

Construction Quality Control Measures of Conversion Layers in Ultra High-Rise Buildings

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ABSTRACT Construction quality directly affect the structure safety of high-rise building. Especially the construction quality of the conversion layer in ultra high-rise buildings plays an important role for the overall quality of ultra high-rise buildings. This article mainly discusses and analyzes the key points, difficulties and quality control in construction of conversion layer, in order to better control the quality of conversion layers in ultra high-rise buildings and build better buildings.

KEYWORDS

High-rise buildings
Conversion layer
Construction quality
Control measures

1. Introduction

With the prosperity of economy and the progress of science and technology, high-rise buildings in china are also booming. Its characteristic is to develop in the direction of higher height, more complex body shape, more complete function and more strong comprehensiveness. In order to meet the requirements of architectural function, realize the change of structure system, and keep the space work performance, the conversion layer must be set.

2. The overall construction characteristics and control points of conversion layer structure

2.1. Construction characteristics

Since the dead weight and construction load of conversion layer was usually very big, the reasonable template support scheme should be selected and the design of template support system should be made. The stress state of conversion structure at construction phase and use phase is different after template support system was set, hence, the bearing capacity of transfer beam and the lower floors at construction phase should be calculated.

During concrete construction of mass concrete conversion layer, the measures used to reduce the hydration heat

of concrete should be adopted to prevent temperature crack of the new concrete.

The conversion layer has large span and load, more reinforcement and steel skeleton with higher height, construction measures should be taken to ensure the stability of steel skeleton so as to facilitate reinforcement layout [1].

Steel skeleton or prestressed stress was used to unload. The steel reinforced concrete and prestressed technique used in the conversion layer structure may reduce weight, and improve the overall seismic performance of structures. When designing templates support, the shaped horizontal steel bone or prestressed balance part or all of the construction load were used to greatly improve the support force performance, this measure is suitable for the situation that conversion layer and the upper structure dose not form the whole work, for example, a small column grid framework or openings shear wall, wall frame structure were used for the upper parts.

2.2. Control points of construction

Since the dead weight of conversion layer, construction load and the superstructure load were usually very big, the reasonable template support scheme should be selected and the template support system should be designed according to the structural characteristics of conversion board.

The conversion board has large load, more reinforcement and steel skeleton with higher height, construction measures should be taken to ensure the stability of steel skeleton.

For mass concrete conversion board, measures used to reduce temperature difference of concrete, temperature variation, concrete shrinkage and creep should be performed during construction, in order to prevent temperature crack and contraction crack of new poured concrete.

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During the construction period of conversion plate, we should timely monitor the deformation of plate, concrete construction temperature, grasp of the situation which is adverse to the construction quality, and take measures to prevent and correct in a timely manner.

3. The important and difficult of construction in conversion layer

3.1. Template support system

Since the density of reinforcement in conversion layer was large and the weight of concrete and reinforcement as well as the construction load is very big, how to determine the template support system of conversion layer is the key of construction of conversion layer, the bearing capacity and overall stability of the support system must be guaranteed.

3.2. Connection and binding of reinforcement

The beam and plate in conversion layer has large reinforcement ratio, longer main reinforcement, large density of arrangement, especially in the region of the beam-column joints, the reinforcements are densely crisscross. Hence, ways to use material correctly to ensure the location and quantity of reinforcement is the key of steel construction.

3.3. Concrete pouring and control of crack

There are crisscrossed reinforcements in the core region of conversion layer with crisscrossed beams and column. The reinforcement spacing is small, hence, it is difficult for concrete to freely fall and easy to produce temperature and shrinkage cracks. As a result, ways to ensure the smooth concrete pouring and prevent the generation of crack are the key to ensure the quality of concrete.

4. Quality control of conversion layer construction

4.1. Quality control of template installation and removal

4.1.1. Installation of beam side template

A 30 mm × 2.5 mm flat iron should be adopted as pull tab. Its length is section width of beam +2 times of rib height of steel template, and holes will be made on the proper position on both ends. As for the lateral of steel form, beam templates are clamped vertically by 8 steel fasteners fixture. Each small bar has a pair of fixture, and all the fixtures are transverse connected by horizontal bar. The end of some horizontal poles supported by beam and plate should resist both sides of template of beam, and connect to the steel pipe fastener fixture, in order to bear the lateral pressure of new concrete. To ensure the concrete do not leak slurry, plastic foam strip or paper should be use for flat-fell seam; when the span of beam and plate is not less than 4000 mm, if there is no requirement of design, the bottom form of beam, plate should be bulge according to the 2% of arch of quantity of the total length [2].

4.1.2. Installation of baseboard template

The 2000 mm × 1000 mm × 18 mm bamboo board is used

for baseboard template. Galvanized iron may be used to package the edges of bamboo board to alleviate the damage caused by collision. A 150 mm × 50 mm turn wood is laid on the top of horizontal bar of steel pipe support frame, clearance distance is 200 mm. After installation of template, the template and wood brace are fixed by nail. Flat-fell seam is sealed by 50 mm wide adhesive tape to ensure that seam of plate is not leak slurry. After installation of template is finished, project technical director will organize relevant personnel to complete the template project acceptance before pouring concrete, casting concrete can be performed after qualified.

4.1.3. Removal of template

After completion of concrete pouring, for plate, the concrete strength is more than 75% of design strength. For the beam, if the span is not more than 8 m, and the concrete strength is more than 75% of design strength. If the beam span is more than 8 m, and the concrete strength is 100% of design strength, demolition of template and the support system will be made. Before demolition, construction personnel should apply for template removal, project technical director organize relevant personnel will validate it, after conforming to the relevant provisions, templates can be demolished.

4.2. Quality control of reinforced installation

If there are several layers of rebar in the same position, in order to ensure the accurate, and straight reinforced location, the short 25 rebar are horizontally placed between two layers of steel bar. Besides that, the space between arris-head iron is one for every 1000 mm long along the beam length direction, and the vertical line between forcing reinforcement of each layer were separated with arris-head iron.

The thickness of reinforced concrete at the bottom of beam is 25 mm, the precast block with more than c20 of small blockage of fine stone concrete were used for cushion block; but for the framework beam with 1200 mm or more of cross section height, since the steel bar diameter is 25 mm or more and there are lots of rebar, the steel weight is very big, fine stone concrete block has been unable to bear the load. 14~20 short reinforced cushion block with the length of 1.4 times of beam section width must be used, there is a 45 degree angle between this short rebar and the bottom longitudinal reinforcement. The included angle is flat between the bottom template and underlying stirrup, or the special concrete protective layer block were used.

For the column, thin cylindrical column or shear wall and others of upper bearing structure of the main and second beam in transformation layer, the structure reinforcement must be inserted into the beam, column of transformation layer, and welded with the rebar in beams and columns, and 2 stirrup are set at 50 mm away from floor, to ensure accurate upper structure reinforcement location.

4.3. Quality control of placing concrete

4.3.1. Mix proportion design of concrete

The mixture ratio design of concrete must be done by the corresponding laboratory with design qualification on the basis of testing the cement, sand, stone, admixture and others of construction site. To prevent construction cold joint appeared in pouring, reducing water retarder was added in the concrete mixture ratio.

4.3.2. Concrete pouring and unloading method

Concrete pouring was started with side beam of one side of house, then the other frame beam perpendicular to the side beam after completion. The casting length reaches to the adjacent axis frame column, then return to pour concrete floor plate. The parallel advance is made by the analogy of this casting method until completion. In the process of casting frame beam concrete, the beam with section height of 1800 mm should use the method with 4 times pouring, 4 times vibrating, and not more than 500 mm of thickness of casting for each time. Accordingly the beam with section height of 1200 mm should use the method with 3 times unloading, three vibrating, to ensure that the concrete is close-grained and without construction cold joint, and is helpful to reduce the trabecular lateral templates pressure [3].

Measuring workers must strictly control the mixing proportion of concrete, cement (bulk), sand, stone, admixture and others must be weighted and measured carefully. The admixture will be calculated by the specialist to guarantee the supply, if using commercial concrete, we should also

ensure that supply.

5. Conclusion

Along with the technical development of high-rise buildings in recent years, as well as the development of national economy, the demands of urban for construction are changing. The lower floors of building were usually used as restaurants, stores or cultural entertainment room, which requires large space and open space. The upper floors are used as residential building, office or hotel. Since there is a sudden change in the stiffness and quality of conversion structure, it is likely to cause larger reaction under the action of external force, leading to larger floor reaction near the conversion layer, making the conversion layer parts to be the weak layer, and affecting the building structure. Therefore, strengthening the analysis and study of conversion layer construction has very important practical significance for improving the quality of construction.

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