buildings

1.Structural forces. The overall flexibility and bearing capacity of super high-rise buildings are affected by the architectural stress equilibrium which has an important impact on the stability of super high-rise buildings in strong earthquake environment.

2.Axial deformation. Super-tall building vertical load is big that can make large axial deformation, caused by the column in which continuous beam bending moment. On the one hand, it can cause negative bending moment of the continuous beam intermediate bearing value decreases, on the other hand causes the increase of bending moment and end bearing negative bending moment value, but it also impact on prefabricated blanking length.

3. Structural malleability. Structural malleability is an important design index of super-tall buildings. Compared with low-rise buildings, high-rise buildings are more flexible, which leads to larger deformation under earthquake action. In order to avoid collapse under earthquake, super-tall building structures still have certain deformation capacity after plastic deformation [1].

2. Research on seismic behavior of concrete

2.1 Super-high strength concrete

At present, with the development of super-tall buildings, super-high strength concrete is increasingly applied [2]. super-high strength concrete has excellent durability and higher strength, but with the improvement of concrete strength grade, its brittleness becomes more significant [3]. When a strong earthquake occurs, the design of load-bearing columns of buildings is very critical [4]. In recent years, the volume and area of China's high-rise building projects are increasing. Architecturally, in order to reduce the weight of the building, the anti-overturning force arm is widened to make it move towards

the structure of large column network [5]. Moreover, the increase in the number of floors of the building structure will increase the clearance between the column network and increase the load borne by the column. At this time, if ordinary reinforced concrete is used, a large section column will be formed, which will lose the use space, and the formed short column is not conducive to seismic resistance [6]. These problems can be solved by using super-high strength and high-strength concrete. Super-high strength concrete has the advantages of good durability, high compressive strength and high stiffness, and it is mainly used in super-tall buildings, modern high-rise buildings and other fields [7]. The adoption of high-strength concrete can greatly reduce the section size of frame column, which is the main way to solve the problem of building bottom column forming fat column [8]. By comparing the seismic performance of columns with ordinary concrete structure and those with high strength concrete structure, the seismic performance of columns with high strength concrete structure is found to be far worse than that of other columns by applying shock sensation to them respectively and studying their seismic performance [9]. Therefore, when designing reinforced concrete seismic columns, the concrete strength grade should not exceed C80[10].

1.2 Building torsion effect.In the seismic design process of super high-rise concrete building structure, in order to ensure the consistency of the overall displacement of concrete and obtain the minimum and maximum displacement structural stiffness, the vertical and lateral forces of the building should be protected to improve the role of torsion force. Because of the suddenness and randomness of earthquakes, it is difficult to predict the time and intensity of earthquakes accurately. Therefore, when analyzing the overall seismic performance of buildings, it is necessary to timely check the seismic hidden dangers inside buildings, conduct scientific analysis and timely correct them to ensure the seismic performance of super-high-rise concrete buildings [11].

3. Conclusion

Full consideration is given to the structural stress, axial deformation and structural ductility in the design of super-tall aseismatic structures. Ultra-high strength concrete is increasingly widely used, and the choice of concrete strength should be appropriate, preferably not more than C80. In order to ensure the consistency of the overall displacement of concrete and obtain the minimum and maximum displacement structural stiffness, the vertical and lateral forces of buildings should be protected to improve the torsion force.

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