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Research on the Function of Architectural Design Based on Seismic Observation Records in Seismic Design of Buildings

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ABSTRACT. *Earthquake resistance is one of the most important design indexes in the design standards of buildings. The quality of earthquake resistance directly affects the stability of building structures. The organic combination of architectural design and seismic design is an inevitable choice to meet the requirements of seismic design of buildings. Whether the seismic requirements are well considered in the architectural design will directly affect the seismic capacity of the building. Good seismic design of buildings can only be realized through the cooperation and good coordination between architectural design and structural design. If the designer did not consider the seismic resistance of the structure in the previous architectural design, then there will be great limitations in the construction of the structure. China's current level of building seismic design technology is insufficient, and there are many problems in the process of building design. This paper discusses the relationship between architectural design and seismic design, and analyzes the role of architectural design in seismic design of buildings based on seismic observation records, with a view to improving the overall seismic level of China's construction industry.*

KEYWORDS: *Architectural design, Earthquake resistance, Construction*

1. Introduction

With the earth's geological activities entering a relatively active period, people have gradually attached importance to the seismic capacity of buildings. How to improve the seismic design level of buildings has become a problem that many buildings must consider in the design process [1]. If the architect can consider the seismic requirements in the construction scheme and preliminary design stage, the structural engineer can reasonably arrange the structural member system to greatly improve and enhance the seismic performance and bearing capacity of the building structure [2]. There is still a misunderstanding about seismic design of buildings. It seems that seismic design of buildings is only a matter for structural engineers and has little to do with architects. If the seismic performance of the building is not fully considered in the specific building design, only the way of strengthening some components can be set in the specific building construction, so that the seismic performance of the building can be improved [3]. Architects should consider the

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anti-seismic design of the structure when designing, so that the structural designer can reasonably arrange the building during the later structural construction [4]. Then, combined with the mass and stiffness distribution of the structure, after fully calculating the seismic force, a detailed seismic structural design scheme is worked out [5]. In an earthquake, the plane shape is complicated. For example, where there are many irregularities on the plane, or where there are too many flanks, all are damaged by the earthquake. There are many obvious cases in the Tangshan earthquake.

In the specific design process of modern buildings, in order to improve the building function and enhance the stability of the internal structure, it is necessary to optimize the seismic design of the building and maximize the service life of the building. Seismic calculations and structural measures based on structures alone are still difficult to obtain better results of earthquake resistance under strong earthquakes, and even the degree of seismic damage of buildings cannot be reduced [6]. Existing research shows that it is difficult to achieve the basic goal of seismic design by relying solely on the seismic design of buildings. The basic requirements of seismic design must be fully implemented in the architectural design, and the relationship between architectural design and seismic design of buildings must be clarified. . If the designer did not consider the seismic resistance of the structure in the previous architectural design, then there will be great limitations in the construction of the structure [8]. In the process of construction of an engineering project, in order to carry out building seismic design, the foundation of building design must be laid first. Whether the design scheme can resist the invasion of earthquakes and meet people's needs is the focus of the construction unit Question [9]. This paper discusses the relationship between architectural design and seismic design, and analyzes the role of architectural design in seismic design of buildings based on seismic observation records, with a view to improving the overall seismic level of China's construction industry.

2. Main Design Problems of Architectural Design in Seismic Design

2.1 The Design of Building Shape

Architectural shape design mainly refers to the plane shape and three-dimensional space shape design of buildings. If the plane shape of the building is complex, many convex and concave design schemes are adopted in the design, or too many overhangs, symmetrical array test arrangements, etc., the damage of these buildings in the earthquake is relatively large. Taking the analysis of building sight as an example, the traditional way is usually for designers to select the best area according to the terrain, such as the facing hillside or the level ground without shelter. However, the designer cannot quantitatively judge the scope that can be observed at a specific position in the early stage. As for the earthquake resistance of buildings, whether the earthquake resistance design requirements are taken into account in the overall planning and preliminary design of the building design, and whether the building design and the structural earthquake resistance requirements

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are well combined will directly affect whether the designed buildings have good earthquake resistance performance and larger earthquake resistance capacity [10]. Parameterized design is not particularly effective in the application process of the construction industry because the actual situation is relatively complicated. In the plane design of buildings, the plane layout has an important influence on the earthquake resistance of buildings. In the plane design of buildings, the space between columns, the space arrangement of walls, the location of stairs, the location of elevator shafts and the number of rooms, etc. all have great influence on the rigidity and quality of buildings.

2.2 Architectural Layout Design

The layout design of buildings has a great impact on the seismic capacity of buildings. The more complex the layout, the greater the adverse impact on the seismic capacity of buildings. After building blocks are generated, the mutual occlusion of building blocks is usually determined only according to the plane relation or the section relation in some places. In building layout design, designers should try their best to maintain the uniform and coordinated distribution of the quality and stiffness of the building structure, avoid abrupt changes, and prevent the torsional effect from adversely affecting the quality, structure and seismic performance of the building. Due to the complexity of architectural design, architectural demand is only one of the necessary considerations. In the design of shear wall, considering that shear wall is the main part of seismic resistance of building structure, the design of this part should be consistent with the requirements of structural seismic resistance. For buildings with high rigidity, elevators should be designed in the middle part of the building, so as to avoid the impact of eccentric and torsional earthquake on the life safety of people taking elevators [11]. In the planning and design process, the spatial geographic information conditions, regional climate characteristics, construction engineering and maintenance management costs are comprehensively considered. In the overall design of building layout, designers should create favorable conditions for the arrangement of structural lateral force resisting members in the scheme. Only in this way can the functional design and seismic design of the building be integrated and the seismic capacity of the building be improved.

3. Control of Design Limits to Be Satisfied in Buildings

In the design of high-rise and super high-rise buildings, roof building is an important part of the design. The center of gravity of the roof building and the center of gravity of the lower building are not on the same line, and when the lateral force resisting wall of the former and the lateral force resisting wall of the lower floor are not continuous up and down, the torsion effect of earthquake will be brought, which is more unfavorable to the earthquake resistance of the building. After the preliminary overall layout is determined, the mutual occlusion analysis of the building groups is carried out. In construction projects, there are other surrounding

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buildings besides their own. The buildings in these environments will have an impact on the resources of the buildings. Before further deepening the design, the impact should be minimized as much as possible. If the designer is abstract, then it is very likely to design a perfect design. Although it is difficult for ordinary people to understand the connotation of the works of some masters of art or abstract works, their superb techniques cannot be excluded [12]. The parametric design method is applied to the scheme design stage respectively, and the application of parametric design is just like that. If the architectural design provided by the architect does not well consider the seismic requirements, it will bring more difficulties to the seismic design of the structure, making the seismic layout and design of the structure limited by the architectural layout, and even causing unreasonable structural design.

In the parametric calculation of buildings, the calculation and analysis of the whole structure are carried out, and the elastic time-history analysis under frequent earthquakes is carried out according to the artificial seismic wave parameters. For example, Table 1 shows the maximum acceleration and duration of seismic waves.

Table 1 Relevant Parameters Such as the Maximum Acceleration Value and Duration of the Seismic Wave

Scope of adaptation	Maximum acceleration value (cm/s2)	Duration (s)	Number of wave values	Time step(s)	Effective duration (s)
Artificial shock wave	95	80	1550	0.05	33.65
Natural shock wave	90	45	1400	0.05	34.67

When performing 3D modeling, the flat curve, vertical curve, and the combination of the two are easily determined and adjusted. The basic equation of the quadratic parabola vertical curve is:

$$D(\mathbf{V}_t, \mathbf{V}_t') = \sqrt{\sum_{i=1}^{c}\left(\frac{V_{ti} - V_{ti}'}{|V_{ti}| + |V_{ti}'|}\right)^2} \quad (1)$$

The length of the vertical curve or the radius of the vertical curve is:

$$\log\Gamma(x) = -\gamma x - \log(x) + \sum_{k=1}^{\infty}[\frac{x}{k} - \log(1+\frac{x}{k})] \quad (2)$$

The sample is sent to the hidden layer unit through the connection weight to generate a new activation value of the hidden layer unit:

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$$C = \sum_{i=1}^{m} \sigma_i l_i r_i \tag{3}$$

The change of architectural layout selection is mainly realized through interpolation points:

$$P = \frac{\sigma_i^2}{\sum_{i=1}^{m} \sigma_i^2} \tag{4}$$

Passive design originates from the concept of architecture. Its earliest proposal is based on HVAC equipment to improve the comfort of the indoor environment of buildings. The definition of passive design in modern architecture is an active and flexible application of architectural methods. The calculation results of the bottom shear force of the building structure under different calculation parameters are shown in Table 2.

Table 2 Shear Forces At the Bottom of the Structure under Different Calculation Parameters

Direction	Calculation of normal seismic wave parameters	Calculation of safety assessment parameters
X	12735kN	11729kN
Y	14628kN	14781kN

Effective utilization of the actual building can provide reliable theoretical guidance for the quality and safety of the building structure and reasonable layout, and fundamentally ensure the stability and safety of the building interior. Due to the different nature of buildings, the arrangement of each floor may be different, so there will be imbalance in symmetry. Different arrangement of these components will result in uneven stress, thus torsion may occur during the earthquake, which is very unfavorable to the building structure. Whether the seismic requirements are considered in the architectural design plays a direct role in the overall restriction. Building layout design plays a very important role in building seismic design. In order to coordinate the relationship between them, in the layout design, the stiffness distribution should be uniform and the mass should be symmetrical as much as possible [13]. Designers improve the seismic design scheme of buildings in strict accordance with the codes and regulations of building design, which brings important reference information for the layout of shear walls in building structures and makes the distribution of shear walls more uniform. In order to reduce the occupied area of land as much as possible, high-rise buildings are becoming more and more popular in modern society, which requires more stringent space design for buildings. In the seismic design of buildings, first of all, the degree of building rigidity and the quality of the building structure should be ensured, and the two should be symmetrical in arrangement to avoid serious deformation of the structure

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under stress.

4. Conclusion

Architectural design has made many important achievements in the long-term development process. The quality of buildings is directly related to the safety of people's lives and property, so we should pay enough attention to the quality of buildings. Architectural design is actually an important part of building seismic design. The overall design requirements of the two buildings are closely related. When designing a building, the earthquake resistance of the building structure should be fully considered. Only when the earthquake resistance is fully satisfied can the damage of the building be reduced. Architectural design is an important aspect of architectural anti-seismic design. Architectural design is closely related to architectural anti-seismic design. It plays an important fundamental role in building earthquake resistance. In order to maximize the destruction of casualties and property losses caused by the earthquake, it is necessary to design a scientific and reasonable feasibility plan first. Earthquake resistance should be taken into account in architectural design, so that the earthquake resistance of the building structure can be brought into full play in structural design. Only by grasping the relationship between architectural design and anti-seismic design and organically integrating architectural design and anti-seismic design in design work can we effectively promote the continuous development of China's construction industry.

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