

JOINT OF PRECAST CONCRETE STRUCTURAL WALL

Field of the Invention

5 The present invention relates to a building structure, in particular to a joint used in a precast concrete structural wall.

Background of the Invention

10 More and more buildings, in particular frame structural buildings, are built with prefabricated members. The use of prefabricated members can reduce the on-site work load, save the labor costs, and improve the construction efficiency.

 CN109057039A discloses a modular integrated building, comprising a plurality
15 of prefabricated room units assembled together. A bottom of the structural wall of the prefabricated room unit at a floor is provided with a semi-prefabricated connecting port, in which exposed reinforcing bars are arranged. In addition, a top of each prefabricated room unit at a next floor is also provided with exposed reinforcing bars, which are inserted into the semi-prefabricated connecting port of said floor. The
20 exposed reinforcing bars of the top of the prefabricated room unit at said next floor are connected with those in the semi-prefabricated connecting port at said floor, and the prefabricated room units of two adjacent floors are connected with each other through in-situ casting concrete in the semi-prefabricated connecting port.

25 The modular integrated building suffers the following defects. The top of the prefabricated room unit at said next floor is provided with exposed reinforcing bars, and the semi-prefabricated connecting port of the structural wall of the prefabricated room unit at said floor is also with exposed reinforcing bars. During construction, the structural wall sometimes cannot be mounted due to collision between the two groups
30 of exposed reinforcing bars. Therefore, the structural wall would be difficult to be

mounted at the construction site.

Summary of the Invention

5 In order to solve the above technical problem, the present invention aims to provide a joint of a precast concrete structural wall for connecting the precast concrete structural wall with a bottom load-bearing member, thereby reducing the construction difficulties and improving the construction efficiency without compromising the structural performance.

10 The present invention proposes a joint of a precast concrete structural wall, for connecting the precast concrete structural wall with a bottom load-bearing member. The joint includes a semi-prefabricated connection port, which is arranged at a lower end of the precast concrete structural wall and configured to be recessed inwardly, and
15 exposed reinforcing bars arranged at a top of the bottom load-bearing member. An inner wall of the semi-precast connection port is formed as a concave-convex surface, which has a plurality of concave portions and a plurality of convex portions that are arranged alternately, and the semi-prefabricated connection port is provided therein with no exposed, vertical connecting bars. The precast concrete structural wall is
20 mounted on the top of the bottom load-bearing member, so that the exposed reinforcing bars are inserted into the concave portions of the semi-prefabricated connection port, the precast concrete structural wall and the bottom load-bearing member being connected with each other through pouring concrete in the semi-prefabricated connection port.

25 Compared with the prior arts, the present invention has the following advantages.

1. By optimizing the shape of the connecting surface of the concrete and the arrangement of the reinforcing bars, the reinforcing bars extending downwardly from
30 the semi-prefabricated connection port of the structural wall will no longer protrude

from the surface of the precast concrete.

2. Since no exposed vertical connecting bars are arranged inside the semi-prefabricated connection port, and the exposed reinforcing bars are placed only
5 on the top of the bottom load-bearing members, the installation problem caused by the collision between the upper bars and the lower bars during construction can be solved, thus reducing the construction difficulty and improving the construction efficiency.

3. The inner wall of the semi-prefabricated connection port is formed as a
10 concave-convex surface, and the exposed reinforcing bars are inserted into the concave portions. By means of which, the joint strength can be ensured, without degrading the structural performance.

4. The number of reinforcing bars in the cast-in-situ concrete part is reduced, the
15 working space for the concrete is increased, and the narrow gap which will hinder the passage of aggregates is reduced. Therefore, the entire cast-in-situ part can be more easily filled with the concrete, and the possibility of forming honeycombs and voids when late pouring concrete on site is reduced, thus ensuring engineering quality and structural stability.

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5. The exposed reinforcing bars are reduced, enabling the surface of the precast concrete structural wall more concise and flat. In this manner, the complexity of the mold for prefabricated members is reduced, thereby reducing the overall cost and production time of the mold and improving the overall benefits of the prefabrication
25 factory.

In summary, compared with the prior arts, the present invention can ensure structural safety, achieve improved benefits of both production and construction, and increase the overall engineering quality and efficiency.

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Brief Description of the Drawings

Fig. 1 is a cross sectional view of a joint of a precast concrete structural wall in a frame structural building according to an embodiment of the present invention;

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Fig. 2 is an enlarged view of a broken-line block A of Fig. 1;

Fig. 3 is an enlarged view of a broken-line block B of Fig. 1;

10 Fig. 4 is an enlarged view of a broken-line block C of Fig. 2;

Fig. 5 is a vertically sectional view of Fig. 4; and

15 Fig. 6 is a flow chart of a construction method according to an embodiment of the present invention.

Detailed Description of the Embodiments

20 In the following, a preferred embodiment according to the present invention will be further illustrated with reference to the accompanying drawings.

Referring to Fig. 1 to Fig. 5, an embodiment of the present invention provides a joint of a precast concrete structural wall, which is used to connect the precast concrete structural wall with a bottom load-bearing member. The bottom load-bearing member may be a beam, a column, or other structural member. The bottom load-bearing member can be a prefabricated one or a cast-in-situ one, which are not limited herein.

30 According to the embodiment of the present invention, the joint may include: a semi-prefabricated connection port 30, which is arranged at a lower end of the precast concrete structural wall 10, and configured to be recessed inwardly; and exposed reinforcing bars 21, which are disposed at the top of the bottom load-bearing member

20. The semi-prefabricated connection port 30 has an inner wall, which consists of a plurality of concave portions 31 and a plurality of convex portions 32 that are arranged alternately. No exposed, vertical connecting bars are provided within the semi-prefabricated connection port 30. The precast concrete structural wall 10 is mounted on the top of the bottom load-bearing member 20, and the exposed reinforcing bars 21 are inserted into the concave portions 31 of the semi-prefabricated connection port 30. Concrete is poured into the semi-prefabricated connection port 30, so that the precast concrete structural wall 10 and the bottom load-bearing member 20 are joined together.

Since the inner wall of the semi-prefabricated connection port 30 has concave and convex portions, a rough joint surface is formed between the cast-in-situ concrete and the precast concrete. Accordingly, strong joint strength can be achieved through force transmission based on the bonding force between the two kinds of concretes.

Optionally, in some embodiments, two sides of the semi-prefabricated connection port 30 are provided with transverse connecting bars 33, which are exposed segments at two ends of transverse reinforcing bars 11 that are arranged in the precast concrete structural wall 10. Said exposed segments of the transverse reinforcing bars 11, after being bent of 180 degrees, extend into the semi-prefabricated connection port 30.

When concrete is poured in the semi-prefabricated connection port 30 in situ, the transverse connecting bars 33 and the exposed reinforcing bars 21 are completely covered by the concrete poured in the semi-prefabricated connection port 30.

Optionally, vertical auxiliary bars are provided in the convex portions 32 at the inner wall of the semi-prefabricated connecting port 30, and located out of the transverse reinforcing bars 11, for fixing the transverse reinforcing bars 11. The vertical auxiliary bars are arranged inside the precast concrete structural wall 10, and

thus are not exposed.

Optionally, vertical strengthening bars 35 are further provided in the convex portions 32 at the inner wall of the semi-prefabricated connecting port 30. The vertical strengthening bars 35 can be the lower ends of vertical reinforcing bars 12 that are arranged inside the precast concrete structural wall 10. That is, the vertical strengthening bar 35 and the vertical reinforcing bar 12, which are enclosed by one and the same line frame in the drawings, are actually one single reinforcing bar.

That is, each vertical strengthening bar 35 is formed by bending a vertical reinforcing bar 12 arranged in the precast concrete structural wall 10. Each vertical reinforcing bar 12 inside the precast concrete structural wall 10 is located above a corresponding concave portion 31 of the semi-prefabricated connection port 30, and the lower end of the vertical reinforcing bar 12 is bent toward a side at a position adjacent to the concave portion 31, and then extends into the convex portion 32 as the vertical strengthening bar 35.

Alternatively, a main portion of each vertical reinforcing bar 12 may correspond to a respective exposed reinforcing bar 21 inserted into the lower concave portion 31, so that they are arranged on the same straight line for achieving better structural performance.

In the present embodiment, the semi-prefabricated connection port 30 is open to the side wall 13 and the bottom surface 14 of the precast concrete structure wall 10.

Optionally, the inner wall 36 of the semi-prefabricated connecting port 30 is connected to the side wall 13 and the bottom surface 14 through respective inclined surfaces. Specifically, the inner wall 36 is connected to the side wall 13 of the precast concrete structure wall through a first inclined surface 37, and to the bottom surface 14 of the precast concrete structural wall through a second inclined surface 38. The

upper end and the bottom surface of the semi-prefabricated connection port 30 are each formed as an inclined surface, so that the cast-in-situ concrete can fully fill the gap formed between an upper layer and a lower layer, thus achieving better connection between the upper layer and the lower layer.

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In the above, the structure of the joint of the precast concrete structural wall has been described by means of the embodiment of the present invention. The specific size parameters of the structure, the type of the bars used, or the like, can be selected according to actual needs.

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For example, in an application scenario, the vertical strengthening bars and the exposed reinforcing bars may adopt T16 steel bars with a diameter of 16 mm, and the transverse connecting bars and the vertical auxiliary bars may adopt T10 steel bars with a diameter of 10 mm.

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Optionally, the concave portion may be an inverted trapezoidal concave portion, and the convex portion is a trapezoidal convex portion. The openings of the two portions are sized to comply with actual arrangement of reinforcing bars.

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Optionally, the spacing of the vertical reinforcing bars inside the precast concrete structural wall is 120-260 mm, and the distance between each vertical reinforcing bar and the vertical strengthening bar that is formed after bending said vertical reinforcing bar is 30-40 mm.

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Optionally, the precast concrete structural wall has a thickness of 175 mm, and the semi-prefabricated connection port has a depth of 125 mm at its concave portion and a depth of 45 mm at its convex portion, with a depth of the concave portion relative to the convex portion being 80 mm.

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Optionally, the height of the semi-prefabricated connection port is 590 mm at its

inner wall, and 620 mm at its opening.

Optionally, the height of the exposed reinforcing bars is 475 mm.

5 It should note that the above size parameters are only examples of parameters in a specific application scenario, but are not intended to limit the present invention. In various application scenarios, different parameters suitable for the scenarios may be selected.

10 Referring to Fig. 6, in some embodiments of the present invention, a method for constructing the joint of the precast concrete structural wall as described above includes the following steps.

15 In step S1, the precast concrete structural wall is mounted on the top of the bottom load-bearing member, so that the exposed reinforcing bars provided on the top of the bottom load-bearing member are inserted into the semi-prefabricated connection port provided at the lower end of the precast concrete structural wall, and specifically, inserted into the concave portions of the semi-prefabricated connection port.

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 In step S2, templates are established at the semi-prefabricated connection port and concrete is poured, so that the precast concrete structural wall and the bottom load-bearing member are connected to each other.

25 In summary, the present invention provides a joint of a precast concrete structural wall and a construction method thereof. Compared with the prior arts, the present invention has the following advantages.

1. By optimizing the arrangement of the reinforcing bars, the reinforcing bars
30 extending downwardly from the semi-prefabricated connection port of the structural

wall will no longer protrude from the surface of the precast concrete.

2. Since no exposed vertical connecting bars are arranged inside the semi-prefabricated connection port, and the exposed reinforcing bars are placed only on the top of the bottom load-bearing members, the installation problem caused by the collision between the upper bars and the lower bars during construction can be solved, thus reducing the construction difficulty and improving the construction efficiency. It is expected to reduce the installation time by about 25%-50% for each prefabricated piece.

3. Through special structural design, for example, the inner wall of the semi-prefabricated connection port is formed as a concave-convex surface, and the exposed reinforcing bars are inserted into the concave portions, the joint strength can be ensured, without degrading the structural performance. After strict evaluation by professional structural engineers, the structural performance according to the present invention, especially when used for a structural wall such as a precast reinforcing concrete bearing or shearing force wall with a thickness of 200 mm and below, is equivalent to that of current arrangement with exposed reinforcing bars, and also equivalent to that of the cast-in-situ reinforcing concrete structural wall. Therefore, the present invention provides effective means for node treatment with respect to precast reinforcing concrete structural wall.

4. Under the premise of ensuring the structural performance, the number of reinforcing bars in the cast-in-situ concrete part is reduced, the working space for the concrete is increased, and the narrow gap which will hinder the passage of aggregates is reduced. Therefore, the entire cast-in-situ part can be more easily filled with the concrete, and the possibility of forming honeycombs and voids when late pouring concrete on site is reduced, thus ensuring engineering quality and structural stability.

5. Under the premise of ensuring structural performance, the exposed reinforcing

bars are reduced, enabling the surface of the precast concrete structural wall more concise and flat. In this manner, the complexity of the mold for prefabricated members is reduced, thereby reducing the overall cost and production time of the mold and improving the overall benefits of the prefabrication factory. The present invention can reduce the complexity of mold assembly and disassembly during the production of the prefabricated members, thereby reducing the time required for production. At the same time, the risk of construction errors and thus the cost of rework and repair are reduced, thus improving the overall benefits of the production line for the prefabricated members.

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In summary, compared with the prior arts, the present invention can ensure structural safety, achieve improved benefits of both production and construction, and increase the overall engineering quality and efficiency.

15 The foregoing description is merely illustrative of preferred embodiments of the present invention, and is not intended to limit the present invention. Various changes and modifications may be made by those skilled in the art. Any modifications, equivalent substitutions, improvements, and the like within the spirit and principles of the present invention are intended to be included within the scope of the present invention.

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CLAIMS

1. A joint of a precast concrete structural wall, for connecting the precast concrete structural wall with a bottom load-bearing member,

5 characterized in that the joint includes a semi-prefabricated connection port, which is arranged at a lower end of the precast concrete structural wall and configured to be recessed inwardly, and exposed reinforcing bars arranged at a top of the bottom load-bearing member,

an inner wall of the semi-precast connection port is formed as a concave-convex
10 surface, which has a plurality of concave portions and a plurality of convex portions that are arranged alternately, and the semi-prefabricated connection port is provided therein with no exposed, vertical connecting bars, and

the precast concrete structural wall is mounted on the top of the bottom load-bearing member, so that the exposed reinforcing bars are inserted into the
15 concave portions of the semi-prefabricated connection port, the precast concrete structural wall and the bottom load-bearing member being connected with each other through pouring concrete in the semi-prefabricated connection port.

2. The joint of the precast concrete structural wall according to claim 1,
20 characterized in that two sides of the semi-prefabricated connection port are provided with transverse connecting bars, which are exposed segments at two ends of transverse reinforcing bars arranged in the precast concrete structural wall, wherein said exposed segments, after being bent of 180 degrees, extend into the semi-prefabricated connection port.

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3. The joint of the precast concrete structural wall according to claim 2, characterized in that the transverse connecting bars and the exposed reinforcing bars are completely covered by concrete poured in the semi-prefabricated connection port.

30 4. The joint of the precast concrete structural wall according to claim 2,

characterized in that vertical auxiliary bars are provided in the convex portions at the inner wall of the semi-prefabricated connecting port, and located out of the transverse reinforcing bars, for fixing the transverse reinforcing bars.

5 5. The joint of the precast concrete structural wall according to claim 1, characterized in that vertical strengthening bars, which are lower ends of vertical reinforcing bars arranged in the precast concrete structural wall, are provided in the convex portions at the inner wall of the semi-prefabricated connecting port.

10 6. The joint of the precast concrete structural wall according to claim 5, characterized in that the vertical strengthening bars are formed by bending the vertical reinforcing bars arranged in the precast concrete structural wall, and

each vertical reinforcing bar inside the precast concrete structural wall is located above a corresponding concave portion of the semi-prefabricated connection port, and
15 the lower end of the vertical reinforcing bar is bent toward a side at a position adjacent to the concave portion, and then extends into said convex portion as the vertical strengthening bar.

7. The joint of the precast concrete structural wall according to claim 1,
20 characterized in that the semi-prefabricated connection port is open to a side wall and a bottom surface of the precast concrete structure wall.

8. The joint of the precast concrete structural wall according to claim 7, characterized in that an inner wall of the semi-prefabricated connecting port is
25 connected to the side wall of the precast concrete structure wall through a first inclined surface, and to the bottom surface of the precast concrete structural wall through a second inclined surface.