

HOOKING STRUCTURE FOR MODULAR INTEGRATED CONSTRUCTION AND METHOD FOR CONSTRUCTING THE SAME

Technical Field

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The present invention relates to a building structure and a construction method thereof. More specifically, the present invention relates to a structure for connecting adjoining wall bodies of adjacent prefabricated building units and a construction method thereof, which are suitable for use in modular integrated constructions.

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Technical Background

In traditional modular integrated constructions, a connecting wall between adjacent prefabricated building units is usually formed by providing a set of laminated layers between the adjacent wall bodies of two prefabricated building units, arranging split bolts between the laminated layers for fixing, and casting concrete to form an integral wall body. The arrangement of the split bolts aims to avoid spalling and cracks of the wall body caused by displacements of the prefabricated building units due to concrete pouring and vibration.

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The construction method for such a connecting wall for the wall bodies comprises steps of: (a) binding rebars of the wall bodies to be connected of the prefabricated building units; (b) hoisting and fixing two prefabricated building units in sequence to a desirable position; (c) reinforcing the formworks of the connecting wall bodies to be connected of the prefabricated building units, and mounting the dorsal bars and inserting the split bolts; (d) pouring concrete between adjacent connecting wall bodies to be connected of the adjacent prefabricated building units; (e) removing the split bolts and the formworks after the concrete is formed; and (f) filling the bolt holes on the wall bodies.

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Thus it can be seen that the traditional connecting structure for connecting the wall bodies not only requires complicated and time-consuming construction steps

with a large number of formworks, which is labor-intensive, and difficult to ensure consistent quality, but also has to fill up a large number of bolt holes left on the wall bodies at a later stage. At the same time, other problems generated also include impossibility for achieving uniform decoration for inner surfaces of the wall bodies of the prefabricated building units.

Summary of the Invention

The present invention aims to provide a hooking structure for modular integrated construction and a construction method thereof, whereby formwork swelling caused by concrete pouring in the wall bodies to be connected of the prefabricated building unit can be avoided, and no holes will be left on the wall bodies to be connected.

The present invention proposes a hooking structure for modular integrated construction, comprising a first to-be-connected wall body arranged on a first prefabricated building unit, and a second to-be-connected wall body arranged on a second prefabricated building unit, wherein the first to-be-connected wall body is adjacent to the second to-be-connected wall body, and a cast-in-situ concrete area is arranged therebetween. An outer side of the first to-be-connected wall body and that of the second to-be-connected wall body are each provided with a plurality of pre-embedded exposed retaining rings, each pre-embedded exposed retaining ring of the first to-be-connected wall body being opposite to a respective one of the pre-embedded exposed retaining rings of the second to-be-connected wall body in position, wherein two pre-embedded exposed retaining rings opposite to each other in position are tied by a hook.

One end of the hook is L-shaped and the other end thereof is U-shaped, and the hook is hooked up to the pre-embedded exposed retaining rings on both sides.

The L-shaped end of the hook is provided with a wave-shaped inner wall, and the U-shaped end of the hook is provided with a sheet-like tongue extending therefrom, the tongue being arranged on one side of an inner wall of the U-shaped end.

The outer sides of the first to-be-connected wall body and the second to-be-connected wall body each have a horizontal cross section having alternating concave portions and convex portions, wherein the pre-embedded exposed retaining rings are provided at the convex portions of the outer sides of the first to-be-connected wall body and the second to-be-connected wall body.

The hook is hinged with a vertical rod at a middle part thereof.

The present invention further proposes a method for constructing the hooking structure for modular integrated construction, comprising: step A of hoisting a second prefabricated building unit to a predetermined position and fixing it; step B of hooking one end of the hook up to the pre-embedded exposed retaining ring provided on the outer side of the second to-be-connected wall body, and setting the other end of the hook obliquely above said one end of the hook; step C of hoisting a first prefabricated building unit to the predetermined position and fixing it; step D of putting down said the other end of the hook to hook up to the pre-embedded exposed retaining ring at a corresponding position on the outer side of the first to-be-connected wall body; and step E of pouring concrete in the cast-in-situ concrete area between the first to-be-connected wall body and the second to-be-connected wall body.

One end of the hook is L-shaped and the other end thereof is U-shaped, and the U-shaped end of the hook is provided with a sheet-like tongue extending therefrom. Thus in step B, the U-shaped end of the hook is hooked up to the pre-embedded exposed retaining ring, and then the tongue is bent toward the pre-embedded exposed retaining ring.

Multiple hooks arranged in the vertical direction are each hinged with a vertical rod at their middle parts, respectively. Thus in step D the vertical rod is pushed downward so that an end of the hook located obliquely above another end thereof moves downward to hook up to the pre-embedded exposed retaining ring.

Compared with the prior arts, the hooking structure for modular integrated construction according to the present invention and the construction method thereof can bring about the following advantages. The hook is adopted to hook up to the pre-embedded exposed retaining rings located on the wall bodies to be connected at both sides. Therefore, the phenomenon of formwork swelling caused by concrete pouring can be avoided, so that no holes will be left on the wall bodies to be connected, as the traditional split bolts do. Accordingly, the procedure of filling up the holes can be omitted. In this manner, uniform decoration for wall surfaces inside the modular integrated construction can be achieved, with better uniformity than that of the wall bodies poured by traditional technologies. Moreover, the construction speed can be improved and the construction load can be reduced.

Brief Description of the Drawings

Fig. 1 schematically shows two adjacent prefabricated building units and a connecting structure thereof.

Fig. 2 schematically shows a hooking structure for modular integrated construction according to the present invention.

Fig. 3 shows the arrangement of pre-embedded exposed retaining rings on a first to-be-connected wall body or a second to-be-connected wall body.

Fig. 4 is a side view of a hook.

Fig. 5 schematically shows the state when an end of the hook is hooked up to the pre-embedded exposed retaining ring and the other end thereof is located obliquely above said end.

Fig. 6 schematically shows the state when the hook is hooked up to the pre-embedded exposed retaining rings on both sides.

Detailed Description of the Embodiments

In the following, the present invention will be further illustrated with reference to embodiments and accompanying drawings.

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The hooking structure for modular integrated construction according to the present invention is arranged between a first prefabricated building unit 1 and a second prefabricated building unit 2 that are horizontally adjacent to each other, and comprises, as shown in Fig. 1, a first to-be-connected wall body 11 provided on the first prefabricated building unit 1 and a second to-be-connected wall body 21 provided on the second prefabricated building unit 2. The first to-be-connected wall body 11 and the second to-be-connected wall body 21 are adjacent to each other, with a gap formed therebetween to function as a cast-in-situ concrete area 3.

15 As shown in Fig. 3, an outer side of the first to-be-connected wall body 11 and that of the second to-be-connected wall body 21 are respectively provided with a plurality of pre-embedded exposed retaining rings 4. Each retaining ring 4 can be formed by bending a steel bar, with a part of the retaining ring being embedded and fixed in a corresponding wall body with the other part thereof protruding from said corresponding wall body. These pre-embedded exposed retaining rings 4 are aligned along a horizontal direction and a vertical direction respectively, thus forming multiple rows and multiple columns of pre-embedded exposed retaining rings 4. As shown in Fig. 2, each pre-embedded exposed retaining ring 4 on the first to-be-connected wall body 11 is opposite to a respective one of the pre-embedded exposed retaining rings 4 on the second to-be-connected wall body 21 in position, and two pre-embedded exposed retaining rings opposite to each other in position are connected with each other by a hook 5, so that the first to-be-connected wall body 11 and the second to-be-connected wall body 21 can be tied together. Through pouring concrete between the first to-be-connected wall body 11 and the second to-be-connected wall body 21, displacement of said wall bodies can be prevented.

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As shown in Fig. 2 and Fig. 3, in this embodiment, the outer sides of the first

to-be-connected wall body 11 and the second to-be-connected wall body 21 each have a horizontal cross section having alternating concave portions and convex portions, so that the outer sides of the wall bodies each form a shape with alternating vertical ridges and vertical grooves. This structure can increase the bonding force between the cast-in-situ concrete and the prefabricated wall bodies. The pre-embedded exposed retaining rings 4 are arranged on the vertical ridges, i.e., convex edges of the first to-be-connected wall body 11 and the second to-be-connected wall body 21.

In this embodiment, as shown in Fig. 4 which is a side view, one end of the hook 5 is L-shaped and the other end thereof is U-shaped, and the two ends are respectively hooked up to the pre-embedded exposed retaining rings 4 at both sides. The L-shaped end 51 of the hook 5 is provided with a wave-shaped inner wall for clamping the pre-embedded exposed retaining ring 4, and the U-shaped end 52 of the hook 5 has a sheet-like tongue 53 extending toward the L-shaped end 51. The tongue 53 is arranged at a side of an inner wall of the U-shaped end 52, thereby forming a duckbilled shape. After the U-shaped end 52 hooks up to the pre-embedded exposed retaining ring 4, the tongue 53 can be bent inward to surround the pre-embedded exposed retaining ring 4. In this manner, it can be prevented the U-shaped end 52 from being separated from the pre-embedded exposed retaining ring 4, and in the meantime, the hook 5 can be rotatable about the pre-embedded exposed retaining ring 4 surrounded by the U-shaped end 52 of the hook 5.

In order to facilitate the rotation of the hook 5 in dual directions, as shown in Fig. 4, a shaft hole 54 is formed in the middle part of the hook 5 close to the L-shaped end 51. As shown in Figs. 5 and 6, a horizontal connecting element 9 passes through the shaft hole 54 so that the hook 5 is hinged to a vertical rod 6. In this manner, the L-shaped end 51 of the hook 5 can be controlled to swing up and down by pulling the vertical rod 6 up and down. Preferably, multiple hooks 5 located at a same vertical position are all hinged to a same vertical rod 6, so that rotation of said multiple hooks 5 can be controlled simultaneously only by pulling the single vertical rod 6 up and down.

As shown in Fig. 2, vertical wall body connecting rebars 8 are also provided in the cast-in-situ concrete area 3. The vertical wall body connecting rebars 8 can be arranged in the grooves formed on the outer sides of the first to-be-connected wall body 11 and the second to-be-connected wall body 21. The first to-be-connected wall body 11 and the second to-be-connected wall body 21 are further pre-buried with exposed connecting rebars 7, which extend toward the cast-in-situ concrete area 3 for connecting with rebars provided in the cast-in-situ concrete area 3. The vertical wall body connecting rebars 8 and other rebars provided in the cast-in-situ concrete area 3 can be pre-bound in whole or in part at factory, so as to reduce the workload at the construction site.

In this embodiment, the method for constructing the hooking structure for modular integrated construction according to the present invention includes the following steps.

In Step 1, a second prefabricated building unit 2 is hoisted to a predetermined position in the construction site and then fixed, and rebars of the second to-be-connected wall body 21 are bound.

In Step 2, the U-shaped end 52 of the hook 5 is hooked up to the pre-embedded exposed retaining ring 4 provided on the outer side of the second to-be-connected wall body 21, and the tongue 53 of the U-shaped end 52 is bent inwardly toward the pre-embedded exposed retaining ring 4, and the other end of the hook 5 is pulled to a diagonally upward position by pulling the vertical rod 6 upward.

In Step 3, a first prefabricated building unit 1 is hoisted to the predetermined position, and then fixed.

In Step 4, the vertical rod 6 is pushed downward to press down the L-shaped end 51 of the hook 5 located at the obliquely upward position, and hook it up to the pre-embedded exposed retaining ring 4 located at a corresponding position on the outer side of the first to-be-connected wall body 11.

In Step 5, the formworks on the other two sides of the walls are sealed and connected with each other, and after that, concrete is poured in the cast-in-situ concrete area 3 between the first to-be-connected wall body 11 and the second to-be-connected wall body 21.

In Step 6, after the concrete in the cast-in-situ concrete area 3 is formed, the formworks are removed, so that the connection between the first prefabricated building unit 1 and the second prefabricated building unit 2 can be realized.

Thus it can be seen that according to the hooking structure for modular integrated construction of the present invention, it is unnecessary to remove the hooks 5 and the pre-embedded exposed retaining rings 4. Therefore, no holes will be left on the wall bodies to be connected, thus avoiding additional work of filling up the holes in the wall bodies. At the same time, uniform decoration for wall surfaces inside the modular integrated construction can be achieved, with better uniformity than that of the wall poured by traditional technologies.

The foregoing merely relates to preferred embodiments of the present invention, but never restricts the present invention. Any modifications, equivalent replacements and improvements falling within the spirit and principle of the present invention should be all contained in the scope of protection of the present invention.

CLAIMS

1. A hooking structure for modular integrated construction, comprising a first to-be-connected wall body (11) arranged on a first prefabricated building unit (1), and
5 a second to-be-connected wall body (21) arranged on a second prefabricated building unit (2), wherein the first to-be-connected wall body (11) is adjacent to the second to-be-connected wall body (21), and a cast-in-situ concrete area (3) is arranged therebetween,

10 characterized in that an outer side of the first to-be-connected wall body (11) and that of the second to-be-connected wall body (21) are each provided with a plurality of pre-embedded exposed retaining rings (4), each pre-embedded exposed retaining ring (4) of the first to-be-connected wall body (11) being opposite to a respective one of the pre-embedded exposed retaining rings (4) of the second to-be-connected wall body (21) in position, wherein two pre-embedded exposed retaining rings (4) opposite
15 to each other in position are tied by a hook (5).

2. The hooking structure for modular integrated construction according to claim 1, characterized in that one end of the hook (5) is L-shaped and the other end thereof is U-shaped, and the hook (5) is hooked up to the pre-embedded exposed retaining
20 rings (4) on both sides.

3. The hooking structure for modular integrated construction according to claim 2, characterized in that the L-shaped end of the hook (5) is provided with a wave-shaped inner wall, and the U-shaped end of the hook (5) is provided with a
25 sheet-like tongue (53) extending therefrom, the tongue (53) being arranged on one side of an inner wall of the U-shaped end.

4. The hooking structure for modular integrated construction according to claim 2 or 3, characterized in that the outer sides of the first to-be-connected wall body (11)
30 and the second to-be-connected wall body (21) each have a horizontal cross section having alternating concave portions and convex portions, wherein the pre-embedded exposed retaining rings (4) are provided at the convex portions of the outer sides of

the first to-be-connected wall body (11) and the second to-be-connected wall body (21).

5 5. The hooking structure for modular integrated construction according to claim 1, 2 or 3, wherein the hook (5) is hinged with a vertical rod (6) at a middle part thereof.

6. A method for constructing the hooking structure for modular integrated construction according to claim 1, comprising:

10 step A, hoisting a second prefabricated building unit (2) to a predetermined position and fixing it;

step B, hooking one end of the hook (5) up to the pre-embedded exposed retaining ring (4) provided on the outer side of the second to-be-connected wall body (21), and setting the other end of the hook (5) obliquely above said one end of the
15 hook (5);

step C, hoisting a first prefabricated building unit (1) to the predetermined position and fixing it;

step D, putting down said the other end of the hook (5) to hook up to the pre-embedded exposed retaining ring (4) at a corresponding position on the outer side
20 of the first to-be-connected wall body (11); and

step E, pouring concrete in the cast-in-situ concrete area (3) between the first to-be-connected wall body (11) and the second to-be-connected wall body (21).

7. The method for constructing the hooking structure for modular integrated construction according to claim 6, characterized in that one end of the hook (5) is
25 L-shaped and the other end thereof is U-shaped, and the U-shaped end of the hook (5) is provided with a sheet-like tongue (53) extending therefrom,

wherein in step B, the U-shaped end of the hook (5) is hooked up to the pre-embedded exposed retaining ring (4), and then the tongue (53) is bent toward the
30 pre-embedded exposed retaining ring (4).

8. The method for constructing the hooking structure for modular integrated

construction according to claim 7, characterized in that multiple hooks (5) arranged in the vertical direction are each hinged with a vertical rod (6) at their middle parts, respectively,

- 5 wherein in step D the vertical rod (6) is pushed downward so that an end of the hook (5) located obliquely above another end thereof moves downward to hook up to the pre-embedded exposed retaining ring (4).