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Research on Relation Between Reinforced Concrete Frame Structure and Materials

Xia Li
Kunming University
650214, Kunming, Yunnan, China

Xinggang Shen
Kunming University
650214, Kunming, Yunnan, China

Abstract: Based on the perspective of seismic performance, this paper conducts research on the design of reinforced concrete frame structures and proposes to quantify the performance level of reinforced concrete frame structures, based on the structural concept, design principles and design strategies of reinforced concrete frames. Reinforced concrete frame beams, slabs, columns and joint reinforcement methods, and designed a set of low-cycle repeated tests of frame joints under horizontal loads to study the shear performance of reinforced concrete frame joints strengthened by new materials, and passed Numerical analysis program was used to simulate and analyze the test, and preliminarily studied the mechanical performance of this new type of material used in the reinforcement of reinforced concrete frame structures.

Keywords: Reinforced Concrete ; Frame Structure; Material

1. INTRODUCTION

J Under the social background of the rapid development of modern architecture in my country, industrial buildings and civil buildings have begun to strengthen the use of reinforced concrete frame structures, making them one of the most used structural forms in building construction. The components of the reinforced concrete frame structure are mainly beams and columns. The structure is simple and clear, the force is clear, it has high strength and ductility, and it has excellent earthquake resistance.

In my country's earthquake-prone areas, reinforced concrete frame structures have become the key structures of buildings. The structural damage process is divided into overall structural collapse and continuous structural collapse. Due to the low probability of structural overall collapse, literature established a damage model through the damage index at the material level and used this damage model to gradually evaluate the damage of local components and even adjacent components. failure, and finally judge the damage of the continuous collapse of the entire structural system. However, literature only simulated and analyzed the damage at the component level, and the feasibility and applicability of using the damage model proposed in this paper to evaluate the overall structural damage still needs to be further improved and verified.

All data in the Revit model are interrelated and dependent on each other. There are two model forms under the structural database: the analysis model and the family instance model. The analysis model is obtained based on the family instance model. Structural analysis data. In view of the stress characteristics of the joints and the severity of joint damage, it is necessary to carry out seismic reinforcement for the frame joints with insufficient bearing capacity, especially the joints of the frame buildings in the earthquake zone. The frame joints damaged in the earthquake also need to be reliably reinforced before they can continue to be used. At present, the reinforcement methods of reinforced concrete frame structures mainly include enlarging section reinforcement method, pasting fiber composite material reinforcement method, pasting steel plate reinforcement method and so on.

The reinforcement method of pasting fiber composite materials and the method of pasting steel plates are currently the most popular reinforcement methods. In my country's building seismic design codes, the goal of building anti-seismic fortification is clearly stipulated, which can be simply summarized as "small earthquakes are not damaged, moderate the earthquake can be repaired, and the earthquake will not collapse" 12 words. According to this building fortification goal, the building structure has a single function, that is, in the event of a rare earthquake, the building cannot collapse, but it cannot effectively control the losses caused by strong earthquakes, such as personal casualties and economic losses. Since most of the earthquakes are random periodic loads, steel bars are prone to fatigue damage under this load. Therefore, it is not appropriate to use the yield, hardening, softening and failure states under monotonic loads to describe the damage of steel bars.

2. THE PROPOSED METHODOLOGY

2.1 Relation between Properties and Materials of Reinforced Concrete Building Structures

The results of the literature show that the damage of building structure steel under alternating seismic loads belongs to high-strain low-cycle fatigue. Therefore, this paper uses the low-cycle fatigue and strength degradation damage theory proposed in literature to evaluate the damage of steel fibers. The basic way to generate a three-dimensional solid model in revit is to finally generate a solid model from points and lines to surfaces. Since the solid model the amount of information is complex, and the extraction of nodes is relatively cumbersome, while the analysis model is the component layout, component positioning and topological relationship generated inside the family instance model, and the data composition form is relatively simple.

Obtain the coordinates of the endpoints through the GetPoint() method and the GetCurve() method and delete duplicate nodes to get all the node information of the model. Only extracting node information is incomplete for the data required for structural analysis. The necessary information for structural analysis is stored in the instance model, and the section,

member length and other information in it can be obtained through the get_Parameter() method. Finally, the geometric information in the Revit model is composed of two parts of information in the family instance model and the analysis model. The method of enlarging section reinforcement is the most traditional reinforcement method, which has a reliable effect on improving the bearing capacity of components.

In recent years, with the widespread application of chemical reinforcement technology, this reinforcement method can better solve the problem of structural connection of reinforced structures, especially for reinforced concrete frame joints, where column-beam reinforcement is anchored by passing through the floor slab or by planting reinforcement on the beam-column. It can ensure joint performance and structural force transmission and is especially suitable for seismic reinforcement of reinforced concrete structures. However, the method of enlarging the cross-section often causes the cross-section of the component to increase significantly, which affects the normal use of the house, and requires concrete vibration and maintenance. The wet work on site is heavy and the maintenance period is long, so the on-site construction is not popular.

This is the biggest difference between performance-based seismic fortification objectives and traditional seismic fortification objectives. Through relevant practical research and investigation, it is shown that the interstudy displacement angle can truly show the comprehensive level of structural deformation of each level of the reinforced concrete frame structure and the impact on the height of the story and has a certain correlation with the level of the damaged structure. Therefore, the level of frame structural members can be quantified through the story displacement angle. Reinforcement materials are self-flowing, self-dense, vibration-free, and fast-setting. On-site, it is only necessary to bind steel bars and erect formwork according to needs, and pour the reinforcement materials, and the surface treatment of the original structure is not highly required. The construction and maintenance period of the new material is shorter than that of the traditional enlarged section concrete (pumping and pouring, vibration-free self-tight chamber, 7d to reach the design strength). To study the performance of reinforced concrete frame structures strengthened by new materials, this paper studies the shear performance of reinforced concrete frame joints strengthened by new materials through experiments and theoretical analysis.

2.2 The Importance of Materials in Reinforced Concrete Frame Structures

Therefore, this paper designs a group of low-cycle repeated loading tests of reinforced concrete frame joints to simulate the damage to the frame joints caused by earthquakes. "Strong column weak beam" is a design principle that can meet the requirements of seismic fortification. Under the influence of large earthquakes, the beam-column joints are the most vulnerable key parts of the frame structure. According to research on earthquakes at home and abroad, when an earthquake occurs, the damage to the building structure is mainly manifested on the columns, that is, the concrete at the end of the column is easily stripped and crushed, and the steel bars are buckled and finally distorted. For the entire reinforced concrete, it is very unfavorable for the frame structure.

The overall damage index curves of structures under different intensities of earthquakes obtained by IDA can be seen from Figure 5. When the PGA is less than 0.4g, the curve is almost linear, and the damage index increases slowly; when the PGA reaches 0.4g, the damage index growth begins becomes faster, indicating that the structure has not yet reached the yield point; when the PGA exceeds 0.4g, the damage index increases rapidly, especially when the PGA is greater than 0.6g, the damage index increases sharply until it is destroyed. The main reinforcement in the beam may be truncated, so the reinforcement information of the left and right sections may be different. To simplify the analysis and reduce the number of elements, the maximum value of all reinforcements near the cross-section at both ends is taken, and the total area of this cross-section point, and all reinforcements is summed and output to obtain the reinforcement of the beam.

Obtain the beam location line and the reinforcement location line through the GetCurve() method. Here, all the reinforcement bars whose reinforcement location line is parallel to the beam location line are screened, and then the distance between the two points of the reinforcement location line and the two ends of the beam location line is judged. If the distance between the two ends of the reinforcement bar is two If the minimum value of the end point distance is less than half of the beam length, the steel bar is located on the other side of the beam. To facilitate the observation of the test phenomenon and the analysis of the test results, the test in this paper uses a plane cross-shaped frame node, and the test frame shown is used to provide the boundary conditions that the lower end of the column is hinged, the upper end is free, and the beam end struts are constrained. The column top uses the reaction force frame and hydraulic jack to provide axial force, and the Schenck machine is used to push the test frame to provide horizontal load on the column top. The test conditions are like the boundary conditions and stress conditions of the nodes under earthquake action.

If the building’s structural design and resource allocation permit, the cross-sectional size of the column can be made as large as possible to ensure that the ratio of the linear stiffness of the column to the linear stiffness of the beam is greater than 1. At the same time, the axial pressure of the column is strictly controlled to ensure meet the design standards and requirements of the building in terms of seismic performance and enhance its ductility. When checking and calculating the bearing capacity of the section, the design bending moment of the column is artificially adjusted and adjusted and enlarged according to the principle of "strong column and weak beam", so that the reinforcement structure of the column is strengthened. In addition, the longitudinal tensile reinforcement at the beam end should not be too large, to avoid the rapid yield stage during an earthquake and the failure to form plastic hinges, which will pose a threat to people's personal safety.

The use of new concrete materials to strengthen reinforced concrete frame joints can effectively increase the joint shear capacity. The method adopted by J2 to reduce the workload of planting bars is feasible to improve the joint shear capacity by no less than the common practice of J1. However, the analysis is based on the results of computer numerical simulation, which needs to be verified by actual experiments. The section size of the components used in the analysis, the stress of the joints, the reinforcement status, the reinforcement thickness, and the reinforcement effect are all individual, what is done is only qualitative research, and the reinforcement effect of the method in this paper should be quantitatively analyzed for the nodes in different situations , still need to conduct many experiments for statistics.

3. CONCLUSION

In the face of people's ever-increasing demands for a better life, the development of my country's construction industry needs to adapt to people's residential and use needs, especially for areas with high earthquake incidence. The safety and stability of structural design and meeting the seismic performance are the primary principles of design. Therefore, in the process of designing a reinforced concrete frame structure, on the one hand, it is necessary to carry out corresponding calculations for the structure in accordance with the current design codes in my country. Through the intra-layer pumping and pouring technology, the shortcomings of the traditional enlarged section method can be effectively solved, and the frame joints can be realized. Quick and effective reinforcement. This method is applicable to both seismically damaged structures and ordinary structures and can be studied and applied as a new method system for structural reinforcement.

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