

【DESCRIPTION】

【Invention Title】

BEAM-COLUMN JOINT AND METHOD FOR CONCURRENTLY CONSTRUCTING
UPPER AND LOWER PARTS OF BUILDING BY USING SAME

5 **【Technical Field】**

The present invention relates to a beam-column joint, in
which the lower part of a built-up beam is penetrated by a
column frame member at a column-beam joint part such that
adjacent beam members are continuously connected to each other
10 so as to achieve rigid joint at the column-beam joint part while
simplifying the details of the joint part, and a method for
concurrently constructing the upper and lower parts of a
building by using the same.

【Background Art】

15 A mixed-use building including a residential complex
building employs different structures for the upper and lower
parts of the building, for example, a lower story Rahmen
structure and an upper story box-frame construction structure,
wherein when the upper and lower structure types are different

from each other, a transfer girder (a load transfer beam) is installed at the boundary part therebetween.

Since such a transfer girder has to support an ultra high load, it is preferable that the transfer girder is rigidly
5 connected to a column so as to reduce a maximum moment. However, the size of a beam is very large since the length of the beam reaches 4m or more, and the details of a joint part with respect to a column at the lower portion thereof are complicated, resulting in the following problems.

10 That is, in the case of designing the conventional RC structure, the reinforcing bars for rigid joint are required excessively and the size of a beam or a column is very large. Therefore, it is difficult to carry out reinforcement placement and concrete pouring to the inside of members. Furthermore, it
15 is much burdensome to carry out the temporary work for floor posts and the like.

Besides, in the case of a conventional steel frame or an SRC structure, in which a steel frame is disposed inside a column and concrete is poured outside the steel frame, a column-
20 beam joint part is constructed in such a manner that a beam is coupled to a side surface of the column.

However, steel frames are not suitable for large beams such as transfer girders and the like due to the material costs, weight problems, and the limitations in the manufacturing specifications. In addition, the SRC structure is very
5 complicated in the details of the joint part thereof because the beam on the both sides of a column is unavoidably cut off by the column and, when a column-beam joint part is moment-bonded, the beam must be rigidly connected to the column.

Particularly, when beams are coupled to the four side
10 surfaces of a column, each of the separated beams must make rigid joint with the column each other. Therefore, there is a lot of difficulty in design and construction due to the mutual interference between these beams.

In addition, as can be seen in Fig. 1, there is also a case
15 where a transfer girder is constructed by placing a precast girder on top of a precast column (Registered Patent No. 10-0544368, etc.).

However, such a PC member has a considerable weight. Therefore, when a span or a girder length becomes large, it is
20 impossible to carry out construction due to the limitation of lifting. In addition, since the beams on the both sides of a column are disconnected as the SRC structure, the details of a

reinforcing bar becomes complicated for the moment-joining at the upper portions of the disconnected beams.

In addition, it is difficult to carry out construction for a lower structure, such as slabs and the like, due to the safety
5 problems until the connection between the column and the beam is completed by pouring concrete to the inside of the precast girder.

【Disclosure】

【Technical Problem】

10 Accordingly, the present invention has been made in an effort to solve the above-mentioned problems and disadvantages occurring in the prior arts, and the present invention attempts to break away from the conventional joining method of joining beams to the side surfaces of a column at a column-beam joint
15 part and provides a beam-column joint, in which the lower part of a beam is penetrated by a column member such that adjacent beam members are continuously connected to each other so as to achieve mutual rigid joint at a column-beam joint part while simplifying the details of the joint part, and a method for
20 concurrently constructing the upper and lower parts of a building by using the same.

The present invention is to provide a beam-column joint, in which column and beam members constituting a transfer floor are produced in the factory and then a column-beam joint part is completed in the field by assembling and installing the column
5 and beam members and pouring concrete, such that it is possible to reduce the burden of lifting and conveying and shorten a construction period through the use of the lightweight factory-produced assembly members, and a method for concurrently constructing the upper and lower parts of a building by using
10 the same.

The present invention is to provide a beam-column joint, in which the length of a beam is reduced, compared with the normal prior art transfer girder, through the use of steel concrete composite members, thereby minimizing temporary work and
15 utilizing materials economically, and a method for concurrently constructing the upper and lower parts of a building by using the same.

The present invention is to provide a beam-column joint, in which the construction of a lower structure may be started
20 earlier regardless of concrete pouring for horizontal members, thereby shortening a construction period, and a method for concurrently constructing the upper and lower parts of a building by using the same.

【Technical Solution】

According to a preferred embodiment of the present invention, there is provided a beam-column joint for rigid joint between a column frame member including a plurality of steel members, which are disposed on the respective corners of concrete columns at positions spaced apart from the surfaces of the columns inwards at predetermined intervals so as to form steel-concrete composite columns, and lattice members, which interconnect the plurality of steel members in a horizontal direction, and a built-up beam including lower flanges and a pair of webs coupled on the both end portions of the lower flanges vertically in an upward direction so as to form a steel concrete composite beam, into which concrete is poured, the beam-column joint characterized in that: the steel members of the column frame member protrude upwards from the column by a predetermined length; the lower flanges of the built-up beam have penetration parts, through which the steel members pass the steel members of the column frame member protrude upwards from the column by a predetermined length; the lower flanges of the built-up beam have penetration parts, through which the steel members pass steel member-fixing plates are fixed and coupled to the inside of the respective webs in the vertical direction at

portions, where the penetration parts of the built-up beam are formed, and the steel members protruding upwards from the upper portions of the column frame member are coupled to the steel member-fixing plates.

5 According to another preferred embodiment of the present invention, there is provided a beam-column joint, in which a base plate is fixed and coupled between the pair of webs at a predetermined height position at a portion, where the penetration part of the built-up beam is formed, and the steel
10 member, which protrudes upwards from the upper portion of the column frame member, is positioned at the lower portion of the base plate.

 According to another preferred embodiment of the present invention, there is provided a beam-column joint, in which a
15 concrete-pouring hole is formed in the center of the base plate.

 According to another preferred embodiment of the present invention, there is provided a beam-column joint, in which a steel pipe for pouring concrete therethrough is integrally coupled to the upper portion of the concrete-pouring hole.

20 According to another preferred embodiment of the present invention, there is provided a beam-column joint, in which an air hole is formed at one side of the base plate.

In addition, according to a preferred embodiment of the present invention, the present invention relates to a method for concurrently constructing the upper and lower parts of a building by using a beam-column joint, and provides a method for
5 concurrently constructing the upper and lower parts of a building by using a beam-column joint, comprising the steps of:
(a) installing a plurality of column frame members, each of which is formed as a multi-layered section and a built-up beam coupled on the upper portion thereof; (b) installing a middle
10 beam between the built-up beams at the upper portions of neighboring ones of the column frame members; (c) forming a steel concrete composite beam by pouring concrete to the inside of the built-up beams and the middle beams; and (d) forming steel-concrete composite columns by installing forms from the
15 lower portions of the column frame members and pouring concrete, while constructing an upper structure at the upper portion of the steel concrete composite beam.

【Advantageous Effects】

According to the present invention, the following effects
20 can be expected.

First, the lower part of the built-up beam is penetrated by the column frame member at the column-beam joint part such that

the adjacent beam members can be continuously connected to each other so as to achieve rigid joint at the column-beam joint part while simplifying the details of the joint part.

Secondly, the column frame members and the built-up beams
5 constituting a transfer floor and the like are produced in the factory and then the column-beam joint part can be completed in the field by assembling and installing the column frame members and the built-up beams and pouring concrete. Therefore, it is possible to reduce the burden of lifting and conveying and
10 shorten a construction period through the use of the lightweight factory-produced assembly members.

Third, the length of a beam can be reduced, compared with the normal prior art transfer girder, through the use of the steel concrete composite members. Therefore, it is possible to
15 minimize temporary work, for example, the installation of floor posts, forms for beam placement, and the like, and to minimize the size of the beams, thereby achieving economical construction.

Fourth, the construction of the lower part of the column frame members having high rigidity may be started earlier
20 regardless of concrete pouring for horizontal members such as the steel concrete composite beams. Therefore, it is possible to shorten a construction period by constructing a building

concurrently at the upper and lower parts of the steel concrete composite beams.

Fifth, the present invention can be applied to various fields such as the pier-beam joint parts of underground structures such as subway tunnels and the like, the column-beam joint parts of a clean room where heavy weight equipment is installed, transfer floors where upper and lower structure types are changed, and the like.

【Description of Drawings】

10 Fig. 1 is a side sectional view showing an embodiment of a prior art transfer girder.

Fig. 2 is a perspective view of a beam-column joint according to the present invention.

15 Fig. 3 is a perspective view showing a state, in which a column frame member is inserted into the lower portion of a built-up beam.

Fig. 4 is a bottom perspective view showing a state, in which an upper part of a column frame member is inserted into the lower portion of a built-up beam.

Fig. 5 is a perspective view illustrating coupling relationship between steel members of a column frame member and steel member-fixing plates of a built-up beam.

Fig. 6 is a perspective view of the beam-column joint according to the present invention, which includes a base plate inside a built-up beam.

Fig. 7(a) and Fig. 7(b) are respectively a top view and a side sectional view of the beam-column joint according to the present invention, which is shown in Fig. 6, and

Fig. 8 illustrates each step of a method for concurrently constructing the upper and lower parts of a building by using a beam-column joint according to the present invention.

【Mode for Invention】

Hereinafter, the present invention will be described in detail in accordance with preferred embodiments thereof and with reference to the accompanying drawings.

Fig. 2 is a perspective view of a beam-column joint according to the present invention, Fig. 3 is a perspective view showing a state, in which a column frame member is inserted into the lower portion of a built-up beam, and Fig. 4 is a bottom perspective view showing a state, in which an upper part of a

column frame member is inserted into the lower portion of a built-up beam.

A beam-column joint, according to the present invention, is to carry out mutual rigid joint between a column frame member 10 including a plurality of steel members 11, which are disposed on the respective corners of concrete columns at positions spaced apart from the surfaces of the columns inwards at predetermined intervals so as to form steel-concrete composite columns 1, and lattice members 12, which interconnect the plurality of steel members 11 in a horizontal direction, and a built-up beam 20 including lower flanges 21 and a pair of webs 22 coupled on the both end portions of the lower flanges 21 vertically in an upward direction so as to form a steel concrete composite beam 2, into which concrete is poured, the beam-column joint is characterized in that the steel members 11 of the column frame member 10 protrude upwards from the column by a predetermined length, and the lower flanges 21 of the built-up beam 20 have penetration parts 24, through which the steel members 11 pass.

That is, the beam-column joint, according to the present invention, is to carry out right joint between the column frame member 10 and the built-up beam 20, which constitute a steel-concrete composite column 1 and a steel concrete composite beam, to each other.

The column frame member 10 includes the plurality of steel members 11 and the lattice members 12.

5 The steel members 11 are disposed on the respective corners of concrete columns at positions spaced apart from the surfaces of the columns inwards at predetermined intervals. As can be seen in Fig. 2, Fig. 3 and the like, as for such steel members 11, an L-shaped steel plate may be used. It is also possible to use steel members 11 having various cross-sectional shapes other than the L-shaped steel.

10 When the size of a column is large, the steel members 11 may be additionally disposed on each surface of the column.

The steel members 11 are formed such that the upper ends thereof protrude upwards by a predetermined length.

15 The lattice members 12 are to connect the steel members 11, which are adjacent to each other on each surface of the column, to each other, such that a plurality of lattice members 12 are disposed in a vertical direction so as to be spaced apart from each other at predetermined intervals along the lengthwise direction of the column.

20 As for the lattice members 12, it is also possible to use not only a horizontal member having the same height at both ends

but also an inclined member having different heights at both ends.

The steel members 11 and the lattice members 12 can be coupled to each other by bolts or welding. In the case of bolt-coupling, as can be seen in Fig. 3 and the like, the steel members 11 and the lattice members 12 are formed with bolt-coupling holes in advance.

The column frame member 10 is excellent in stiffness and free-standing performance and can be formed as a multi-layered section as can be seen in Fig. 8(c) and Fig. 8(d).

The built-up beam 20 includes the lower flanges 21 and the one pair of webs 22, wherein the webs 22 of the built-up beam 20 may be formed folding the both ends of the lower flange 21 upwards in the vertical direction. Herein, when the size of a beam is large, there is a limitation of the forming equipment, so that separate steel plates can be combined by welding and the like.

The one pair of webs 22 are disposed to be spaced apart from each other at a predetermined distance so as to be side plates of the composite beam and can be respectively coupled to the top surfaces or side surfaces of the both ends of the lower flanges 21.

An upper flange 23, which is vertically coupled to the inside or outside of the beam, may be coupled to the upper end of the web 22 member.

5 The lower flange 21 of the built-up beam 20 is formed with a penetration part 24 and the steel members 11 protruding by a predetermined length above the column penetrate the penetration part 24.

Therefore, as can be seen in Fig. 4, the steel members 11 of the column frame member 10 pass through the penetration part 10 24, which is formed in the lower flange 21 of the built-up beam 20, and extend to the inside of the beam so as to be disposed therein such that the beam at both sides of the column can be continuous. Therefore, the details of the joint part can be configured very simply while constructing the column-beam joint 15 part with rigid joint.

The beam members located at both sides of the prior art column can be pre-assembled in the factory so that the webs 22 and the upper flanges 23 are continuous on the upper portion of the column.

20 The concrete (C) poured in the column member and the beam members can be integrated with each other through the penetration part 24.

The present invention can be applied to the column-beam joint part, which constitutes the transfer floor, in the case of a building having different upper and lower construction types, for example, a lower story Rahmen structure and an upper story box-frame construction structure, and shorten a construction period through the process of producing the column frame member 10 and the built-up beam 20 in the factory and then assembling and installing the same in the field.

Also, the size of a beam can be minimized by constructing the beam as a steel concrete composite beam. Therefore, it is possible to reduce the number of concrete pouring and solve the interference problem with facilities.

In addition, since the built-up beam 20, which is minimized in size compared with existing ones, is supported on the column frame member 10 of excellent rigidity, it is not necessary to provide a form and a floor post for beam placement, thereby minimizing the temporary work.

In addition, since the construction of the lower portion of the column frame member 10 can be started earlier regardless of concrete pouring for the steel concrete composite beam 2, which is a horizontal member, the construction of a building can be

concurrently carried out at the upper and lower parts of the beam, thereby shortening the construction period.

The present invention can be applied to various fields such as the pier-beam joint parts of underground structures such as subway tunnels and the like, the column-beam joint parts of a clean room where heavy weight equipment is installed, and the like.

Fig. 5 is a perspective view illustrating coupling relationship between steel members of a column frame member and steel member-fixing plates of a built-up beam.

As can be seen in Fig. 5, the steel members 11 protruding upwards from the upper portion of the column frame member 10 may be coupled to the steel member-fixing plate 25.

That is, the steel members 11 can be fixed to the built-up beam 20 by coupling the upper portions of the steel members 11, which are inserted into the built-up beam 20 through the penetration part 24, to the steel member-fixing plates 25 coupled to the web 22.

The steel member-fixing plate 25 is coupled to the inside of the web 22 by welding.

The upper portions of the steel members 11 and the steel member-fixing plates 25 can be coupled to each other by welding or bolt-coupling. When bolt-coupling these members, the steel members 11 and the steel member-fixing plates 25 may be formed with a plurality of bolt-coupling holes at positions corresponding to each other.

Fig. 6 is a perspective view of the beam-column joint according to the present invention, which includes a base plate provided inside a built-up beam.

As can be seen in Fig. 6, a base plate 26 may be fixed and coupled between the one pair of webs 22 at a predetermined height position at a portion, where the penetration part 24 of the built-up beam 20 is formed, and the steel members 11, which protrude upwards from the upper portion of the column frame member 10, may be positioned at the lower portion of the base plate 26.

When the concrete of the beam and the concrete of column have different strength or physical properties from each other, it is possible to pour the concrete of the vertical member first and then pour the concrete of the horizontal member later. To the contrary, it is also possible to pour the concrete of the horizontal member first and then pour the concrete of the

vertical member later. As described, concrete pouring for the vertical member and the horizontal member may be separately carried out.

When the concrete of the beam and the concrete of the
5 column are separately poured as described above, the base plate 26 defines the concrete boundary between the beam and the column.

Particularly, the base plate 26 can securely support the steel members 11 through the configuration, in which the upper ends of the steel members 11, which protrude upwards from the
10 upper portion of the column frame member 10, are in contact with the lower surface of the base plate 26.

As shown in Fig. 5, when the steel member-fixing plates 25 are coupled to the inside of the webs 22 of the built-up beam 20, the steel members 11 are more securely supported by the steel
15 member-fixing plates 25 and the base plate 26.

Fig. 7(a) and Fig. 7(b) are respectively a top view and a side sectional view of the beam-column joint according to the present invention, which is shown in Fig. 6.

As can be seen in Fig. 7(a) and Fig. 7(b), a concrete-
20 pouring hole 261 can be formed in the center of the base plate 26.

When the base plate 26 is coupled to the inside of the built-up beam 20 such that the boundaries of the beam concrete and the column concrete are divided from each other, the concrete of the column member can be poured in the column
5 through the concrete-pouring hole 261.

Herein, the concrete (C) can be dropped directly through the concrete-pouring hole 261 at the height of the base plate 26, and it is preferable that a tremie pipe is inserted in the concrete-pouring hole 261 so as to minimize the concrete
10 dropping height, thereby controlling the quality of the concrete.

That is, the distance between the lower end of the tremie pipe and a concrete pouring surface is minimized so as to prevent the separation of materials due to the free fall of the concrete.

15 Even though Fig. 7(b) shows an embodiment, in which the concrete (C) is first poured in the beam, but it is also possible to pour the concrete in the column first and then pour the concrete in the beam in some cases.

As can be seen in Fig. 6 and Fig. 7(b), a steel pipe 262
20 for concrete pouring may be integrally coupled to the upper portion of the concrete-pouring hole 261.

The steel pipe 262 is installed for the later concrete pouring for the inside of the column when the concrete is first poured in the beam, which is the horizontal member.

Of course, even though the column concrete is poured
5 earlier than the beam concrete, the column concrete can be prevented from entering into the beam by pouring the concrete through the steel pipe 262 into the column.

Meanwhile, when the column concrete is poured using the tremie pipe, the wrinkles formed on the outside of the tremie
10 pipe may be caught by the concrete-pouring hole 261 of the base plate 26 and interfere with the upward and downward movement of the tremie pipe. Therefore, even in this case, when the steel pipe 262 is used, the steel pipe 262 serves as a guide for the tremie pipe so as to facilitate the upward and downward movement
15 of the tremie pipe.

The base plate 26 may have an air hole formed at one side thereof.

When the column concrete at the lower portion of the beam is poured first, the upper end portion of the column concrete,
20 that is, the lower surface of the base plate 26 may be filled with air, causing concrete cavities. Therefore, an air hole (not shown) may be formed in a predetermined size at a side of the

base plate 26 so that the trapped air may escape to the outside from the lower surface of the base plate 26.

Besides, when the concrete is filled in the lower part of the base plate 26, the concrete is discharged through the air
5 hole. Therefore, it is possible to visually confirm whether the concrete is fully charged by means of the air hole.

Fig. 8 illustrates each step of a method for concurrently constructing the upper and lower parts of a building by using a beam-column joint, according to the present invention.

10 A method for concurrently constructing the upper and lower parts of a building by using a beam-column joint, according to the present invention, relates to a method for concurrently constructing the upper and lower parts of a building, by using the beam-column joint, which has been described with reference
15 to Fig. 2 to Fig. 7 hereinabove.

As for the method for concurrently constructing the upper and lower parts of a building by using a beam-column joint, according to the present invention, first, (a) a plurality of column frame members 10 are installed, wherein each of the
20 plurality of column frame members 10 is formed in a multi-layered section and has a built-up beam 20 on the upper portion thereof (Fig. 8(a)).

The column frame member 10 includes the plurality of steel members 11 and the lattice members 12, and the built-up beam 20 includes the lower flanges 21 and one pair of webs 22. The column frame member 10 and the built-up beam 20 may be produced
5 in the factory in advance and then transferred to the field.

The column frame member 10 has the steel members 11, of which upper ends are positioned in the beam through the penetration part 24, which is formed in the lower flange 21 of the built-up beam 20.

10 The upper portions of the steel members 11 may be welded or bolt-coupled to the steel member-fixing plates 25, which are coupled to the webs 22, such that the steel members 11 can be fixed to the built-up beam 20.

The column frame member 10 is excellent in stiffness and
15 free-standing performance and can be formed as one section including basement layers and ground layers.

Next, (b) a middle beam 20a is installed between the built-up beams 20 on the upper portions of neighboring ones of the column frame members 10, and (c) a steel concrete composite beam
20 2 is formed by pouring concrete in the built-up beams 20 and the middle beam 20a (Fig. 8(b)).

It is preferable that the middle beam 20a is formed in the same size and shape as the built-up beam 20, and the middle beam 20a and the built-up beam 20 may be coupled to each other by coupling the webs and the lower flanges with connection plates.

5 When the base plate 26 is fixed and coupled to the inside of the built-up beam 20, it is possible to divide the beam concrete and the column concrete by the base plate 26.

10 In step (c), it is also possible to carry out the work for the lower portion of the column frame member 10, such as the placement of forms, floor forms and floor reinforcing bars, the concrete pouring and the like, regardless of the concrete pouring for the steel concrete composite beam 2 (Fig. 8(c)).

15 Furthermore, (d) the forms are installed from the lower portion of the column frame member 10 and then the concrete is poured so as to form the steel-concrete composite column 1, while an upper structure 3 is constructed on the steel concrete composite beam 2 (Fig. 8(d)).

20 Therefore, a building can be constructed in an up-up manner concurrently at the upper part and the lower part of the steel concrete composite beam 2, which can be used as a transfer girder and the like, thereby greatly shortening a construction period.

In this case, the concrete pouring of the column frame member 10 is carried out in order from the basement layer and the concrete pouring for the transfer floor or the first floor is carried out at the very end.

【CLAIMS】

【Claim 1】

A beam-column joint for rigid joint between a column frame member (10) including a plurality of steel members (11), which
5 are disposed on the respective corners of concrete columns at positions spaced apart from the surfaces of the columns inwards at predetermined intervals so as to form steel-concrete composite columns (1), and lattice members (12), which interconnect the plurality of steel members (11) in a horizontal
10 direction, and a built-up beam (20) including lower flanges (21) and a pair of webs (22) coupled on the both end portions of the lower flanges (21) vertically in an upward direction so as to form a steel concrete composite beam (2), into which concrete is poured, the beam-column joint characterized in that:

15 the steel members (11) of the column frame member (10) protrude upwards from the column by a predetermined length; and

the lower flanges (21) of the built-up beam (20) have penetration parts (24), through which the steel members (11) pass; and

steel member-fixing plates (25) are fixed and coupled to the inside of the respective webs (22) in the vertical direction at portions, where the penetration parts (24) of the built-up beam (20) are formed, and the steel members (11) protruding upwards from the upper portions of the column frame member (10) are coupled to the steel member-fixing plates (25).

【Claim 2】

The beam-column joint according to claim 1, wherein a base plate (26) is fixed and coupled between the pair of webs (22) at a predetermined height position at a portion, where the penetration part (24) of the built-up beam (20) is formed, and the steel member (11), which protrudes upwards from the upper portion of the column frame member (10), is positioned at the lower portion of the base plate (26).

【Claim 3】

The beam-column joint according to claim 3, wherein a concrete-pouring hole (261) is formed in the center of the base plate (26).

【Claim 4】

The beam-column joint according to claim 4, wherein a steel pipe (262) for pouring concrete therethrough is integrally coupled to the upper portion of the concrete-pouring hole (261).

【Claim 5】

5 The beam-column joint according to claim 4, wherein an air hole is formed at one side of the base plate (26).

【Claim 6】

A method for concurrently constructing the upper and lower parts of a building by using the beam-column joint of claim 1,
10 comprising the steps of:

(a) installing a plurality of column frame members (10), each of which is formed as a multi-layered section and has a built-up beam (20) coupled on the upper portion thereof;

(b) installing a middle beam (20a) between the built-up
15 beams (20) at the upper portions of neighboring ones of the column frame members;

(c) forming a steel concrete composite beam (2) by pouring concrete to the inside of the built-up beams (20) and the middle beams (20a); and

(d) forming steel-concrete composite columns (1) by installing forms from the lower portions of the column frame members (10) and pouring concrete, while constructing an upper structure (3) at the upper portion of the steel concrete
5 composite beam (2).