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Research Article

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Research Status and Prospect of the Connection Joint of the Prefabricated Shear Wall Structure

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ABSTRACT

Prefabricated shear wall structure is a suitable construction system to the housing industrialization development.This paper analyzes that the research status of the structure connection joint of the prefabricated shear wall.Expecting the future of a new connection joint method,then analyzing it and comparing it with the traditional connection joint,to find its advantages.

Keywords: Prefabricated shear wall structure, connection joint, status and prospect.

INTRODUCTION

Shear wall structure is widely used in high-rise residential buildings,but the traditional cast-in-situ concrete structure exists some adverse factor,including the large energy consumption,pollution and low level of industrialization. For the realization of the housing industrialization and construction energy conservation,it demands for a suitable prefabricated shear wall structure,and it is one of the important ways.From the perspective of the research and application experience of China and foreign countries,all follow factors are important.whether the connection joint of the prefabricated shear wall structure is reliable, and it makes the whole structure with enough bearing capacity, stiffness and ductility,is one important factor. Whether the connection joint of the structure is convenient and accuracy to construction, is another important factors.All the factors are affecting the popularization and application of the fabricated structure.

EXPERIMENTAL SECTION

1 International research status of the connection joint of the fabricated structure.

The national science foundation is funding for concrete shear wall with prestressed assembly[1,2], conducted a series of theoretical analysis and research ,and make a theoretical analysis for a new form of concrete beams instead of the steel coupling beam.Soudki,published an article on the PCI journal pointed out that cast-in-place connection with the reasonable levels flat-fell seam,[3,4] the vertical mixing bar connection, the flat-fell seam mix processing method, are very necessary to the research about the seismic performance of prefabricated shear wall.E.Schultz has make a test research of the seismic performance of the vertical connection between prefabricated shear wall.Improve the vertical nodes design for trans-missing the horizontal force between the wallboard, enhance the overall stiffness of precast shear wall structure for improving the seismic performance.Adajar Yamaguchi, has proposed a new main rebar connection method of prefabricated shear wall [5,6,] examined the maximum tensile load and the influence of the bonding resistance, the tests showed that the tensile properties coming from the three main factors of the lap length of nodes, the constraint levels of the reinforced concrete and the rebars for constraints.

Around the world, especially the European and American countries, has one batch of prefabricated structure used in engineering practice, and the prefabricated structure has a fast development, and the industrialization get to a high degree.

2 The research present situation and existing problems of the connection joint of the prefabricated shear wall structure.

2.1 Using different ways of reinforcing bar connection of prefabricated shear wall structure.

Chinese scholars have make tests and theoretical analysis for the different reinforced connection method of prefabricated shear wall structures,and evaluated the performance of them. some achievements have important reference for compiling "technical specification for concrete structures of fabricated (in China)."

Southeast University has carried on the new type of prefabricated shear wall structure (precast concrete shear wall unit through local cast-in-situ, main wall vertical reserved metal corrugated pipe grouting anchor bar connection, beam, plate composite with cast-in-situ) node, experimental study proves that the node of the prefabricated prefabricated has an uniform ability with the cast-in-situ node for anti-seismic.Harbin Industrial University have design and made 108 precast concrete structure with plug hole grouting reinforced lap joint specimen, given a reasonable lap length. Built a full-scale model with three layers, showed that the deformation ability between prefabricated wall is stronger, and it has improved the seismic energy dissipation capacity of overall structure.Tsinghua University's research shows that the sleeve pulp anchor connection and indirect pulp sleeve anchor lap can effectively transfer the vertical reinforcement stress, its bearing capacity ,and deformation capacity is greater than the vertical distribution of reinforced connection specimens, crack distribution is similar with the cast-in-situ wall.Nanjing University of Science and Technology,has make the test of post-tensioned unbonded prestressed fabricated of short limb shear wall, the test showed that the reasonable design of post-tensioned unbonded precast short limb shear wall, should achieved "strong wall weak beam".

2.2 The problems of using different ways of steel bar connection prefabricated shear wall structure.

The connection mode is great affected by the construction quality , the early cracking of horizontal direction would happen.For pulp anchor connection, construction is difficult, the thickness of concrete on the edge of the hole is very small in every reserved holes of each piece of the upper wall, the hole is easy to be damaged in the process of transportation and installation of components.In addition, the more important is that the grouting is not easy to dense.

2.3 Using the steel connection mode of prefabricated shear wall structure.Southwest Jiaotong University has make tests to show that ,strength reinforced concrete frame compared with reinforced concrete frame has good seismic performance, can be used as the second line of defense when earthquake.Southeast University’s experiments show that,the steel frame can control the development of the fracture in shear wall, form a complete energy consumption mechanism, come to a second line of defense when earthquake, make the seismic capability of the structure improved significantly.Tongji University's tests show that ,there are no obvious difference between the shear failure form of steel reinforced concrete shear wall and the damage form of ordinary concrete shear wall, but the existence of steel framed has made the shear bearing capacity of the wall greatly improved, also made degradation of the stiffness of the wall to be flat.At the same time ,it also improved the ductility of the wall.

In view of the steel and concrete composite component as a shear wall structure has a good performance, some scholars have use steel as the connection of precast shear wall structure component instead of edge constraint component.Beijing University of Architecture and Architectural design and Research Institute of Beijing ,have make tests ,shows that the combination of assembled monolithic steel shear wall structure has good seismic performance and integrity. This method replace the traditional shear wall with steel edge artifacts in reinforced, operation is simple, the ductility of the steel performance got better.

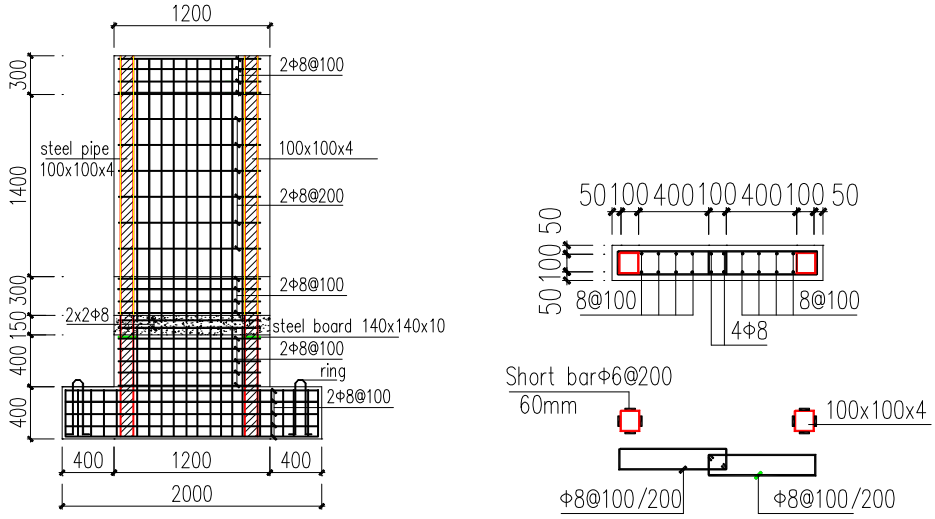
2.4 The advantages and existing problems of using the steel connection mode of prefabricated shear wall structure.

All of the above mentioned research, are used the Angle steel , this method of using the built-in Angle instead of the edge of the shear wall components, can get the well mechanical performance that is not worse than the traditional reinforced concrete shear wall.On the other side ,the quantity of the steel is not large.Compared with external steel frame concrete shear wall, greatly reduces the amount of steel.Due to using the built-in steel,it is in favor of the fire prevention of the high-rise building requirements.Fluctuation of prefabricated wall use steel connection compared with vertical steel bar connection, is more convenient in construction, and improve the accuracy and efficiency of the construction.But the connection with Angle, has a less poor reliability to the other sections, such as steel pipe connection, can better guarantee the reliability of the connection. In addition, set the steel shear key can improve the shear bearing capacity of horizontal construction joints, but construction technology is more trouble.

3 The research vision and innovation suggestions of connection system of the prefabricated shear wall structure.

If using the rectangle steel tube instead of Angle steel,It will be the concrete filled steel tube, the bearing capacity is higher, it also can be a shear components directly, without additional steel shear key,Also it can play a good ductility of steel pipe concrete, the characteristics of the seismic performance is superior,By the edge of the built-in rectangular concrete-filled steel tube structure of shear wall components, form a new type of prefabricated shear wall structure, should be able to get better results.

In order to achieve this goal, it is necessary to design a scheme of reasonable prefabricated shear wall structure with built-in pipe (as shown in figure 1).Because of the overall structure of shear wall belongs to the eccentric force components, it is necessary to examine the performance of the new type of shear walls under the action of the vertical pressure force.Based on the parameters obtained from the test, we can make the aseismic performance test, with the method of pseudo static test, and reasonable theoretical analysis.And we can conclude a fitting formula of shear bearing capacity of the weakest position of the horizontal seam of this new type of shear wall.Compared with cast-in-place concrete shear wall structure, research and scientific evaluation of the seismic performance of the node of prefabricated shear wall with new type.



(a)reinforcement structure diagram of the facade (b)reinforcement structure diagram of Planar

Figure 1. Scheme of the prefabricated shear wall with built-in steel tube

Results and Discussion

Although the prefabricated concrete shear wall structure is still in its infancy and there also have be some problems,But it has a huge advantage in the structure performance, production efficiency, saving resources, protecting the environment. As the study progress of new type connection mode getting gradually mature, it can make the prefabricated concrete shear wall structure to be a wide development prospects.

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