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Design Strategy of Special-Shaped Structural Column in Residential Building

Ding Bin

Wenzhou Polytechnic, Wenzhou 325035, China

ABSTRACT. *At present, in the construction of residential buildings, the special-shaped structural column is a kind of structural frame column with high application value. The special-shaped structural column makes the stability of the building structure greatly improved, the spatial layout more scientific and reasonable, and the bearing capacity greatly improved. Therefore, the design unit of construction scheme of construction project needs to have more knowledge and understanding of this kind of building structure frame column form, so as to combine with the needs of project construction, carry out the design of special-shaped structural column of construction project to effectively guide the construction project. This can promote the use of the building has a better quality and safety, and effectively protect the personal safety of housing users. Based on this, this paper summarizes the related content of special-shaped structural columns, and makes in-depth analysis and Research on the specific strategy of using special-shaped structural columns in the design of residential buildings.*

KEYWORDS: *Residence; Architecture, Special shape; Structural column; Design; Strategy*

1. Introduction

Introduction: In recent years, with the rapid development of social economy, many cities have invested a lot of manpower, financial resources, material resources and technology in the construction of modern cities. At the same time, many people from other places have been attracted to the city for modernization. The contradiction between the rapid development of the city and the insufficient supply and demand of people's housing use also leads to the problem, which restricts the long-term and steady development of the city. Therefore, it is necessary for the city to vigorously carry out the construction of residential buildings, especially high-rise buildings, in order to alleviate and improve the contradiction. In the practical and effective application of protecting people's housing use needs, the effect of special-shaped structural column is very good. After practical application, the spatial layout of the building tends to be more scientific and reasonable, and the modifiability and service life of the house are significantly improved. Therefore, this paper explores and analyzes the application strategy of this kind of building structural frame column in the design of residential building engineering.

2. Overview of Special-Shaped Structural Column

The special-shaped structural column refers to the structural column whose cross-section form is quite different from the rectangular cross-section form of the construction engineering under the normal circumstances. This kind of structural column mainly includes cross, l, t and other cross-section forms, and the height thickness ratio is controlled below 4. The concrete application in the design and construction of building engineering includes frame shear wall structure and special-shaped column frame structure system.

Relying on different cross-section columns to support the building, it can avoid the protruding of frame columns in the past design and construction of building engineering, and increase the available space greatly. And in the construction period, we can also use insulation materials with strong insulation effect for wall construction design, which can improve the application effect of the wall. Therefore, the frame column of this kind of building structure needs to be used more in the design and construction of building engineering [1].

3. Analysis on Design Strategy of Special-Shaped Structural Columns in Residential Buildings

3.1 Structural System Design

First of all, during the structural system design of special-shaped structural columns for residential buildings,

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it is necessary for the construction scheme design unit to effectively grasp and study the architectural layout, stress and other conditions of the project, and then based on the application of special-shaped structural columns, special-shaped columns and frame columns can be used to determine the final special-shaped column structure. If the target residential building project has a larger application requirements of underground space, it needs designers to optimize the design of the bottom of the frame structure, so that the bottom can form a transfer layer with column drawing belt, so as to achieve the purpose of rational utilization of the underground space of the residential building. At the same time, the designer calculates and analyzes the height parameters of the house when carrying out the design of the special-shaped structural column in the residential construction project, so as to ensure that the design of the special-shaped structural column has a very good result in the construction and application of the construction project.

When the buried depth of the first floor foundation of the residential building is controlled as 4m, the standard floor height can be controlled as 2.8m. In terms of the strength grade of concrete used in construction, it is required to use C40 concrete in the bottom area of the building, and then with the rise of the building floor, the concrete grade can be gradually reduced. In order to ensure the good construction quality of the stratum, the three forms of the special-shaped column section of the building can be used.

If the construction project is constructed in non seismic area, the height, thickness and shear wall thickness of special-shaped columns need to be controlled, which are 950mm, 250mm and 250mm respectively; If the building is located in the seismic area, it need to be controlled in 750 mm, 200 mm and 200 mm respectively; If the section thickness of special-shaped columns in residential buildings is not more than 200 mm, the number of single row of longitudinal stress-bearing steel bars shall be controlled below 2;

If the thickness is more than 200 mm and less than 250 mm, the number of single row is reasonable to be set as 3. Compared with the stirrup spacing design, the stirrup spacing is required to be 2 times of the stirrup spacing; The design forms of longitudinal reinforcement and stirrup of special-shaped column frame mainly include cross, T-shaped and L-shaped. If it is in the same section, the designer can control the diameter of the longitudinal stressed steel bar, which is more than 14 mm but not more than 25 mm, and the diameter of each steel bar should be consistent. If the spacing between the bars is more than 250mm, the longitudinal structural bars need to be designed in the spacing area, and the diameter is controlled to 12mm, so that the effect of the bars in the use period is good; In the aspect of longitudinal reinforcement ratio of special-shaped frame columns, designers should pay attention to that if the seismic grade is grade 2, the reinforcement ratio of middle column, side column and corner column should be more than 0.7% and 0.9%. If the seismic grade is grade 3, the reinforcement ratio parameters of the three indexes should exceed 0.6%, 0.6% and 0.8% respectively. The longitudinal reinforcement ratio of special-shaped frame columns shall not exceed 3% according to the seismic grade [2]; In the design of stirrups for special-shaped frame columns of buildings, attention should be paid to the use of composite stirrups. The stirrup shall be set as internal closed type. Hook design shall be carried out at the end of stirrup, and 135 degree angle is suitable. The diameter of the hook should be more than 10d. When designing the length of the stirrup densification area, pay attention to the reference section length, which is one sixth of the reference value. The stirrup diameter remains unchanged, and the spacing between stirrups should be controlled to 100mm; In the design of special-shaped column frame joints in residential buildings, designers need to determine and analyze the parameters such as section width, limb width and thickness of frame beams in advance. If the two parameters are the same and the beam section width of the special-shaped column frame protrudes outward towards the column body and the length is less than 50 mm, it is necessary to design the frame joint towards the column bar. If the section protrudes more than 50 mm towards the outside of the column, it is necessary to design the beam column joint from the outside of the stressed reinforcement [3]; When designing the connection between the column and the infilled wall of the residential building, the staff is required to design the construction material type scientifically and reasonably. In general, the light-weight materials should be used for design and construction as much as possible, in order to make good connection with the special-shaped column frame with the help of the application advantages of this kind of materials. If a residential construction project is determined to use masonry for wall construction, the designer needs to pull the reinforcement and frame column at the junction of the frame and infilled wall. The reinforcement is mainly extended from the edge area of the column, and then it can be placed into the wall. If the anti-seismic grade of the building belongs to level 2 and level 3 respectively, the filling length of the infilled wall needs to be controlled separately. The former needs to be filled completely, and the latter's filling amount refers to the wall length which is about one fifth of the wall. The strength of the infill material in the wall shall be controlled, which shall exceed M2.5. If the length of the infilled wall of the building exceeds 5m, it is required to design the connection between the top of the wall and the beam. When the height is more than 4m and less than 5m, the reinforced concrete horizontal wall beam needs to be built in the middle of the infilled wall, and the wall beam needs to be effectively connected with the special-shaped column [4].

Secondly, during the design of the special-shaped column structure system of residential buildings, designers

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are required to refer to the relevant standards for the standardized design of the system to ensure the high practical application value of the special-shaped column frame system. In the aspect of structural design of residential buildings, it is advocated to control the structural stability, that is to say, when the Designer completes the design work of special-shaped structural columns of buildings, he needs to have a good grasp of the seismic fortification requirements and intensity of the building itself, the height of the building and the operation technology used in the construction. From the perspective of architectural effect, economy and safety, the best structural frame system is selected. Designers also need to evaluate the structural ductility, increase the number of statically indeterminate and so on, so that the structural stability can be greatly improved compared with that before. If the structure is damaged during use, it also has a very ideal stability effect, and the risk of large damage is low, especially it can resist the threat of earthquake disaster, and the risk of building collapse is small; During the aseismic design of special-shaped columns in residential buildings, designers are required to pay attention not to design complicated single span frame structures for special-shaped columns. Designers should avoid the reduction of seismic effect. During the design of the elevator shaft and stairs of the building, the frame column shall be designed according to the layout of the building. The overall residential building special-shaped column structure needs to be cast-in-situ concrete structure construction [5].

3.2 Structural Layout Design

First of all, the layout of special-shaped column structure in residential buildings requires the designer to adhere to the characteristics of regularity and simplicity in the layout work. Moreover, it should be in an independent unit to prevent eccentricity and ensure that the load-bearing capacity and stiffness of the completed special-shaped column structure meet the standard and maintain a uniform state. When arranging the vertical and horizontal grid lines of the special-shaped column structure frame, pay attention to the alignment design, and the center lines of the special-shaped column section limb thickness and the frame beam shear wall should always be aligned.

Secondly, the vertical layout. When carrying out the vertical layout design of the special-shaped column frame of the construction project, the designer is required to accurately grasp the key points of the seismic design of the building under construction. When the vertical section and facade of a building are arranged vertically, the designer should master the characteristics of internal collection, uniformity and regularity. For vertical structural members, the section size and material strength shall be checked. If the two indexes have great changes in the same floor of the building, then it is necessary to perfect the design. For the vertical layout of special-shaped column structure system of buildings, it is proposed to directly arrange the special-shaped columns in a continuous state, but for other special-shaped columns, it is necessary to carry out targeted layout. For example, there is a big difference between the vertical layout of high-rise buildings with underground space needs and the normal vertical layout of coherent special-shaped columns after the design of special-shaped columns. It is required to transform the special-shaped column beam and drag column of the building in the actual vertical layout. After the completion of the design of this link, continue to transform the small column network, so as to finally build a large space at the bottom of the special-shaped column, so as to make the special-shaped column structure of the building fully through, and ensure that the use value of the special-shaped column is effectively highlighted [6].

4. Conclusion

The application value of special-shaped structural columns in residential buildings is high, which is worth to be applied and popularized in the construction of residential buildings in more places in the future. The specific application requires that the residential building designers have a full grasp of the content of the special-shaped structural column and master the design points. The designer should scientifically and reasonably design the structural frame column of the construction project, so as to ensure that the construction project can give full play to the use value after completion. In this paper, there are still many defects and deficiencies in the design of special-shaped column structure of residential buildings. It is necessary for designers to continue to strengthen the research and innovation of this part in the future research of special-shaped column structure of buildings, so as to promote the application of special-shaped columns in more types of architectural design and construction.

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References

[1] Zhou Chengjia (2016). Application of special-shaped column in multi-storey frame structure. Science & Technology Information, vol.14, no.31, pp.59-60.
[2] Wang Shenghui (2016). Analysis of problems in the design of residential structure. Henan Building Materials, no. 5, pp.161-162.
[3] Pan Xiao (2015). Discussion on the design of special-shaped column structure residence. China Housing Facilities, no. Z4, pp.79-81.
[4] Su Hexian, Pan Wen, Zhang Xingxian (2019). Study on base isolation of frame structure with special-shaped columns in 8-degree area. Journal of Vibration and Shock, vol.38, no.20, pp.154-163.
[5] Wu Yiran, Shi Yongjiu, Meng Lingye (2019). Bearing capacity test of T-shaped CFST special-shaped column and I-shaped steel beam joint. Journal of Shenyang Jianzhu University (Natural Science), vol.35, no.5, pp.769-778.
[6] Zhu Hao, Liu Feng (2019). Experimental study on bearing capacity of concrete filled steel tubular composite special-shaped columns with L-section and single steel plate connection. Scientific and Technological Innovation, no. 25, pp.109-110.