

# Identification of Building Structure and Advances in Reinforcement and Renovation Technology

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**Abstract.** With the development of the society, we get new development opportunities on our construction industry in historical period. However, there are still some problems in the existing structural identification and reinforcement of the building- there are many buildings in China difficult to directly remove and reconstruct because of its special nature such as long rebuilding construction cycle and the high cost, in order to maintain the stability and integrity of the building, we must develop a targeted repair and transformation technology, improve the functional use of the building saving cost. Therefore, the purpose of this paper is to discuss the identification and reinforcement technology of building structure in our country, I hope to provide some suggestions for reference.

## 1. Introduction

Building structural identification and reinforcement technology produced from the beginning of the history of the building in human history. With the development of social economy, and building materials changes, the building identification and reinforcement industry expand rapidly.

Taking our country building for example, China's building structure identification and reinforcement technology started from the last century, but buildings basically had some quality problems or security risks in the 70-80's, structural identification and reinforcement technology development also developed relatively slow, most of the old housing construction now have begun to aging with the time passed.

With the research and development in the early time of liberation and reform and opening up, structural identification and reinforcement technology has new development in the new century, it has been optimized in the course of practice, and developed more perfect. With China's rapid economic development, the cause of real estate booming in the process of urbanization, the construction market is becoming saturated, it has become a new challenge that how to use the transformation of old buildings to reduce the cost of construction to meet people's living needs. According to statistics, construction and renovation can save a lot of money and duration, in contrast, the cost of building renovation is only about 60% of new ones, and shorten nearly half of the duration. Responding to the needs of the market, building structural identification and reinforcement and reconstruction technology is booming, coupled with the continuous improvement of housing construction standards with social development, the task of structural identification and reinforcement and transformation becomes more important.

Although the building identification and reinforcement technology develops well, there are still some problems that need to be intensified compared to other countries with exceptionally developed construction industry. Overall, it is difficult to achieve unity between practice and theory in the

domestic building maintenance and reconstruction at present, which is one of the major obstructions of structural identification and structural reinforcement. Therefore, it is a powerful means to promote the development of China's construction industry by innovating the structural identification and reinforcement technology.

## 2. Classification of architectural structures

In general, the building structure can meet the necessary functional conditions so as to achieve the stability of the building. These functional conditions not only include the bearing building itself may appear, durability and building use function, but also need to take some uncertain factors into account such as the building will be encountered in the process of converting from drawings to reality and the randomness building may suffer during using it. Buildings are eligible when the stability of randomness is allowed to occur during the construction and use of the building. Similarly, the identification of building structures is also required. Identification of reliable standards not only takes stability of buildings under standard conditions within consideration it is also need to allow randomness and blurring factors in the process, in order to make an more accurate analysis on the real state of the building structure.

### 2.1 Standard and classification of structural identification

China's housing construction structure makes sub-building level according to different building classification, building structure is generally divided into civil buildings, public buildings and industrial buildings. Industrial buildings, housing construction and so have different structures and service life standards. Therefore, different use of buildings has different building identification standards. According to national anti-seismic, fire safety standards, architectural identification of the standards vary. Civil buildings pay more attention to safety and use function, therefore, the identification of civil building structure is divided into safety identification and functional identification. For the identification of safety, it is focusing on the construction of security risks, emergency facilities, and the identification of dangerous levels, national standards includes "building seismic appraisal standards," "dangerous housing appraisal standards," "fire building structure identification standards" and so on, the functional identification is mainly focused on the building inspection and maintenance of use functions. Standard for structural qualification of public and industrial buildings need to take the external force, the use of life and structural stress design into account in addition to routine civil building identification standards, standards are "industrial structures seismic identification standard" "steel industry building reliability evaluation standards" and so on. These make a new definition for China's structural identification and reinforcement. Under the guidance of these identification criteria, the identification of building structures will use a special identification method.

### 2.2 Concrete method of structural identification

There are many ways to identify building structures, the traditional way of identification is empirical identification, which generally construction units invited experienced construction experts to the scene to visit to the building structure, and the expert decides the problems existing in the building structure by experience though on-site observation and auxiliary tool survey. This identification method is generally applicable only to the simple structure of the building because it is limited by experts' experience.

At present, the commonly used method of building identification is the laboratory identification method, which based on the existing drawings, delimits the scope and standards of identification, sampling survey, testing the actual site of the experimental object, study the parameters of the actual object to identify the building structure. Using this identification method, concrete will be

used as the study object, doing strength test after core sampling. It can be said that this method is more scientific, identification is relatively accurate relative to the empirical method.

With the development of structural identification technology, probability identification method has been generally respected. This method is the most reliable detection and identification method nowadays, which usually using a unified rebound instrument to detect the structure of the building, it can accurately detects and analysts the results of the building materials' indicators in a short time, and it is the technical assurance of building structure identification.

### 3. Reinforcement technology and method

The purpose of identification of building structures is to detect and evaluate the buildings, select the buildings that can be reinforced, to achieve rational allocation of resources for the market, cost-saving and new development of construction industry. At present, China's reinforcement technology has a relatively large development. In general, reinforcement depends mainly on building structure, therefore, the reinforcement technology is mainly for aspects those are the traditional wood structure reinforcement, brick masonry and concrete structure reinforcement and steel structure reinforcement.

#### 3.1 Traditional wood structure reinforcement

China's ancient buildings mainly used wooden structure, but with the development of the times, new building materials gradually replaced it. But many ancient buildings and characteristic buildings also retain the national-characteristic materials. Therefore, the method of reinforcement transformation of the wood structure also needs to be taken attention.

Generally, the reinforcement of wood structure should be focused on the beam fixed. We often use the method of Reinforcement at the under support, When found the initial crack in the wood beam member and the bearing capacity is insufficient after identification, we usually add the lower pole to change the force under the beam to reinforce the buildings. However, this method needs to ensure the structural integrity of wood beams, it can't be used when there is beam wood corrosion, insects and other phenomena to avoid potential safety problems. Wood beams and structural columns can also be strengthened if ads stiffness component sin the fragile place. For example, add the steel components, wood splints in the wooden beam support nodes to prevent damage; or connect the concrete in the slightly damaged column corner. In the wood structure reinforcement, reinforcement materials should be rugged and aesthetic, at present, the materials used in China are quite diverse.

#### 3.2 Reinforcement of brick and concrete structures

Reinforcement of brick and concrete structures is more modern. These two materials are very common in the use of building structures, the method of identification and reinforcement has also been tested over a long period of time and develops well, in this paper, the methods of reinforcement are summarized.

Brick masonry and concrete structure reinforcement is divided into direct reinforcement and indirect reinforcement. They are both based on building identification found in the actual situation, direct reinforcement is more common which is a direct implementation and reinforcement measures, including section strengthening method, external adhesion reinforcement method and replacement material reinforcement method. In the section strengthening method, reinforcement of brick masonry and concrete cross - section directly reinforced for pressure components, using the appropriate strength grade of concrete, increase the cross-sectional area of the original component, improve the bearing capacity of the wall and concrete; external adhesion reinforcement is to increase the external force structure based on the original structure, such as topical reinforcement

mesh, brushing the cement, add angle steel outside the original structure, external reinforcement materials (carbon fiber, steel) and so on, reinforcing structures whose bearing capacity is insufficient; The replacement material reinforcement method relies on the external material, For example, brick masonry structure reinforcement can be realized by adding new concrete grouting column to support and to improve the carrying capacity of the wall. For reinforcing concrete structures, we can replacement of the original structure with higher strength grade concrete to ensure the strength and stability of the structure.

Indirect reinforcement is supported by the use of fulcrum or additional prestressing method to achieve. It is applicable to performance or capacity of the original component is insufficient, and difficult to be directly reinforced.

### 3.3 Steel structure reinforcement

Reinforcement of steel structures is often used for ceiling, wall reinforcement. The main methods are to reduce the degree of crack diffusion, enhance cross-section and connection strength and so on, to increase in bearing capacity by welding building structural steel. Steel structure reinforcement technology is relatively more complex, the requirements is also higher for the material and reinforced components performance.

## 4. Summary

The development of our building structural identification and reinforcement technology is based on the progress of construction technology. With the increasing demand of national standards for the building, we have increasing requirements on the safety and energy efficiency for the building, the life-span and safety of the building become an inevitable requirement, in order to avoid environmental pollution crisis in the process of urban construction, the requirements of identification and reinforcement of buildings will increase. This paper made a comprehensive introduction on the development of building structure identification and reinforcement technology in China, I hope it can provide some theoretical references for the identification and reinforcement of urban buildings in the process of urbanization in China.

## References

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