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CONSTRUCTION TECHNOLOGY

The Discussion on Construction Engineering Technology on Ultra High-rise Building

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ABSTRACT With the speeding up of urbanization and increasing of urban population, the urban land resources are increasingly scarce. Emergence of ultra high-rise building is an inevitable trend. At present, our construction industry is in the rapid development period, where the proportion of ultra high-rise buildings in urban architecture of many big cities constantly increases. The improving ultra high-rise engineering technology is an important part of the construction industry in our country. This paper will analyze the ultra high-rise construction technology of building work in detail.

KEYWORDS

Ultra high-rise buildings

Characteristic

Construction technology

1. Introduction

With the continuous development of China's social economy and urbanization, the continuous improvement of urbanization is an important aspect of our Chinese dream, improving the modern architectural technology, strengthening the process of urbanization, building ultra high-rise skyscrapers is the effective ways to save land resource, and alleviate the increasing urban population in our country. In this paper, a comprehensive analysis is made on the present situation of ultra high-rise buildings and construction technology.

2. Characteristic of ultra high-rise buildings

At present, there is no unified standard on the definition of high-rise building, of which the more authoritative definition is specified on the United Nations conference of international high-rise building on the high-rise building construction in 1972. It has a limit to the height of building, generally is above 100 meters or more than 40 layers. The record of the world's tallest building is constantly refreshed, once the Pentagon was the tallest building in the world, later was Malaysia's Petronas Towers in Kuala Lumpur. Now the world's first building is the United Arab Emirates Dubai Tower, which is 828.14 m high, into the sky, its amazing modern architectural technology.

The differences between ordinary architecture construction application technology and high-rise buildings mainly include the following aspects: first, the investment amount was huge, increasing pressure, and construction period was long; second, working at height has higher risk, and the security of operation should enhance; third, the foundation embedment is deeper, there are higher requirements for concrete foundation slab and crack control; fourth, narrow work space increases organization difficulty of time and space of construction work; fifth, ultra high-rise buildings have a higher requirement for foundation soundness and construction materials; sixth, a series of construction building with great height and distinctive modeling increase the difficulty of construction.

3. The optimization focus of ultra high-rise buildings construction technology

Since there are a series of features for ultra high-rise buildings, such as high requirement of engineering technology, great volume of the work, high difficulty, and large capital investment. We should continually optimize the construction technology, mainly including the following aspects: first, with the main building construction as the key, promote the construction of main building in the process of construction. Perform the main building construction in advance as far as possible, to minimize the payback period of funds, speed up the construction speed through scientific planning, and rational layout on the premise of

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quality assurance; second, in the process of construction, safety must continuously improve. Do good jobs in security work, conduct a series of technical optimization for the special construction environment, and minimize the total project amount; third, due to the special height of ultra high-rise buildings, perform a series of specific measures through the most efficient vertical transportation system. We shall make full use of vertical lift system in the process of construction to improve the operation efficiency; fourth, strengthen management measures of general contracting, focus on improving the utilization of construction space and time, combined with the operation characteristics of ultra high-rise buildings construction step by step, carry on the reasonable, orderly construction of floor space, orderly organize each floor space construction, realize the three-dimensional flow process of the architecture construction space, closely connect each type of work process, weaken the negative influence of narrow working place on construction time as far as possible, and improve the utilization of construction time.

4. The modern construction technology system measures in ultra high-rise buildings construction

Compared with ordinary architectural technology, ultra high-rise buildings require higher technology and security. Now, China possess several ultra high-rise technologies: steel structure construction technology, concrete pumping technology of ultra high-rise buildings, integral sliding mode method, integral climbing form method, athwart construction method and so on, the following will introduce one by one.

4.1. Series construction technology of steel structure

The steel structure of high-rise building is the main part of building, it is critical to guarantee the smooth construction of steel structure, the steel structure mainly includes heavy steel structure, light steel structure, complex structure of steel and concrete, etc. In the actual circumstances of the specific application of high-rise building steel structure, steel structure is not only strong and durable, has good heat preservation effect and strong corrosion resistance, but also easy to conduct mass production, it also is the most commonly used building materials of high-rise building at present. For the specific strength of the steel structure, in the construction of ultra high-rise buildings, the application of steel structure construction is very necessary. In general, steel structure has poor high temperature resistance, in order to promote stability, the temperature need to stay under 250 degrees, also cannot be lower than normal temperature, if the temperature is over 300 degrees, the strength of the building steel will decrease along with the increase of temperature. Therefore, it is important to pay attention to fireproofing, avoid high temperature operation and daub paint to form a protective layer in the process of construction, prevent the steel structure from corrosion. With the continuous application of steel structure construction technology, must make a series of supporting facilities design and construction for fire containment, fireproof coatings and other emergency shelter, to ensure the smooth installation of steel structure.

4.2. Integral sliding mode method and series of climbing form method

During the construction of ultra high-rise buildings, ultra high-rise buildings have big difficulty, long construction period and higher requirements for the various technologies, in order to further enhance the work efficiency, shorten the construction period, mainly adopt a series of core barrel, and shear wall and frame beam and other vertical structures. With the increasing development and progress of construction engineering technology, the construction process of ultra high-rise buildings after entering the standard layer has larger repeatability. In order to minimize the construction period, reduce the outrigger turnover and template applications, mainly adopt integral sliding mode method and climbing mode method in the construction of ultra high-rise buildings. The emergence of integral sliding mode method and climbing mode method can ensure the building integrity of the main floor, broaden the working space of construction, improve the construction efficiency, reduce the adhesion, pipe laying and high cross aerial work. In order to improve the security of building construction, reduce a series of operation, irradiation, pipe laying and high cross operation and so on. Now, the technology has been widely used in high-rise building, it may enhance the efficiency of construction operation, ensure safe operation, and improve the comprehensive benefits of enterprise construction. Integral sliding mode method is mainly used for building walls, install slide template around the main pillar, pour concrete, and apply the hoist to lift the poured structure to the wanted position, through the good combination with other techniques, greatly improve the efficiency of project, save a lot of building materials and human resources. Now the cost of building construction increasingly promotes, and the call for green building is becoming higher. Through a series of construction technology and specified structures of sliding mode method, simplify the construction process, create a series of comprehensive benefits of economic benefits, social benefits and environmental benefits.

4.3. Application of athwart construction method

Athwart construction method has a series of relatively complex construction principles. In general, the construction principle of athwart construction method is to pour the middle supporting columns inside the building, and build underground continuous wall and other supporting structures along the axis of building basement. Make it as the important support of the upper structure weight

loaded by construction before completing the architecture construction bottom plate. In this case, conduct the down excavation of steps, and perform the bottom cover of underground structure of every layer, at the same time, enforce the construction of structure on the ground step by step [1].

Compared with the traditional construction technology, athwart construction method has the following advantages: first, athwart construction method can greatly save the time limit of basement, no difference between engineering, except for occupying absolute time limit for the next layer. Besides that, it can ensure the contemporary construction of the basement under the first floor and structure above the ground; second, compared with the ordinary temporary support, it can guarantee a solid foundation, reduce the pressure of adjacent pipeline. This method conducts pouring layer by layer on the basement structure, as the supporting structure, the middle support column has stronger stiffness for internal support. By means of step by step casting, make integral load and the main pillar avoid deformation and distortion of the foundation, and decrease significantly the settlement influence of adjacent underground pipelines, roads and structures; third, athwart construction method can satisfy the arrangement of poured underground continuous wall during construction, to reduce the pressure of floor and floor reinforcement issues, and let floor design to be more reasonable. Apply reliable or planed red line to construct underground continuous wall, let it become a permanent exterior wall of basement, thereby expanding the construction area of engineering; fourth, under the premise of meeting structure pipeline layout, poured underground continuous wall can be built close to or on planed red line and used as a permanent basement exterior wall, then achieve the goal of extension of building area.

4.4. Pumping concrete technology is the concrete refining technology adopted by ultra high-rise buildings

Since ultra high-rise buildings have larger weight, bigger pressure, longer time limit, in the process of building engineering construction, hence demand for concrete was large. Traditional concrete technology which needs to configure a large number of machines and cement is difficult to meet the requirements. At present, the pouring concrete technology usually used in mainland of China is to configure the fly ash and chemicals in certain proportion. With the development of modern construction technology, emergence of pumping concrete technology provides greatly convenience for the transport of concrete, improve work efficiency, save a lot of manpower, is quick and efficient, it is the foundation to construct the ultra high-rise buildings smoothly [2]. With the progress and development of pumping concrete technology and the direct pumping of concrete by machine to the required location, the efficiency of building is greatly improved.

5. Specific measures for issues of ultra high-rise buildings engineering construction

5.1. The problems of reinforced concrete precast pile and the corresponding measures

5.1.1. Breaking of pile body

Strict inspection on bending condition of pile before construction; guarantee the quality of concrete; effective control of slenderness ratio of each pile; timely repairment should be made once the pile body fractures!

5.1.2. Tilt of pile body

Strictly control verticality of pre-bored hole; ensure construction site must be smooth; in process of pile extension, and ensure that axis coincidence of pile up and down.

5.1.3. Breaking of pile body

The choice of pile hammer must be reasonable, ensure heavy hammer taps; design of pile should be carried out in accordance with relevant quality standards; and strength of precast pile should meet the design strength requirements.

5.2. The problems in steel structure installation process and the corresponding measures

5.2.1. Displacement of bolt

Effectively guarantee bolted frame strength and stiffness, check bolted frame dimension, after completing bolt installation and reexamination should be made to prevent problems.

5.2.2. The displacement of steel column

Before pouring the foundation concrete, re-examination the pillar axis measurement in detail, fix the embedded bolt with fixed chuck or fixed frame, and avoid dislocation.

5.2.3 The vertical deviation of steel column is greater than the specified deviation

When lifting the steel column, we should effectively fix the whole row of column, arrange column bracing, and then hoist the upper structure. Temporary support should be added immediately to prevent impact due to wind or collision.

5.2.4. Mounting surfaces is not in conformity with the provisions

Timely clean up the dirt on the mounting surfaces of bolt and remove the burr by grit blast or polish.

5.2.5. Connection plate is not closely connected

The ratio of planar slope of component and connection steel is more than 1:20, when needing straight connection during the process of steel plate connection, gaskets should be placed in the gap to guarantee close contact.

5.3. The problems of reinforced concrete construction project and the corresponding measures

5.3.1. A honeycomb pitting surface

The process of casting may be conducted in a hierarchical

manner. Thus, choose correct proportion of concrete and mortar sand to increase stiffness of the template [3].

5.3.2. Lack of edges

When the edges of concrete member are damaged, repair it in time. When disassembling module, protect the edges are not destroyed; surface of wood template plane will be polished and smooth.

5.3.3. Hole

When making the pouring of concrete, select fine stone concrete; clean up the loose concrete around the holes which are formed, complete the surface protection work; inspection holes should be leaved when pouring the high strength plate and pillar.

6. Conclusion

Finally, with the development of economy, contradiction between urban land resources and population was more highlight. The rise of ultra high-rise buildings is the inevitable trend of social and economic development, and mature ultra high-rise buildings construction technology is the key. Now the ultra high-rise buildings level in our country has reached the world high level stage, but the development is imbalanced. The top cities have mature technology, while the technical level of lower-tier cities still needs to continue to strengthen. Therefore, we need to constantly accumulate experience in practice, absorb advanced construction technology at home and abroad, develop and perfect constantly, promote the ascension of high-rise buildings level and the rapid advance of urbanization.

Conflicts of interest

These authors have no conflicts of interest to declare.

Authors' contributions

These authors contributed equally to this work.

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