

Application of Optimization Technology in Housing Structural Design

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ABSTRACT Application of optimization technology of housing structural design has a very important role in promoting the improvement of optimization technology of construction enterprise structural design, upgrading optimization technology application ability of structural designer and quality of building products, as well as increasing the actual benefit of construction enterprises. Started from the definition of housing structural design optimization, the study will analyze the problems in optimization technology of housing structural design, in order to reduce construction costs, reflecting the value of structure optimization, making housing structural design function be more suitable for people living and life, and greatly enhancing the safety and seismic performance.

KEYWORDS

Housing structure
Optimization technology
Structure detailed
Conceptual design

1. Definition of optimization housing structural design

The rapid development of our economy recently, had highly increase demands of people in term of living conditions and living environment. The optimization design of houses coordinate structure and aesthetics in order to make it applicable, safe, economic and convenient, which is the important in improving people's living environment. Housing structural design optimization concepts focus on practical criteria, and conduct the optimized design was according to the basic situation of project construction and consider planned cost as the control center. Its content was to establish a model of structural optimization design against the structure of building foundation, the structural program of roof system, structure program of the containment system and other aspects. Through the scientific calculation of various key parameters in several variable parameters with different influence, to establish the final optimized program of architectural engineering structural design.

Housing structural optimization was very important,

especially to greatly improve the economy of structures, structural design optimization of housing construction which can save material, reduce the internal and external decoration, as well as to improve its mechanical performance and enhance the economic performance of the building. Besides that, structural optimization design reduces the total cost of building engineering significantly. By economical use of land, a numeral data indicate that housing structural design optimization effectively reduce 25% of the cost for the project. Moreover, it maximize the effectiveness usage of construction materials, fully coordinate the relationship between the various units of the internal structure of building engineering with each other, and enhance the architectural engineering structural design economy.

2. Problems of optimization technology in housing structural design

Optimization modern housing structural design was a complex process which related to the safety, economy and applicability of housing. There were several problems encountered during optimization housing structural design.

2.1. Lack of detailed geological survey data

Observed from today's structural design work, there are general lack of detailed geological survey data, and design drawings was made only according to the situation of adjacent architecture simply. The objective of the construction site survey is to ensure the process of scientific foundation work, and achieve the basic security. Usually, housing de-

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signer will minimize the endurance value, and simply consider that there is no problem for housing structures, and such technical issues buried a security risk for housing [1]. For example, when processing on the softer ground, ignore of the soil replacement cushion design, and it process based on experience judgment. During the process of housing structural design, the designer has no sufficient awareness of security risks for softer ground, as they use sand cushion to strengthen load-bearing capacity purely on the basis of personal experience, and the lack of accurate calculation for its width thickness also causes a waste of costs.

2.2. Problem of the structural column design

The structural column in housing structural design may be designed as a single force column and its cross section and reinforcement must meet the regulatory requirements. Hence, if the housing structure includes shock-proof function, vibration requirements must also be met. When the structural column is used as load-bearing column, it will advance the stress of structural column, thus limited the pull-beam function of structural column to housing structure, so that the overall housing structural design hid security crisis. Ground ring beam usually implants into structural column, in this case, there is no need to set up additional foundation. However, when the structural column acts as load-bearing column, there will be inevitable overload phenomenon for the compression capabilities of the column bottom foundation, which leading to crack. In the actual construction, the column under the load-bearing beam should meet the criteria, if the load and span of load-bearing beam is in the minimum state, structural column may be used under the beam. At this time, it is necessary to ignore the function of structural column, we shall retest compressive strength of lower half of the wall, while, design and construction may be made only if the requirements are met [2].

2.3. Problems in seismic design

During housing structural seismic design, designers generally consider six degrees fortification as no fortification. In order to facilitate stress analysis, designers prefer the column with smaller cross-section, increase the line stiffness of beam, which the beam will be designed as hinged beam, and compressive capabilities of column body was designed as axial compression. This method of operation can facilitate analysis on the force of housing structure, but threaten to the overall structural safety of housing. As it ignores bending moment constraint between beams and columns and the smaller cross-sectional area of column body. Once the entire housing structure encounters the force, bending capacity was clearly insufficient, and resulting in crack of beam bottom.

2.4. Problems in structural wall design

The load-bearing capacity design of housing structural de-

sign is mainly done through the floor design. During housing structural design, some walls without load-bearing capacity are often placed on the floor, and then this part will be considered within the scope of the load force with equivalent effect, and slab reinforcement will be calculated on the basis of this data. In addition, designers will build the top of partition by ramp brick, causing crack of top of floor. The steel bar in two-way slab which produces bending moments in both directions, in the meantime, it should be stacked and maintained vertical horizontal direction. The calculation should be based on the span of both directions.

3. Optimization design technology in housing structural design

3.1. optimization design stage of housing structure

The design optimization of designers for housing structure may be divided into three stages:

3.1.1. First stage is to select variables

Under normal circumstances, reference data which is important for designer to decide the final design, may be used as a variable for the designer to select. For example, target parameters of project include house price parameters and expected loss parameters; on the other hands, control and constraint parameters include the parameters which show house structure reliability. If the housing construction designer considers the parameter with small change or consideration as the design reference index, the corresponding structural design, programming and computing -related work will reduce the difficulty, thereby, designers may better find reference data in line with optimal design [3].

3.1.2. Second stage is the determination of correlation function

Designers will made a reasonable, scientific selection from many similar reference functions according to a set of functions for predetermined housing cross-sectional dimensions and steel bar size area, then analyze the various related properties of this group of data functions, thereby minimizing cost of housing construction.

3.1.3. Third phase is to consider conditions

Considering for the strengthening of structural stability and durability of housing, the obligatory indexes of housing design should include housing size, structure stability, structure rigidity, force limit and deformation limit, plasticity and determination of structure, etc. In the actual design process, designers should be combined with specific condition of housing construction projects, compare and analyze obligatory condition in actual construction and targeted obligatory condition, in order to ensure that all conditions are in line with the relevant requirements of the building, eventually achieve the purpose of optimizing design.

3.2. The housing structural engineer should actively participate preliminary engineering planning

Housing structural engineers should actively participate in the preliminary engineering planning, which serve as important contents of implementation of structural optimization techniques. Since the housing structural engineering architect is difficult to grasp the correct analysis on force of structure system in the actual construction, they shall actively participate in the preliminary design, help architects to design and progressively innovate, so that the whole building optimization features can be fully reflected.

3.3. Housing structural optimization design should optimize the conceptual design by combining with detailed structure

Conceptual design is the design method which use design concept as main line through the entire design process, as well as design concept, the complicated sensibility and instant thinking of designer will rise to a unified rational thinking thereby completing the entire design. However, when conceptual design was used in the condition without specific quantization values, inevitably there is a greater difference between the formula and actual condition. Therefore, during the optimization housing structural design, the conceptual design was usually adopted. The value was considered as an auxiliary and reference basis, at the same time, designers need to flexibly apply the structural design optimization method during design. One kind of seismic design ideas was used throughout the design process and the conceptual design was used as a key guide. During the design process, we shall focus on optimizing the structural design of details, for example, the profiled plate of in-situ plate prone to cracks around the corner, and it may be divided into rectangular plate. When choosing steel bar model, give full consideration to its ultimate tensile resistance and the other factors.

3.4. Optimization housing structural design should take full account of the lower part of the housing foundation structural design

Foundation is an important part of the structural design. Although foundation is buried in the ground, belongs to hidden engineering, but its importance is self-evident, the height, security and others of buildings are greatly affected by the foundation. Therefore, the structural design optimization of foundation in housing structure must select the appropriate program, such as pile foundation, we must select the foundation type, depth design and pile foundation style according to site geological conditions and the condition factors of other construction site, to minimize the cost.

4. Conclusion

In short, the optimization technology of house structural design is a complex system engineering. The related structural design engineers need the properly use of structural analysis software, to choose the best structural system. At the same time, we should vigorously tap the inherent potential in the foundation design, fully use scientific methods and means, and vigorously reduce the construction cost, so that the housing structure optimization is throughout the design process, thereby reflect the structural optimization value. The housing structural design function not only more suitable for people's living and life, but also vigorously improve its safety and seismic performance.

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