Measures for Design and Optimization of Architectural Spatial Structure under New Situation

Miao Zhang
Class 052204 Civil Engineering Major, School of Engineering, China University of Geosciences, Wuhan 430074

Abstract: With the acceleration of urbanization in China, people have higher and higher requirements for building safety, comfort and artistry. For building construction units, it is necessary to further optimize building space structure design and further improve building safety quality. Architectural designers should improve the acceptance system of building materials, strictly control the quality; Improve the welding process of building space structure, ensure the rigid space structure of scaffolding installation, and ensure the safety of building use; Do a good job of building structure calculation to ensure the safety of building construction; Strictly control the installation precision of steel structure, ensure the safety of building space structure, and comprehensively improve the quality of building engineering.

Key words: building construction; Building space; Structural design; Optimization measures

In recent years, the scale of construction projects in China is increasing, the space system is becoming more and more complex, and the space structure plays a more and more important role in the architectural space design. Architectural designers should pay attention to the design of building space structure, standardize the calculation process of membrane structure and load-bearing structure, further reduce the error, strengthen the control of building space structure design, analyze the steel structure and concrete structure, select the high-quality building materials to further enhance the stability of building structure and ensure the overall structural quality of the building. At the same time, the designer should also carefully design the scaffold rigid structure space, steel structure space structure construction scheme to ensure the smooth completion of the building project.

1. The characteristics of building space structure under the new situation

1.1 Diversification of building materials

High-rise building is a mainstream development trend of building industry in our country, and space grid has become a new hot spot of building space structure. In order to meet the requirement of high-rise building bearing, stronger and corrosion-resistant materials are more favored by the building designers. In addition to ordinary carbon steel, aluminum alloy, stainless steel gradually become the building space structure design commonly used materials, not only can be used to build building corridors, awning and doors and Windows, but also can be used to do building decoration, to meet the building space structure bearing, corrosion resistance and decorative role. In addition, China's architectural design began to use the membrane structure of building fabric, which can not only reduce the building's own weight, but also enhance the stability and corrosion resistance of the building structure. Building fabric is a new type of composite material, with high strength, light transmission, non-flammable and easy to clean and other characteristics, can be used to do building space structure.

1.2 unique and changeable form of space structure

At present, China's architectural spatial structure forms are more and more diversified, which can not only reflect the architect's style, but also reflect the regional and humanistic characteristics, and become a landmark building of the city. In the design of architectural spatial structure, many architects are no longer limited to a single architectural style, and begin to try a combination of various architectural styles to create a unique architectural style, which is practical, ornamental and economic value.

1.3 The application of prestressing technology

Prestressing technology is widely used in the suspension cable structure of buildings, which can not only ensure the balance of the structure, but also strengthen the building space structure. For example, architectural designers can use external prestressing technology to strengthen the reinforced concrete structure, and use the main structure and section anchor to fix the main section of the building, so that the main structure can withstand the transfer stress, improve the mechanical performance of the building engineering structure, and the rigid carrying capacity of the building. In addition, the architectural designer can also apply the prestressed technology in the lattice shell project or the design of the grid engineering, the use of prestressed technology to analyze the cable scheme, construction tension, limit load, etc., to further improve the building space grid structure design.

2. Under the new situation of building space structure design points and norms

The building space structure design is mainly divided into wood structure, steel structure, concrete structure and masonry structure, according to the requirements of the construction side, engineering quality standards, etc. to carry out the building space structure design, not only to meet the design needs of investors, use needs, but also to ensure the safety of the building project. First, the architectural spatial structure design should follow the design principles of beauty, practicality, economy and green environmental protection, do a good job in the basic plan design, comprehensive geological conditions of the construction site to design the spatial structure design drawing, for example, for the soft foundation, uneven soil, designers to increase the number of strips under the column, reduce the weight of the building, strengthen the hardness of the foundation, To ensure the stability and weight of the whole building. Second, the architectural design should pay attention to the space structure design of the basement, focusing on the connection design of the seismic joints and expansion joints in

the basement, and improve the seismic performance of the building. The basement space structure design should match the strength and weighing of the whole building. If the basement adopts concrete walls, then the beam between the main foundation beam and the floor of the building can no longer be designed. If the whole building adopts an independent foundation design, the basement can adopt a cone foundation design to reduce engineering consumption and practice the green construction concept.

In the design of the stairs and beams inside the building, the architectural designer should consider the height of the stairs comprehensively, ensure that the height of the stairs and the height of the entrance of the building should be in a reasonable range, and control the height and stability of the floor. At the same time, the designer should also pay attention to the height and Angle of the beam to match the section, if the building girder exposed, to design cross-section beam, both can reduce the weight of the beam itself, but also to ensure the weight of the beam. In the design of building spatial structure, designers should do a good job of structural calculation and analysis, clear building floor structure, load-bearing wall structure and other values, can use BIM software for accurate calculation, and adjust the building spatial structure design drawing according to the building model, improve building safety and earthquake resistance.

3. Building space structure design and optimization measures under the new situation

3.1 Pay attention to the calculation of building spatial structure and reduce the design error

The spatial structure of high-rise buildings is more complex, and architectural design is to integrate building construction drawings, construction standards and site survey data to carry out spatial structure design, analyze all kinds of data, standardize the calculation process of building structure, further analyze design errors, and lay a good foundation for subsequent construction. First, the designer can use BIM software to calculate the building spatial structure, import the data of the main building height, height, load-bearing wall position, foundation pile foundation and basement into the system, carefully check the design drawing data, and build a three-dimensional model of the building, according to the model to analyze whether the building spatial structure design is reasonable, and further adjust the various structural data. Check whether the design data is reasonable, carefully analyze the design error, select the appropriate parameters to adjust the spatial structure design drawings. Second, the designer should strengthen the calculation of the building space structure, the detailed calculation of the steel structure, concrete structure, etc., verify whether the parameters are reasonable, whether the error is within the standard range, optimize the structural design scheme, so that the overall number of spatial structure design is more reasonable.

3.2 Formulate a material re-inspection system to ensure the quality of construction materials

The quality of building materials is the key factor that affects the service life and building quality of buildings, and it is also an important factor that affects the design of building spatial structure. First of all, the designer should actively communicate with the construction side to develop a sound re-inspection system for building materials, such as the quality of steel, concrete, cement and various accessories. In addition to the inspection of the qualification certificate of materials and accessories, the quality of all materials and accessories should be tested to avoid the problem of material evidence discrepancy. For example, designers can work with engineering supervisors to formulate quality inspection standards for steel pipes and clarify the standards for different types of steel pipes. In addition to testing hardness and stiffness, ordinary structural steel pipes should also be tested for weldability. Steel pipes that resist drilling require the use of medium carbon and high manganese materials. To replace the relevant materials in time to ensure the quality of design and construction. Secondly, the designer should also conduct on-site test and inspection for the building wood structure, steel structure and concrete structure materials, use the incoming materials to carry out the experiment, and complete the experiment together with the construction personnel to observe whether the steel bar, steel pipe, cement and other building materials meet the toughness, stiffness and seismic performance required by the design drawings, and import the experimental data into the BIM model. Scientifically verify the final renderings of the building spatial structure, correct the design drawings in time, and replace the substandard building materials and accessories.

3.3 Strengthen the management of welding and scaffolding structure to ensure construction safety

First, the architectural designer should strengthen the welding process management of the steel structure, strictly control the size of the weld, ensure that the size deformation of the welded component meets the requirements of the design drawings, and ensure the stability of the steel structure. For example, designers in the design of large welding structural components, long-span space structural components, to carry out scientific calculations, clear weld size, welding process specifications, welding experiments, according to the experimental data to determine the size of the weld and welding machine construction plan, to further improve the quality of welding process. Second, designers in the building space structure design, to reasonable design of scaffolding rigid space structure design, to ensure the rigidity of scaffolding, reasonable design of full scaffold installation program. For example, designers can work together with construction personnel to carry out scaffold rigidity and pressure test, the use of prestressed technology for scaffold rigidity test, to prevent the scaffold from deformation or sinking during the installation process, reasonable design of scaffold connector installation scheme, to ensure the rationality of scaffold space structure. At the same time, the scaffold in the installation and use of the process to continue to strengthen, according to the scaffolding rigid pressure test data, focus on the scaffold bearing heavy place reinforcement, to ensure the safety of construction personnel, to further improve the stability of the building space structure. Architectural designers should strengthen the design and management of welding and scaffold space structure, strictly calculate the pressure and rigidity data of scaffolding, scientifically control the size of welding joints of space components, do a good job in the reinforcement design of scaffolding, further ensure construction safety and improve the construction quality of construction projects.

3.4 Pay attention to the design of steel structure and improve the design quality of building space structure

Steel structure design is an important component of building space structure design, and it is also one of the important factors affecting the entire building structure system. Designers should constantly improve the design accuracy of steel structure, reasonable control of the height difference of support coordinates, according to the steel structure space design drawings and compressive test data to design the installation plan of steel structure, as far as possible to reduce the height difference of support coordinates, to avoid deformation of steel structure in the installation process. For example, designers can analyze the axis and the standard difference of the embedded support, clarify the position of the embedded support, use architectural CAD software to build a model, analyze the axis and elevation position of the embedded support, the error value, and ensure that the error value is within the range of building construction standards. Once the support is found to be abnormal, the position of the rod should be adjusted to reduce the excess. Adjust the position of the hinge support connected with the bolt to avoid changes in the steel structure system. At the same time, the designer should also pay attention to the fire protection design of the steel structure, according to the selection of materials, to choose the appropriate fire protection coating materials, to ensure that the fire protection coating and the original bottom coating of the steel structure are matched, and to further improve the fire protection performance of the steel structure. Construction enterprises should strengthen the safety education of designers and construction personnel, let them pay attention to the problem of steel structure support, fire protection design, construction according to the building spatial structure design drawings, avoid changes in the bearing design of the building spatial structure, eliminate the safety hazards in the design of the building spatial structure and the construction process, and ensure that the building project is of high quality and delivered on schedule.

Epilogue

Architectural designers should actively respond to the challenges of the new era, constantly learn new concepts and technologies of architectural spatial structure design, run BIM software through the entire architectural spatial structure design, carry out scientific calculations on architectural steel structure, wooden structure, concrete structure, etc., build three-dimensional architectural models, and focus on the analysis of architectural spatial structure welding, scaffolding structure, steel structure space, etc. Further improve the quality of architectural spatial structure design. At the same time, the designer should actively cooperate with the construction personnel to accept the incoming building materials and accessories, conduct experiments on the building spatial structure, timely adjust the design drawing of the building spatial structure, and comprehensively improve the quality of architectural design and construction.

References:

[1] Qiqi Lu. Analysis on the design of a 100-meter high-rise building without inner column in Guangzhou [J]. Anhui Architecture,2022,29(10):73-75.

[2] Xin Pei. Spatial optimization design of concrete structure based on Virtual reality technology [J]. Journal of Chengdu University of Technology,2022,25(01):29-32.

[3] Jiong Bai,Heng Chi. Analysis of the influence of floor deformation on the exterior wall structure design of underground large space [J]. Urban Road and Bridge Control,2022,No.275(03):246-249+25.

[4] Jiong Bo,Heng Chi. Analysis of the influence of floor deformation on the exterior wall structure design of underground large space [J]. Urban Road and Bridge Control,2022,No.275(03):246-249+25.

[5] Haoran Chen. Study on construction technology of frame structure of building engineering [J]. Farm Staff,2020,No.648(05):81.