

BEAM-GIRDER JOINT OF PREFABRICATED STEEL ASSEMBLY

BACKGROUND OF THE INVENTION

Field of the Invention

5 [01] The present invention relates to a beam-girder joint of a prefabricated steel assembly, which can induce moment values of a connected end portion and a central portion of a beam to be similar to each other through rigid connection of the beam and a girder, thereby reducing dancing of the beam and effectively
10 supporting negative moment at the connected portion of the beam.

Background Art

15 [02] As a steel-concrete composite member which can show all of strength of steel and strength of concrete in a structural member, such as a column or a beam, through composition of steel and concrete, representatively, there is a member that a shear connector, such as a stud, is welded and attached to the surface of I-shaped or H-shaped steel and concrete is poured thereon. Moreover, recently, prefabricated composite members that are
20 formed in such a way that tie bars or lattice bars are welded to the surface of a 'L'-shaped or 'C'-shaped steel at a factory have been frequently used. The prefabricated composite members which have been previously produced at the factory are constructed on the site when concrete is poured on the prefabricated composite

members on the site (Korean Patent Publication No 2001-0005431 and Korean Patent No. 10-1274999).

[03] However, the prefabricated composite members are more increased in welded portions than conventional composite members since the tie bars or lattice bars are welded to the 'L'-shaped steel, and is weak to welding chemically in case of high-carbon rebars. Therefore, the prefabricated composite members cause various problems to manufacturers and structural designers, such as reliability in welded portions.

[04] In general, a beam joined to a column is called a girder (G) and a beam joined to the girder (G) is called a beam (B).

[05] In conventional steel frame structures, steel framed reinforced concrete structures, PRC (Prefabricated Reinforced Concrete) or PSRC (Prefabricated Steel Reinforced Concrete) structures that horizontal rebars are prefabricated to rebars arranged at edges of a member or 'L'-shaped steels at a factory and concrete is poured on the site, or the conventional frame structures (Korean Patent Publication No 2001-0005431 and Korean Patent No. 10-1274999) using the prefabricated composite members that the tie bars or lattice bars are welded to the surface of the section steels and concrete is poured on the site, the beam is joined to the girder as a simple beam, and has been designed as a slab-composite beam.

[06] Moreover, in general, at the time of design of a slab frame structure, as shown in FIG. 1, the girder (G) is arranged in an X-axis direction which is a short leg direction with a short span, and the beam (B) is joined to a neighboring girder (G) in a Y-axis direction which is a long leg direction. The arrow in FIG. 1 indicates a load transfer route of a deck plate.

[07] However, in this instance, because the beam (B) is mounted in the long leg direction, the beam (B) is elongated. As shown by the bending moment diagram of FIG. 1, because a moment (M_0) at the central portion of the beam (B) increases due to pin-joining between the girder (G) and the beam (B), it is uneconomical due to an increase of the quantity of the beam (B).

SUMMARY OF THE INVENTION

[08] Accordingly, the present invention has been made to solve the above-mentioned problems occurring in the prior arts, and it is an object of the present invention to provide a beam-girder joint of a prefabricated steel assembly, which can induce moment values of a connected end portion of a beam and a central portion to be similar to each other through rigid connection of the beam and a girder, thereby reducing dancing of the beam.

[09] To accomplish the above object, according to the present invention, there is provided a beam-girder joint of a prefabricated steel assembly including: a girder steel assembly adapted to form a girder; and a beam steel assembly adapted to

form a beam, which is joined to one side of the girder in an orthogonal direction, wherein the girder steel assembly includes first main shape steel members arranged at edges of a member in a longitudinal direction and first connection shape steel members
5 joined to one side of the first main shape steel members in order to connect the neighboring first main shape steel members with each other, the beam steel assembly includes second main shape steel members arranged at edges of a member in a longitudinal direction and second connection shape steel members joined to one
10 side of the second main shape steel members in order to connect the neighboring second main shape steel members with each other, and the first main shape steel members of the girder steel assembly are cut such that the second main shape steel members of the beam steel assembly pass through.

15 **[10]** In an embodiment of the present invention, first connection plates getting in contact with the outer surfaces of the second main shape steel members are disposed at cut end portions of the first main shape steel members, and connection rebars passing through the second main shape steel members
20 connect and support the first connection plates facing each other.

[11] In an embodiment of the present invention, the beam-girder joint further includes: a first auxiliary shape steel member of the upper portion connected to the upper portion of the first main shape steel member; a second auxiliary shape steel

member of the upper portion connected to the upper portion of the second main shape steel member, wherein the second auxiliary shape steel member of the upper portion is cut so that the first auxiliary shape steel member of the upper portion can pass
5 through; second connection plates disposed at the cut end portions of the second auxiliary shape steel member to get in contact with the outer surface of the first auxiliary shape steel member of the upper portion; and connection rebars passing through the first auxiliary shape steel member of the upper
10 portion to connect and support the second connection plates facing each other.

[12] In an embodiment of the present invention, joint plates, which are inclined outwardly and downwardly, are respectively connected to an end portion of the second main shape
15 steel member of the upper portion and an end portion of the second main shape steel member of the lower portion.

[13] The beam-girder joint of the prefabricated steel assembly according to the present invention shows the following effects.

20 [14] First, the beam-girder joint of the prefabricated steel assembly according to the present invention can join the beam and the girder rigidly since the first main shape steel members arranged at the edges of the member of the girder steel assembly in the longitudinal direction of the member are cut such

that the second main shape steel members arranged at the edges of the member of the beam steel assembly in the longitudinal direction of the member can pass through in order to support the outer surfaces of the second main shape steel members. Therefore, the beam-girder joint of the prefabricated steel assembly according to the present invention can induce moment values of the connected end portion and the central portion of the beam to be similar to each other, thereby reducing dancing of the beam and also reducing a steel ratio.

[15] Second, the beam-girder joint of the prefabricated steel assembly according to the present invention can effectively support negative moment generated at the joined end portion of the beam of the beam-girder joint since the second auxiliary shape steel members are connected to the upper portion of the second main shape steel member at the upper portion of the beam steel assembly.

BRIEF DESCRIPTION OF THE DRAWINGS

[16] The above and other objects, features and advantages of the present invention will be apparent from the following detailed description of the preferred embodiments of the invention in conjunction with the accompanying drawings, in which:

[17] FIG. 1 is a plan view showing a conventional slab floor frame structure;

[18] FIG. 2 is a plan view showing a slab floor frame structure to which a beam-girder joint of a prefabricated steel assembly according to the present invention is applied;

[19] FIG. 3 is a perspective view showing the beam-girder joint of the prefabricated steel assembly according to the present invention;

[20] FIG. 4 is a perspective view showing a girder steel assembly;

[21] FIG. 5 is a perspective view showing a beam steel assembly;

[22] FIG. 6 is a sectional view taken in an A direction of FIG. 3;

[23] FIG. 7 is a sectional view taken in a B direction of FIG. 3;

[24] FIG. 8 is a perspective view showing a column frame structure to which the beam-girder joint of the prefabricated steel assembly according to the present invention is applied; and

[25] FIG. 9 is a perspective view showing a state where a wire is bent in the beam steel assembly.

BEST MODE

[26] To accomplish the above object, according to the present invention, there is provided a beam-girder joint of a prefabricated steel assembly including: a girder steel assembly adapted to form a girder; and a beam steel assembly adapted to form a beam, which is joined to one side of the girder in an orthogonal direction, wherein the girder steel assembly includes first main shape steel members arranged at edges of a member in a longitudinal direction and first connection shape steel members joined to one side of the first main shape steel members in order to connect the neighboring first main shape steel members with each other, the beam steel assembly includes second main shape steel members arranged at edges of a member in a longitudinal direction and second connection shape steel members joined to one side of the second main shape steel members in order to connect the neighboring second main shape steel members with each other, and the first main shape steel members of the girder steel assembly are cut such that the second main shape steel members of the beam steel assembly pass through.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[27] Hereinafter, preferred embodiments of the present invention will be described in detail with reference to the accompanying drawings.

[28] FIG. 2 is a plan view showing a slab floor frame structure to which a beam-girder joint of a prefabricated steel assembly according to the present invention is applied, FIG. 3 is a perspective view showing the beam-girder joint of the prefabricated steel assembly according to the present invention, FIG. 4 is a perspective view showing a girder steel assembly, FIG. 5 is a perspective view showing a beam steel assembly, FIG. 6 is a sectional view taken in an A direction of FIG. 3, and FIG. 7 is a sectional view taken in a B direction of FIG. 3.

[29] As shown in FIGS. 3 to 5, a beam-girder joint of a prefabricated steel assembly according to the present invention includes: a girder steel assembly 1 adapted to form a girder (G); and a beam steel assembly 2 adapted to form a beam (B), which is joined to one side of the girder (G) in an orthogonal direction, wherein the girder steel assembly 1 includes first main shape steel members 11a and 11b arranged at edges of a member in a longitudinal direction and first connection shape steel members 12 joined to one side of the first main shape steel members 11a and 11b in order to connect the neighboring first main shape steel members 11a and 11b with each other, the beam steel assembly 2 includes second main shape steel members 21a and 21b arranged at edges of a member in a longitudinal direction and second connection shape steel members 22 joined to one side of the second main shape steel members 21a and 21b in order to

connect the neighboring second main shape steel members 21a and 21b with each other, and the first main shape steel members 11a and 11b of the girder steel assembly 1 are cut such that the second main shape steel members 21a and 21b of the beam steel assembly 2 pass through.

[30] The present invention is to provide a beam-girder joint of a prefabricated steel assembly, which can induce moment values of a connected end portion of the beam and a central portion to be similar to each other through rigid connection of the beam and the girder, thereby reducing dancing of the beam and effectively supporting negative moment at the connected portion of the beam.

[31] The beam-girder joint of the prefabricated steel assembly according to the present invention includes the girder steel assembly 1 and the beam steel assembly 2, and the girder steel assembly 1 has the girder (G) and the beam steel assembly has the beam (B).

[32] The beam steel assembly 2 is connected to one side of the girder (G) in the orthogonal direction.

[33] As shown in FIG. 4, the girder steel assembly 1 includes the first main shape steel members 11a and 11b arranged at edges of the member in the longitudinal direction and the first connection shape steel members 12 joined to one side of the first main shape steel members 11a and 11b in order to connect

the neighboring first main shape steel members 11a and 11b with each other.

[34] In FIG. 4, a pair of the first main shape steel members 11a are arranged at an upper portion of the member, and a pair of the first main shape steel members 11b are arranged at a lower portion of the member so that the first main shape steel members 11a and 11b are spaced apart from each other at a predetermined interval downwardly.

[35] A pair of the first main shape steel members 11a of the upper portion of the members adjoining each other, a pair of the first main shape steel members 11b of the lower portion of the members, and the vertically neighboring first main shape steel members 11a and 11b are connected to the first connection shape steel members 12 via bolts.

[36] Moreover, as shown in FIG. 5, the beam steel assembly 2 includes the second main shape steel members 21a and 21b arranged at edges of the member in the longitudinal direction and the second connection shape steel members 22 joined to one side of the second main shape steel members 21a and 21b in order to connect the neighboring second main shape steel members 21a and 21b with each other.

[37] In FIG. 5, a pair of the second main shape steel members 21a are arranged at an upper portion of the member, and a pair of the second main shape steel members 21b are arranged at a

lower portion of the member so that the second main shape steel members 21a and 21b are spaced apart from each other at a predetermined interval downwardly.

[38] A pair of the second main shape steel members 21a of the upper portion of the members adjoining each other, a pair of the second main shape steel members 21b of the lower portion of the members, and the vertically neighboring second main shape steel members 21a and 21b are connected to the second connection shape steel members 22 via bolts.

[39] The first main shape steel members 11a and 11b of the girder steel assembly 1 are cut such that the second main shape steel members 21a and 21b of the beam steel assembly 2 pass through.

[40] As shown in FIG. 2, when the beam-girder joint of the prefabricated steel assembly according to the present invention is applied, the girder (G) is installed in the long leg direction (Y-axis direction), and the beam (B) is joined rigidly between the neighboring girders (G) in the short leg direction (X-axis direction). Therefore, the beam-girder joint of the prefabricated steel assembly according to the present invention can reduce the length of the beam (B) and a moment value (M_2) at the central portion of the beam (B) so that the steel composite concrete member can be designed economically.

[41] In order to achieve the above, the beam-girder joint is formed in such a way that the second main shape steel members 21a and 21b of the beam steel assembly 2 are not segmented but the beam steel assembly 2 passes through the girder steel assembly 1.

[42] In this instance, the first main shape steel members 11a and 11b of the girder steel assembly 1 are cut at a portion where the beam steel assembly 2 passes through and are supported on the outer surfaces of the second main shape steel members 21a and 21b.

[43] Therefore, the beam-girder joint of the prefabricated steel assembly according to the present invention can greatly reduce dancing of the beam (B) to reduce a steel ratio.

[44] The arrow of FIG. 2 indicates a load transfer route of a deck plate.

[45] Preferably, the first main shape steel members 11a and 11b and the second main shape steel members 21a and 21b use 'L'-shaped steels corresponding to the shape of the edges of the members.

[46] The 'L'-shaped steels are suitable for joining with other section steels.

[47] The first connection shape steel members 12 and the second connection shape steel members 22 are arranged vertically or inclinedly.

[48] Because the first connection shape steel members 12 which are orthogonal to each other may interfere with each other at the joined portion, the first connection shape steel members 12 are respectively connected to the inner surface and the outer surface of the first main shape steel members 11a and 11b to avoid interference.

[49] For instance, the first connection shape steel member 12 of the upper portion which connects the first main shape steel members 11a of the upper portions of the members and the first connection shape steel member 12 of a lateral side which connects the upper and lower first main shape steel members 11a and 11b may interfere with each other. Therefore, the first connection shape steel members 12 of the upper portion connects the first main shape steel members 11a, which neighbor on the inner surfaces of the members, with each other, and the first connection shape steel members 12 of the lateral side connects the first main shape steel members 11a, which neighbor on the outer surfaces of the members.

[50] Likewise, because the second connection shape steel members 22 which are orthogonal to each other may interfere with each other at the joined portion, the second connection shape steel members 22 are respectively connected to the inner surface and the outer surface of the second main shape steel members 21a and 21b to avoid interference.

[51] As shown in FIGS. 3 and 5, first connection plates 13 getting in contact with the outer surfaces of the second main shape steel members 21a and 21b are disposed at cut end portions of the first main shape steel members 11a and 11b, and connection
5 rebars 14 passing through the second main shape steel members 21a and 21b connect and support the first connection plates 13 facing each other.

[52] The first connection plates 13 are welded and connected to the cut end portions of the first main shape steel
10 members 11a and 11b in order to transfer stress from the cut portions.

[53] The first connection plates 13 facing each other are connected with each other by the connection rebars 14. Therefore, the present invention can smoothly transfer tensile force by the
15 connection rebars 14.

[54] In order to achieve the above, the first connection plates 13 and the second main shape steel members 21a and 21b respectively have through holes which may be formed previously so that the connection rebars 14 can pass through.

20 [55] After the connection rebars 14 pass through the first connection plates 13 and the second main shape steel members 21a and 21b, nuts are fastened to the connection rebars 14 from the outside of the second main shape steel members 21a or 21b.

[56] Each of the connection rebars 14 may have a spiral thread formed on the outer surface of the end portion for nut-coupling.

[57] Preferably, the connection rebars 14 are arranged at
5 the right and the left of the first main shape steel members 11a and 11b in a pair not to generate a partial disposition when tensile force is transferred.

[58] Considering the above, the first connection plates 13
10 may be connected with the cut end portions of the first main shape steel members 11a and 11b in a T-shape to extend toward the cut end portions of the first main shape steel members 11a and 11b.

[59] As shown in FIGS. 3, 5 and 7, the beam-girder joint further includes: a first auxiliary shape steel member 15a of the
15 upper portion connected to the upper portion of the first main shape steel member 11a; second auxiliary shape steel members 23 of the upper portion connected to the upper portion of the second main shape steel member 21a, wherein the second auxiliary shape steel member 23 of the upper portion is cut so that the first
20 auxiliary shape steel member 15a of the upper portion can pass through; second connection plates 24 disposed at the cut end portions of the second auxiliary shape steel member 23 to get in contact with the outer surface of the first auxiliary shape steel member 15a of the upper portion; and connection rebars 25 passing

through the first auxiliary shape steel member 15a of the upper portion to connect and support the second connection plates 24 facing each other.

[60] The beam-girder joint needs strengthening in tension
5 at the upper portion of the member since the beam (B) generates negative moment.

[61] So, the second auxiliary shape steel member 23 of the upper portion may be joined to the upper portion of the second main shape steel member 21a of the upper portion.

10 [62] However, compression force acts to the upper portion since the girder (G) mainly generates positive moment at the beam-girder joint. Therefore, the first auxiliary shape steel member 15a of the upper portion is not cut to transfer the compression force, but the second auxiliary shape steel member 23
15 of the upper portion of the beam steel assembly 2 is cut. Therefore, the connection rebars 25 connect the cut portions of the second auxiliary shape steel member 23 of the upper portion with each other so as to smoothly transfer tensile force.

[63] The second auxiliary shape steel member 23 of the
20 upper portion may be disposed throughout the entire length of the member, but may be disposed only at a predetermined section near the beam-girder joint where negative moment is generated.

[64] Likewise, the first auxiliary shape steel member 15a of the upper portion also may be disposed only at a predetermined

section near the beam-girder joint. However, because load greater than that of the beam (B) is applied to the girder (G), in order to secure dancing of the girder (G), the first auxiliary shape steel member 15a of the upper portion may be disposed throughout
5 the entire length of the girder (G).

[65] Meanwhile, a first auxiliary shape steel member 15b of the lower portion may be connected to the lower portion of the first main shape steel member 11b of the lower portion of the girder steel assembly 1 in order to strengthen tensile force and
10 support shearing force at the lower portion of the girder steel assembly 1.

[66] As shown in FIGS. 3, 5 and 7, joint plates 26a and 26b, which are inclined outwardly and downwardly, may be respectively connected to an end portion of the second main shape steel member
15 21a of the upper portion and an end portion of the second main shape steel member 21b of the lower portion.

[67] When the joint plates 26a and 26b are prepared, when an intermediate beam (not shown) is installed, the intermediate beam is lifted so that a lower joint plate of the intermediate
20 beam is located between the upper and lower joint plates 26a and 26b of the second main shape steel members 21a and 21b, and then, is moved in a lateral direction and in a downward direction so that the joint plates meet each other.

[68] Therefore, the present invention makes it easy to connect the intermediate beam and makes it possible to reduce the construction duration.

[69] Moreover, because the joint plates come into close contact with each other at the joined surface of the member to directly transfer shearing force, there is no need for bolts to bear the shearing force and it is enough to fasten only tension bolts. Therefore, the present invention is economical since greatly reducing the number of bolts.

[70] Furthermore, because the bolts transfer only tensile force, bolt coupling holes may have clearance to absorb a construction error.

[71] Inclined joint plates 16a and 16b may be connected to end portions of the first main shape steel members 11a and 11b of the girder steel assembly 1. FIG. 8 is a perspective view showing a column frame structure to which the beam-girder joint of the prefabricated steel assembly according to the present invention is applied.

[72] As shown in FIG. 8, the beam-girder joint of the prefabricated steel assembly according to the present invention is also applicable to a column panel zone.

[73] In this instance, a column steel assembly includes: column main shape steel members 31 arranged at edges of a column along the surface of the column in the vertical direction; and

horizontal support members 32 for connecting the neighboring column main shape steel members 31 in the horizontal direction.

[74] Because the beam steel assembly 2 and the girder steel assembly 1 pass through between the vertically neighboring horizontal support members 32, it makes a column-beam joint possible in the panel zone.

[75] FIG. 9 is a perspective view showing a state where a wire is bent in the beam steel assembly.

[76] In order to support the negative moment applied to a beam connection part of the beam-girder joint, a wire (W) is disposed at the upper portion of the beam steel assembly 2 in order to induce prestress.

[77] As shown in FIGS. 8 and 9, an anchoring plate 27 at which the wire(W) is anchored by an anchoring device 28 may be connected to the upper portion of the second main shape steel member 21a at the upper portion of the beam steel assembly 2.

[78] When the second auxiliary shape steel member 23 of the upper portion and the first auxiliary shape steel member 15a of the upper portion are prepared, the anchoring plate 27 is connected to the upper portion of the second auxiliary shape steel member 23, and the wire (W) passes through the first auxiliary shape steel member 15a of the upper portion.

[79] Moreover, when the joint plate 26a is prepared, an upper portion of the central part of the joint plate 26a is cut

partially so that there is no interference when the wire (W) is arranged.

[80] In the meantime, the beam steel assembly 2 is favorable for bending the wire (W) since the inside of the beam
5 steel assembly 2 is empty.

[81] Bent bars 29 are respectively connected to the inside of the neighboring second main shape steel members 21a of the upper portion and the inside of the neighboring second main shape steel member 21b of the lower portion, and the wire (W) is bent
10 and arranged at the portion where the bent bars 29 are located.

[82] The wire (W) is located above the continuity part of the beam-girder joint, wherein the wire (W) is bent downwardly at the position of the bent bar 29 located at the upper portion and is bent again at the position of the bent bar 29 located at the
15 lower portion so as to be located below the central portion of the beam.

[83] The beam-girder joint of the prefabricated steel assembly according to the present invention can induce moment values of the connected end portion of the beam and the central
20 portion to be similar to each other through rigid connection of the beam and the girder, thereby reducing dancing of the beam to reduce a steel ratio and effectively supporting negative moment at the connected portion of the beam.

What is claimed is:

1. A beam-girder joint of a prefabricated steel assembly comprising:

a girder steel assembly adapted to form a girder; and

a beam steel assembly adapted to form a beam, which is joined to one side of the girder in an orthogonal direction,

wherein the girder steel assembly includes first main shape steel members arranged at edges of a member in a longitudinal direction and first connection shape steel members joined to one side of the first main shape steel members in order to connect the neighboring first main shape steel members with each other,

wherein the beam steel assembly includes second main shape steel members arranged at edges of a member in a longitudinal direction and second connection shape steel members joined to one side of the second main shape steel members in order to connect the neighboring second main shape steel members with each other, and

wherein the first main shape steel members of the girder steel assembly are cut such that the second main shape steel members of the beam steel assembly pass through, and

wherein first connection plates getting in contact with the outer surfaces of the second main shape steel members are disposed at cut end portions of the first main shape steel

members, and connection rebars passing through the second main shape steel members connect and support the first connection plates facing each other.

2. The beam-girder joint according to claim 1, further comprising: a first auxiliary shape steel member of the upper portion connected to the upper portion of the first main shape steel member; a second auxiliary shape steel member of the upper portion connected to the upper portion of the second main shape steel member, wherein the second auxiliary shape steel member of the upper portion is cut so that the first auxiliary shape steel member of the upper portion can pass through; second connection plates disposed at the cut end portions of the second auxiliary shape steel member to get in contact with the outer surface of the first auxiliary shape steel member of the upper portion; and connection rebars passing through the first auxiliary shape steel member of the upper portion to connect and support the second connection plates facing each other.

3. The beam-girder joint according to claim 1, wherein joint plates, which are inclined outwardly and downwardly, are respectively connected to an end portion of the second main shape steel member of the upper portion and an end portion of the second main shape steel member of the lower portion.