

Key Construction Technology and Quality Control Points of Main Wooden Structure of Super High Rise Building

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Abstract:

The basic dynamic characteristics of wood structure building is one of the important indexes of the main wood structure of super high-rise building. With the accelerating process of urbanization, the rapid development of the construction industry, land resources are more and more tense, the number of high-rise buildings is more and more. Compared with ordinary buildings, high-rise buildings not only have higher vertical height, but also have more complex and changeable main structure and more concealed works. The main structure construction of high-rise building puts forward higher requirements for the technical ability of construction personnel. This paper mainly explores the key technology and quality control points of high-rise building main structure construction. At the same time, this paper studies the application of BIM Technology in the construction of super high-rise steel structure. The application of BIM system in component processing and on-site installation organically combines the design, processing, transportation, installation and other processes, so as to establish a smooth information communication channel among owners, general contractors and subcontractors. The experimental data show that the quality, duration, cost and safety of the project are under control.

Keywords: High Rise Building, Wooden Structure, BIM Technology, Component Processing.

I. INTRODUCTION

In this paper, a construction project as the background, the project ground for the standard office building, underground for equipment room [1-2]. The height of the structure above the ground is 197.8m, and the total construction area is 126000m², including 97000m² above the ground and 290000m² underground [3]. The core tube structure is composed of reinforced concrete beams, slabs, walls and steel columns. The basement structural column is rigid steel

column, the beam and floor are cast-in-place reinforced concrete structure, and the interlayer is set locally. H-shaped steel columns are added to the core tube from the second floor underground. The third floor of the frame structure basement is encased with cross columns, and the second floor and the first floor underground are encased with box columns and filled with concrete [4-5]. The vertical stress structure above the ground is rectangular concrete-filled steel tubular column, the core tube and the outer steel frame are connected by H-beam and rectangular steel column, and the outer steel frame is self-supporting profiled steel plate concrete composite floor. The total amount of steel used in the steel structure of the project is 12000t, and the thickness of the main components is 6, 8, 10, 14, 15, 16, 25, 30, 35 and 60mm, with the maximum thickness of 60mm [6]. The main materials of steel are Q345B, Q345C, etc.

II. QUALITY CONTROL POINTS OF RECTANGULAR STEEL PIPE STRUCTURE PROCESSING

2.1 Technological process of rectangular steel pipe column processing

The processing flow of rectangular steel pipe column is shown in Figure 1:

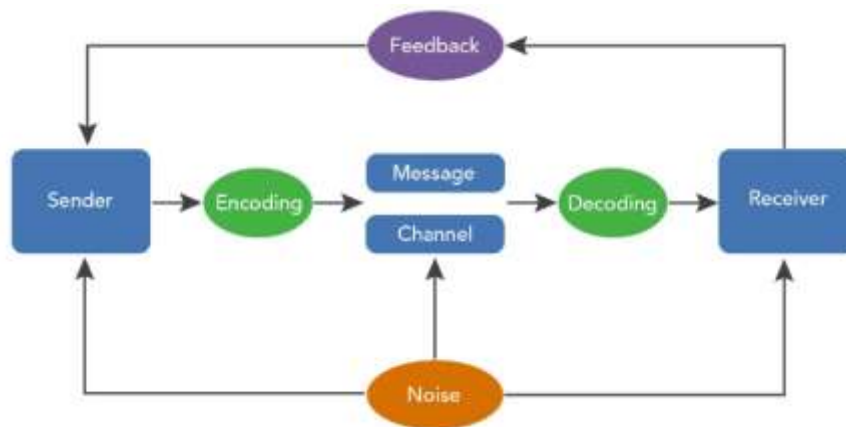


Fig 1: Manufacturing process flow chart of rectangular steel pipe column

Material preparation: according to the detailed drawing of steel structure signed by the construction unit and the design unit, the specification, variety and net consumption of steel required shall be counted, and the net consumption shall be taken as the basis. Combined with the processing capacity of their own enterprises and a certain reasonable amount of loss, it is the final purchase quantity [7-8]. Some construction units will make requirements for steel manufacturers, which must be met in the purchase.

As the main material of steel structure, the quality of steel determines the quality of the whole steel structure project. It is the material basis of our whole quality control. There must be a strict inspection system in the factory. The quality activities of the whole steel structure project construction also start from the steel sampling and inspection. After passing the on-site inspection and the third party inspection, the steel can go through the warehousing procedures. The processing plant shall inspect and test the quantity, variety, specification and size of the

steel used, compare the steel quality guarantee with the nominal value on the steel, and inspect the surface quality of the steel.

The control points of steel structure raw material inspection are as follows: 1. To ensure the safety and reliability of the purchasing channel, it is necessary to order from the supplier with relevant qualification. 2. Each batch of raw materials entering the site must have a separate and effective factory inspection certificate, in which the material quality and chemical composition are in line with the specifications and design requirements. When the above-mentioned supporting documents are not available or the authenticity of the documents is in doubt, the relevant raw materials shall be sampled and rechecked, and the materials can only be used after the quality meets the national standards and design requirements after being tested by the testing unit recognized by the local construction quality management organization. 3. In the process of incoming inspection, if the quality of raw materials is in doubt, it is necessary to carry out re inspection. For imported materials, it is necessary to carry out commodity inspection. If the result of commodity inspection is in doubt, it can be re inspected.

2.2 Quality control points of steel column processing

1. Setting out

(1) Before lofting, be familiar with drawings and relevant specifications, fully understand design intent, and find out difficulties in component processing, so as to establish control points in a targeted manner. If the construction deepening drawings need to be changed, they must be approved by the original design and obtain the design change documents signed by the original design. Without the consent of the original design, no one may modify the contents of the drawings without authorization. (2) Set up a special lofting table, which must be smooth, solid and not shake. Usually, lofting is carried out according to the actual size of components; When the component size of the component is too large and it is difficult to set out the original size, it can be explained by the blanking diagram. (3) The size, diameter, hole position, etc. required by the drawing must be marked when making the first pieces such as sample rods and sample plates, especially the reserved rods and machining deformation should be met.

2. Correction and molding

(1) Correction is also a key process, and the problems are concentrated, which is the root of many problems in the later process and will cause distortion of components. Some processing plants ignore the correction of raw materials, and they think that the correction can be carried out after the components are formed, resulting in irreparable defects of some rectangular columns in the inner partition. From the management point of view, the fundamental reason is that the handover inspection between different processes is not in place. (2) Assembly machines are generally used for forming steel products. Steel plates are cut and welded according to the drawing requirements, transported to the assembly processing area by crane, and assembled on the assembly machine according to the shape and size required by the drawing. Check whether the size, shape, structure and the previous procedure meet the requirements, and then carry out

fixed welding. As shown in fig. 2: the rectangular steel column first fixes the three panels and the inner partition to form a u-shaped structure.

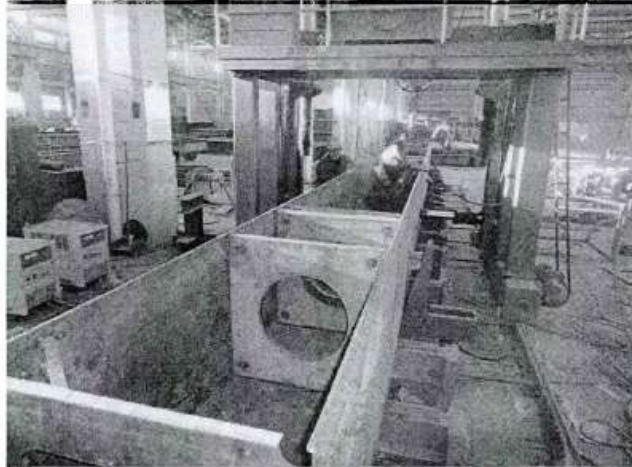


Fig 2: The steel column is being tack welded

3. Welding

The weld of rectangular column adopts full penetration weld and partial penetration weld, and the groove angle is different. For the convenience of processing, the main weld of column adopts full penetration weld, which saves time and simplifies the process. During full penetration welding, CO₂ gas shielded welding is used for manual backing welding, and automatic double wire submerged arc welding is used after polishing [9-10].

(1) The groove shall be polished before backing welding, and the electroslag welding place shall be polished by air gouging;

(2) The height of backing weld: 3-5mm from the plate surface;

(3) It is required that the backing welding should be smooth, without deep pit, base metal burn, air hole, crack and other defects.

In order to ensure that the bottom welding and cover welding can be combined without defects affecting the strength of the weld, the bottom welding bead should be cleaned to show the metal luster, and hand-held grinder is commonly used for grinding.

III. DIFFICULTIES IN QUALITY CONTROL OF CONCRETE JACKING OF RECTANGULAR STEEL TUBE COLUMN

3.1 Selection of concrete pouring technology

It is required in the construction specification that the concrete in the concrete-filled steel tubular column should be non shrinkage concrete, and attention should be paid to the selection of concrete slump in addition to meeting the strength index. The concrete mix proportion shall be calculated according to the design strength grade of concrete and determined by test. For pumping and jacking pouring method, the concrete mix proportion shall meet the pumpability

requirements. High performance concrete must be used in the concrete of rectangular steel tube column, which is the premise of the two materials working together. The self compacting concrete without vibration is the most suitable choice. In order to compensate shrinkage, enhance the integrity of steel and concrete, and increase the fluidity of concrete, expansion agent and polyfusis acid water reducer should be added. In engineering practice, it is found that most mixing plants usually use CAI series water reducing agent. When this kind of water reducing agent is mixed with polyfusis acid water reducing agent, the concrete will harden rapidly. Therefore, the mixing plant must be required to clean the mixing plant and tank truck more than three times to ensure the quality of concrete.

The actual super high-rise structure of self compacting concrete grade C30, C40, C50, C60, need to point out is the concept of high performance, green concrete, and the past we pursue the concept of high strength concrete is different, concrete high workability, high durability, environmental protection, sustainable development is the highest realm of today's construction field.

In the concrete jacking operation of the column core, the internal structure of the steel column must be able to make the pumping concrete pass smoothly. All steel tube inner diaphragms shall be provided with a single hole for concrete pouring, and the hole diameter shall not be less than 200 mm. Air holes shall be set at the four corners of the inner diaphragms, and the hole diameter shall be 25 mm. See Fig. 3 for details. A round hole with a diameter of 150 mm is opened at the lower part of the column limb, and the pipe is welded, 650 mm away from the floor structure layer, so as to facilitate the operation of workers.



Fig 3: Construction of inner diaphragm of rectangular steel tube column

The outlet pressure and delivery capacity of the pump should be considered in the selection of ground pump. HBT110C towed concrete pumps produced by Sany heavy industry are selected as concrete pumps, and two of them are arranged in the structural construction stage. The length of horizontal pump pipe should be 25% of the length of vertical pump pipe. After

the pump pipe of the concrete pump enters the main building, it goes up to the construction operation layer along the middle position of the core tube through 200×300 holes reserved on the floor. The high-strength pump pipe with a diameter of 125mm is selected as the pump pipe. When the building height is 100m, the outlet pressure of the concrete pump can reach 13MPa. It is necessary to detect the wall thickness of the pump pipe frequently to prevent accidents.

3.2 Key points of process control

In the process of concrete pouring, the following work of the mixing station should be spot checked: (1) mix proportion of self compacting concrete; (2) Whether the type and particle size of coarse and fine aggregate are consistent with those of previous trial mix; (3) The collapse degree and collapse expansion degree of concrete, the structure of this project is as high as 200m, the one-time jacking height of self compacting concrete is 9m, and the self compacting concrete has strong thixotropy, so the fluidity requirement of Liu concrete is very high; (4) The temperature of concrete mixture transported to the site shall not be higher than 35 °C and not lower than 5 °C.

Before lifting concrete, hand over procedures shall be completed with the site supervisor of the steel structure subcontractor to confirm that all beam column joints of the lifting steel column have been installed, and the lifting operation shall be arranged with the approval of the supervision engineer after the weld inspection is qualified. In this project, the pump pipe bears large pressure and the amount of concrete is large. The abrasion of the pump pipe should be checked by ultrasonic regularly. If the pump pipe with large wall thickness abrasion occurs, it must be replaced immediately, so as not to cause the pump pipe burst and hurt people. In order to reduce the pipe pressure as much as possible and prevent the pump pipe from blocking, the transportation volume of concrete should be reasonably arranged to ensure the continuous supply of concrete for the concrete pump, and the shutdown time of the concrete pump should not exceed 15 minutes.

Measures for pump pipe blockage during jacking construction: stop pumping immediately when pipe blockage occurs during jacking, check the pump pipe first, if the pump pipe is blocked, find the position immediately and remove the blocking point in time. If the inside of the steel pipe is blocked, the specific location of the blocking point can be determined through the observation hole, and then the upper part of the pipe can be drilled to restart the jacking.

Two sets of high-pressure pumps are arranged in the project site, one for core tube construction, one for rectangular steel tube column jacking concrete, and two sets of standby pumps for each other. When one set of pump fails, the other set can be used immediately to ensure the continuity of jacking construction.

When there are obstacles in the jacking construction which cannot be eliminated in a short time, the construction method should be adjusted to the top grouting high dropping method immediately. The concrete suitable for the high dropping method configured by the mixing station should be used. At the same time, a layer of cement mortar no less than 100 mm should

be poured in the column to prevent the concrete from bouncing. Then, manual pouring and vibration shall be carried out. The height of each pouring shall not exceed 1.5m. The concrete pouring shall be stopped at 500mm away from the top of the column.

3.3 Quality inspection of concrete filled steel tube

According to the requirements of technical specification for concrete filled rectangular steel tube structure, the quality of core concrete in steel column is checked by knocking method. In the concrete jacking construction, the test block shall be reserved and the strength shall be tested according to the requirements of the concrete strength inspection and evaluation standard. Besides, the stress pulse reflected wave method and direct wave method shall be used to test the integrity of the concrete-filled steel tubular column. Three concrete specimens can also be poured at the same time. When testing CFST columns, the three specimens are tested at the same time.

IV. CONCLUSION

In the jacking construction of rectangular steel tube core concrete, the jacking operation has the advantages of saving labor, not occupying the construction period, no tower crane cooperation, no high-altitude operation and so on. More and more projects use this method to pour concrete. It is the fastest way to improve the quality of engineering design and construction to sum up the experience and lessons from the engineering quality accidents. In this case, the designer did not comply with the design specifications when designing the diaphragm of rectangular steel column, the design of concrete through hole did not meet the construction needs, and the negligence of the designer was an important cause of the accident. In addition, the construction unit does not follow the construction specifications in the concrete jacking operation, and does not obtain the consent of the supervision unit in advance, which also requires the construction unit to strengthen the awareness of on-site quality control. Self compacting concrete has excellent working performance, but its quality control work must be paid attention to by the construction unit. If it is not treated correctly, it will not give full play to the characteristics of self compacting concrete, but will cause quality accidents.

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