The Design on Laminated Prefabricated Column base joint and The Research on its Construction Technics

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Abstract. Based on the loading features and disease characteristics of the existing column base joint, this paper studies a kind of laminated prefabricated column base joint and systematically analyses its structural layout, construction process of technics, quality control, and principles of technics.

1. Introduction

Compared with cast-in-place concrete, prefabricated concrete has been widely applied in Chinese architectural field with its significant advantages in energy-saving, material-reducing and construction efficiency. However, beams, columns, foundations and other components of prefabricated buildings are connected by joints. To a large extent, the overall safety of the prefabricated structure is affected by joints.

Many experts and scholars at home and abroad have made a lot of researches on the form and performance of column base joint. For example, Yao Dekang and his counterparts[1-5]have stated the design methods of various common column base joints and new type of column base joints. Furthermore, they have analyzed the loading mechanisms and seismic performance. At the same time, Kanvin and his counterparts[6-8]have studied the failure form of column base joint and worked out the calculation formula of the bearing capacity and shearing forces of column base joints through amount of experiments and finite element models. Besides, Meng Qingchun and his counterparts[9-10] have designed a frame model with better hysteretic performance and semi-rigid performance of column base joints by using finite element software.

The analysis shows that the existing research results will actively affect the connection performance of concrete column base joints. But the existing researches mainly focus on the connectivity of dry process or wet-mixing method. There are still a lot to do in quick connection, accurate position, load-bearing and local cracking. As a result, this paper will show and discuss the laminated prefabricate column base joint on the basis of the existing engineering structure.

2. The structural design of the laminated prefabricate column base joint

2.1. structural design

The laminated prefabricate column base joint has been designed to improve the connection strength, seismic performance, shearing strength, quick positioning of construction and so on, with a view to solving the problems in current column base joints. The concrete structural diagram is shown in figure 2, and the structural diagram of cast-in-place concrete column base joint is shown in figure 1.
2.2. Structural features
Compared with cast-in-place concrete column base joint, the laminated prefabricate column base joint has its own advantages as follows:

(1) The connected steel body of foundation and convex set are added on the bottom of the prefabricated column to realize an immediate split joint, accurate position and to improve the efficiency of construction, though more steels will be used.

(2) The basic anchor plate is setted inside to fasten rebar, besides, angle steels are reinforced at the side of columns, which will improve mechanical behaviors and expand load distribution so as to prevent concentrated force.

(3) The structure is designed with grooves at the top of the foundation and steps at the side of the prefabricated column, which contributes to enhancing the overall connection between the column and the foundation, and improving the crack resistance of the core region of the column base and the secondary casting joint.

3. Analysis on construction process of technics in laminated prefabricated column base joint

3.1. The construction process of technics
The diagram of construction process of technics in laminated prefabricated column base joint as shown in figure 3.
3.2. key points of constructional quality control

1) Preparation of prefabricated columns: The suitable connecting convex set is retained at the center of the bottom, at the same time, steel body is designed at the center of connecting convex set. The connecting steps are set at the side of the prefabricated column according to the specific size. The diagram of cross section about prefabricated column as shown in figure 4.

2) The fundamental construction of reinforced concrete: Before pouring, the anchor plate setted at the bottom and reinforcing bars should be connected with bolt. Before initial set, connective groove should be made using stereotyped mold on the top of the cast-in-place concrete to connect with prefabricated column. The diagram of cross section about reinforced concrete foundation as shown in figure 5.
Figure 4: The cross section diagram of prefabricated column
(Note: 1-basic anchor plate; 2-basic connecting steel body; 3-connecting convex set; 6-connecting reinforcement bars; 8-connecting groove at the bottom of column; 9-grooves of reinforced angel steel; 10-Connecting stairs; 11-load-bearing steel of column; 12-prefabricated column; 13-reinforced concrete foundation)

3) The hoisting of prefabricated column: During hoisting, one should prevent collision. One should inject slurry inside first, then convex set is inserted without shaking.

4) The connecting settings of reinforced angel steel and bolts: First, the prefabricated column should be positioned supported. Then connect bars with 1.1 to 1.3 times of pull. The bottom of reinforced angel steel and reinforced concrete firmly connected with bolts, finally, the upper reinforced angel steel and prefabricated column are firmly connected with bolts.

5) The construction of post-pouring concrete: Self-compacting concrete should be finished in one time and the outside should be maintained.

4. Analysis on principle of structural technics
(1) The suitable connecting convex set and are designed at the below of the prefabricated column while connective groove made by stereotyped mold on the upper of the foundation, which will implement fast as well as accurate positioning.

1) Steel body and connecting convex set are setted at the bottom of prefabricated column can be connected to the foundation quickly and accurately, which not only makes site splice easier but also makes construction faster.

2) The prefabricated columns are prepared in casting yard, then perform post-pouring after hoisting. Also, connective grooves made by stereotyped mold will greatly improve construction efficiency.

(2) The connecting settings of reinforced angel steel and the basic anchor plate are designed inside to fasten rebar, besides, angle steels are reinforced at the side of columns, which will improve mechanical behaviors and expand load distribution so as to prevent concentrated force pull.

1) The foundation and prefabricated columns can be effectively connected with the circumferential angel steel designed on the column base joint. Besides, it can improve the lateral shear resistance capacity and anti-bending capability in a transverse way. As a result, the overall performance of the structure will be effectively enhanced.
2) The anchor plate setted at the bottom of the foundation makes the connection between upper reinforcement bars and the basic reinforcement bars more stable. At the same time, it will improve anti-pulling capacity so as to enhance the overall performance of the structure effectively.

3) Angel steel on core area, post-pouring concrete, self-compacting concrete and interfacial transition zone will improve anti-pulling capacity.

1) Angel steel on core area, post-pouring concrete, self-compacting concrete and interfacial transition zone will improve both crack resistance and connection.

2) Casting small-volume concrete and blend some anti-cracking materials at the joint of the core area, which can reduce temperature shrinkage deformation of the concrete in the joint area. Furthermore, it will greatly improve the anti-cracking capacity of the joint.

5. Conclusion
(1) A kind of laminated prefabricated column base joint has been designed as a way to improve the connection the existing column base joint and to solve the problems of construction. In this point, this paper compares it to the cast-in-place column base joint.

(2) To combine with construction process and structural features of laminated prefabricated column base joint, this paper has analyzed the key points on quality control and stated main control points during construction process.

(3) Compared with the existing column base joint, laminated prefabricated column base joint enjoys its stability, good load-bearing and efficiency. Therefore, the laminated prefabricated column base joint is feasible in technics and logical in design.

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