

Description

Title of the Invention: COLUMN-BEAM JOINT STRUCTURE USING HYBRID MOUNTING BRACKET

Technical Field

[001] The present invention relates to a column-beam joint structure using a hybrid mounting bracket having a U-shaped cross-section and provided at one side of a column, in which an end of a beam, to both ends of which bearing supporting devices protruding downward are joined, is placed inside the hybrid mounting bracket, and concrete is poured in this state, thereby enabling easy joining of a factory-manufactured beam to the column, shortening the construction period, and achieving excellent structural performance of a joint part.

Background Art

[002] A conventional reinforced concrete structure (RC structure) is constructed by installing a form at a construction site, placing reinforcing bars inside the form, and then pouring and curing concrete. In this instance, a large amount of on-site labor is required for formwork and reinforcement work. In addition, processes for concrete curing and form dismantling are required, resulting in a long construction period and making it difficult to ensure uniform quality.

[003] Furthermore, to support the form, external temporary members such as joists, yokes, and floor posts must be installed, adding extra steps for installation and removal of the temporary members. Thus, the temporary members hinder worker movement.

[004] In particular, for large-scale structures with large members, form installation and reinforcement work are performed at high elevations, causing safety risks. Additionally, the installation scale of temporary members increases, resulting in significantly higher construction costs.

[005] To solve the problems of the conventional RC construction method, a concrete-filled tube (CFT) column in which concrete is filled inside a steel tube or a prefabricated column (PSRC column) with an integrated permanent form attached to a prefabricated column frame have been developed (Korean Patent No. 10-1490748).

[006] The PSRC column is configured by fixing a lightweight permanent form to a horizontal support member and an L-shaped steel member with high stiffness. The PSRC column has several advantages in that on-site rebar placement and form installation/removal processes can be omitted or significantly reduced and the construction period can be reduced since the lightweight permanent form is pre-attached at the factory and installed integrally. Additionally, the PSRC column has further advantages in that the lateral performance is excellent since the steel members are placed on the external portion of the column, and in that the need for temporary members can be minimized since the column can stand independently during installation. In addition, the PSRC column has still further advantages in that the lifting burden is low due to the lightweight members and in that there is no need to do fireproofing treatment since the steel members are embedded inside the concrete.

[007] Meanwhile, to replace the conventional RC beam connected to the column during the construction of a structure, various types of beams, such as a PC beam made of precast concrete, a TSC beam in which concrete is filled inside a U-shaped steel plate, and a PSRC beam in which steel members are placed on the outer part of the beam, can be used.

[008] When such beams are connected to columns, bolted joints are mainly used.

[009] A bolted joint transfers stress via friction-type

joint between joined plate surfaces.

[010] In this case, to minimize the loss of the base material cross-section caused by bolt hole drilling, the minimum spacing between bolts must be maintained.

[011] Moreover, the friction-type joint requires surface treatment such as sandblasting so that the friction coefficient of joint surfaces must be at least 0.5. It is also essential to prevent contamination from oil, moisture, dust, paint, etc.

[012] Furthermore, for the friction-type joint, splice plates must be attached to both sides of the members. In the case of an H-shaped steel beam, a total of eight splice plates (three for each upper and lower flange, and two for a web) are required, resulting in a large amount of steel and complicated fabrication.

[013] Additionally, the bolted joint requires many fastening points, which increases the working time and requires a crane until the joint work is completed, making it difficult to operate lifting equipment efficiently. Furthermore, the bolted joint work is performed at high elevations, raising concerns about worker safety.

[014] In addition, to join a beam to a column, a bracket is provided at one side of the column. However, when the shapes of the column and the beam differ, end details of the bracket and the beam must be changed according to the type of beams, degrading manufacturability and complicating details of a joint part.

Disclosure

Technical Problem

[015] Accordingly, the present invention has been made in view of the above-mentioned problems occurring in the related art, and it is an objective of the present invention to provide a column-beam joint structure using a hybrid mounting bracket

which enables easy joint construction when joining a factory-manufactured beam to a column on site, can shorten the construction period, and has excellent structural performance of a joint part.

Technical Solution

[016] According to a preferred embodiment of the present invention, there is provided a column-beam joint structure using a hybrid mounting bracket for installing a beam between a pair of columns arranged to be spaced apart from each other, including: a hybrid mounting bracket which is placed at one side of the column and has a U-shaped cross-section with an open top and in which an end of the beam is placed; and bearing supporting devices which are provided at both ends of the beam such that lower portions thereof protrude downward beyond the bottom of the beam, wherein concrete is poured inside the hybrid mounting bracket so that the beam is joined to the hybrid mounting bracket.

[017] In a preferred embodiment, the hybrid mounting bracket comprises: four horizontal main steel members spaced apart vertically and horizontally and having one end joined to one side of the column; vertical connection bars connecting the horizontal main steel members located at upper and lower portions thereof; horizontal connection bars connecting the horizontal main steel members located right and left at the lower portion thereof; and a lightweight permanent form joined to the outer sides of the vertical connection bars and to the lower side of the horizontal connection bars.

[018] In another preferred embodiment, a seating bar on which the beam is placed is provided between the pair of lower horizontal main steel members, and the bearing supporting device of the beam is arranged inside the seating bar such that the bearing supporting device is spaced apart from the seating bar.

[019] In another preferred embodiment, a horizontal

anchoring member, one end of which is joined to the column, is provided in an inner upper portion of the hybrid mounting bracket in the longitudinal direction, a first joint plate is coupled to the outer end of the horizontal anchoring member, and a second joint plate is provided on the upper side of the end of the beam at a position corresponding to the first joint plate, such that the first joint plate and the second joint plate are joined together by fastening bolts.

[020] In another preferred embodiment, the first joint plate and the second joint plate are provided to be spaced apart from each other, and a compression bolt, having one end supported by the opposite joint plate, is joined through either the first joint plate or the second joint plate.

[021] In another preferred embodiment, guide plates, each inclined downward and inward to guide the lower end of the beam, are provided on both lower sides inside the hybrid mounting bracket.

[022] In another preferred embodiment, a fixed end form, formed in a U-shape including a bottom plate and side plates protruding from both upper sides of the bottom plate, is provided at the front end of the hybrid mounting bracket and configured to have inner surfaces of the side plates spaced apart from the side surfaces of the beam, and a variable end form is provided on the front surfaces of the side plates of the fixed end form to be slidably coupled in the left-right direction.

[023] In another preferred embodiment, the hybrid mounting bracket is formed such that the width thereof increases toward the column when viewed in plan.

Advantageous Effect

[024] According to the present invention, the column-beam joint structure using a hybrid mounting bracket can achieve the following effects.

[025] First, the column-beam joint structure using a hybrid mounting bracket which is provided at one side of the column enables easy joint construction of the factory-manufactured beam to a column on site by pouring concrete in the state in which the end of the beam is placed inside the hybrid mounting bracket having the U-shaped cross-section with the open top.

[026] Second, the column-beam joint structure using a hybrid mounting bracket includes the bearing supporting devices, which protrude downward from both ends of the beam and are embedded and engaged in the concrete poured inside the hybrid mounting bracket, thereby stably supporting the shear force and lower compressive force of the beam. Furthermore, the column-beam joint structure using a hybrid mounting bracket can bear the tensile force due to the bearing pressure generated between the bearing supporting device and the concrete in front of the bearing supporting device, thereby achieving excellent structural performance of a joint part.

[027] Third, during the column-beam joint construction, a joining process such as bolting can be omitted or minimized, and the column-beam joint structure can be applied regardless of the type of beams. Since the end of the beam is placed inside the hybrid mounting bracket, the column-beam joint structure can be installed without additional temporary members. In addition, since the joint part is not exposed to the outside, on-site fireproofing work can be omitted. Accordingly, the column-beam joint structure can shorten the construction period.

Description of Drawings

[028] FIG. 1 is a perspective view illustrating a state in which a hybrid mounting bracket is joined to a column.

[029] FIG. 2 is a perspective view illustrating a state in which a beam is joined to the hybrid mounting bracket.

[030] FIG. 3 is a perspective view illustrating the beam

provided with a bearing supporting device.

[031] FIG. 4 is a perspective view illustrating the joining relationship between the bearing supporting device and the beam.

[032] FIG. 5 is a side cross-sectional view illustrating a joining process of the hybrid mounting bracket and the beam.

[033] FIG. 6 is a side cross-sectional view illustrating a joined state of the hybrid mounting bracket and the beam.

[034] FIG. 7 is a side cross-sectional view illustrating a state in which concrete is poured inside the hybrid mounting bracket.

[035] FIG. 8 is a perspective view illustrating a hybrid mounting bracket including horizontal main steel members and connection bars.

[036] FIG. 9 is a side cross-sectional view illustrating a state in which the beam is placed on a seating bar.

[037] FIG. 10 is a side cross-sectional view showing a state in which a horizontal anchoring member is joined.

[038] FIG. 11 is a perspective view illustrating a state in which first and second joint plates are joined by a fastening bolt.

[039] FIG. 12 is a plan view showing a state in which first and second joint plates are coupled by fastening bolts.

[040] FIG. 13 is a perspective view illustrating a guide plate.

[041] FIG. 14 is a cross-sectional view showing a state in which a beam is installed between guide plates.

[042] FIG. 15 is a perspective view showing the joining relationship of end forms.

[043] FIG. 16 is a perspective view showing a joined state of the end forms.

[044] FIG. 17 is a plan view illustrating an embodiment in which a hybrid mounting bracket having a trapezoidal shape is

provided.

[045] FIG. 18 is a plan view illustrating a state in which beams are coupled to all four sides of a column by means of the hybrid mounting bracket.

Best Mode

[046] To accomplish the above-mentioned objective, a column-beam joint structure using a hybrid mounting bracket, which is for installing a beam between a pair of columns arranged to be spaced apart from each other, including: a hybrid mounting bracket which is placed at one side of the column and has a U-shaped cross-section with an open top and in which an end of the beam is placed; and bearing supporting devices which are provided at both ends of the beam such that lower portions thereof protrude downward beyond the bottom of the beam, wherein concrete is poured inside the hybrid mounting bracket so that the beam is joined to the hybrid mounting bracket.

Mode for Invention

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

[048]

[049] FIG. 1 is a perspective view illustrating a state in which a hybrid mounting bracket is joined to a column, FIG. 2 is a perspective view illustrating a state in which a beam is joined to the hybrid mounting bracket, FIG. 3 is a perspective view illustrating the beam provided with a bearing supporting device, FIG. 4 is a perspective view illustrating the joining relationship between the bearing supporting device and the beam, FIG. 5 is a side cross-sectional view illustrating a joining process of the hybrid mounting bracket and the beam, FIG. 6 is a side cross-sectional view illustrating a joined state of the hybrid mounting bracket and the beam, and FIG. 7 is a side cross-

sectional view illustrating a state in which concrete is poured inside the hybrid mounting bracket.

[050] As illustrated in FIGS. 1 to 7, the column-beam joint structure using a hybrid mounting bracket according to the present invention, which is for installing a beam 2 between a pair of columns 1 arranged to be spaced apart from each other, includes: a hybrid mounting bracket 3 which is placed at one side of the column 1 and has a U-shaped cross-section with an open top and in which an end of the beam 2 is placed; and bearing supporting devices 21 which are provided at both ends of the beam 2 such that lower portions thereof protrude downward beyond the bottom of the beam 2, wherein concrete 4 is poured inside the hybrid mounting bracket 3 so that the beam 2 is joined to the hybrid mounting bracket 3.

[051] The present invention is intended to provide a column-beam joint structure using a hybrid mounting bracket, which enables easy joining of the factory-manufactured beam 2 onto the column 1 on-site, shortens the construction period, and provides excellent structural performance of a joint part.

[052] The present invention is intended for joining the prefabricated beam 2 to one side of the previously installed column 1.

[053] The column 1 may be a PSRC column or a CFT column. Additionally, the beam 2 may be a PC beam, a TSC beam, a steel beam, or a PSRC beam.

[054] The hybrid mounting bracket 3 is provided at one side of the column 1.

[055] The hybrid mounting bracket 3 has a U-shaped cross-section with an open top, and the end of the beam 2 is inserted from above and placed therein.

[056] The hybrid mounting bracket 3 may be formed by bending or welding a steel plate.

[057] Concrete 4 is poured inside the hybrid mounting bracket 3, thereby fixing and joining the end of the beam 2 to the interior of the hybrid mounting bracket 3.

[058] In other words, the beam 2 is installed to overlap with the hybrid mounting bracket 3 over a predetermined length, and concrete 4 is filled into the overlapped portion to integrate both elements (see FIG. 7).

[059] Accordingly, by simply pouring concrete 4 inside the hybrid mounting bracket 3, the beam 2 can be joined, making it possible to omit or minimize a joining process such as bolting. Moreover, since the end of the beam 2 is inserted into the hybrid mounting bracket 3 and integrated by pouring concrete 4, the joint structure can be applied regardless of the type of the beam 2.

[060] Additionally, since the end of the beam 2 is received and placed inside the hybrid mounting bracket 3, installation is possible without the use of temporary supports. In addition, after the beam 2 is placed, a rigging device connected to lifting equipment can be detached immediately, significantly reducing the usage time of the lifting equipment.

[061] An upper anchoring rebar extending toward the column 1 may be arranged at the top of the beam 2 to resist the negative moment at the end.

[062] The shear force of the beam 2 is directly transmitted at a portion placed in the hybrid mounting bracket 3, making shear bolts unnecessary. The compressive force at the bottom of the beam 2 is borne by the concrete 4 poured inside the hybrid mounting bracket 3.

[063] However, when load reversal occurs due to seismic loads or the like, tensile force may act on the bottom of the beam 2. In such a case, while upper anchoring rebars can be embedded into the slab at the top of the beam (2), it is

difficult to arrange lower anchoring rebars to resist the tensile force at the bottom of the beam (2).

[064] Therefore, bearing supporting devices 21 are installed at both ends of the beam 2.

[065] Each bearing supporting device 21 protrudes a predetermined length downward beyond the bottom of the beam 2 (see FIGS. 3 and 5), and is embedded and interlocked in the concrete 4 poured inside the hybrid mounting bracket 3 (see FIG. 7).

[066] Accordingly, when tensile force acts on the bottom of the beam 2, the tensile force can be borne by the bearing pressure between the bearing supporting device 21 and the concrete 4 located in front of the bearing supporting device 21 even without a lower tensile rebar.

[067] The bearing supporting device 21 may include a pressure plate 211 and a rib reinforcement plate 212 (see FIGS. 3 and 4).

[068] An upper portion of the pressure plate 211 is fixed to the end of the beam 2.

[069] A lower portion of the pressure plate 211 protrudes below the bottom of the beam 2 and comes into contact with the concrete 4 at the bottom of the beam 2 to generate bearing pressure.

[070] The pressure plate 211 may be fixed to the end of the beam 2 by welding or bolting.

[071] When the beam 2 is a PC beam, a lower rebar 20 arranged inside the beam 2 may protrude to the end of the beam 2 and pass through the pressure plate 211. Thereafter, a nut 213 is fastened to a threaded outer circumferential surface at the end of the lower rebar 20 to fix the bearing supporting device 21 to the end of the beam 2. A washer plate 214 may be provided between the pressure plate 211 and the nut 213 to distribute stress

around the nut 213.

[072] When bearing pressure acts on the pressure plate 211, bending moment may also act on the pressure plate 211, thereby causing flexural deformation. If the bearing pressure is supported solely by the bearing plate 211, the bearing plate 211 may need to be excessively thick.

[073] Therefore, the rib reinforcement plate 212 may be joined to one side of the pressure plate 211 to reinforce the flexural stiffness of the pressure plate 211.

[074] The rib reinforcement plates 212 may be arranged in multiple rows in the vertical direction. In some cases, additional rib reinforcement plates 212 may be arranged in the horizontal direction.

[075] As illustrated in FIG. 3, the pressure plate 211 may be formed using a C-shaped steel section, but is not limited thereto. The pressure plate 211 may be formed in various cross-sectional shapes.

[076] In conventional methods, fireproof coating is applied to a beam at the factory excluding a joint part, and then, the joint part is treated later on the spot.

[077] In the present invention, the joint of the beam 2 is formed inside the hybrid mounting bracket 3, such that the joint part is not exposed to the outside and is embedded within the structure. Accordingly, the fireproof coating of the beam 2 can be completed 100% in advance at the factory, and on-site fireproofing work can be omitted.

[078]

[079] FIG. 8 is a perspective view illustrating the hybrid mounting bracket including horizontal main steel members and connection bars.

[080] As illustrated in FIGS. 1 and 8, the hybrid mounting bracket 3 may include: four horizontal main steel members 31

spaced apart vertically and horizontally and having one end joined to one side of the column 1; vertical connection bars 32a connecting the horizontal main steel members 31 located at upper and lower portions thereof; horizontal connection bars 32b connecting the horizontal main steel members 31 located right and left at the lower portion thereof; and a lightweight permanent form 33 joined to the outer sides of the vertical connection bars 32a and to the lower side of the horizontal connection bars 32b.

[081] The hybrid mounting bracket 3 may include the horizontal main steel members 31, the vertical connection bars 32a, and the horizontal connection bars 32b in order to reduce the weight of the components and transfer the load of the beam 2 to the column 1 by supporting the load of the beam 2.

[082] The four horizontal main steel members 31 are arranged to be spaced apart in vertical and horizontal directions.

[083] Each horizontal main steel member 31 may be formed using an L-shaped steel section and may be disposed at each corner of the hybrid mounting bracket 3.

[084] When the column 1 is a PSRC column having vertical steel members 11 at corners thereof, the horizontal main steel members 31 may penetrate the column 1 in the horizontal direction and be provided to protrude to the outside of the side surface of the column 1 (see FIG. 1).

[085] The horizontal main steel members 31 spaced apart from each other may be interconnected by the horizontal connection bars 32b and the vertical connection bars 32a.

[086] The vertical connection bars 32a connect a pair of horizontal main steel members 31 neighboring vertically.

[087] The horizontal connection bars 32b are located beneath the horizontal main steel members to connect a pair of lower horizontal main steel members 31 placed right and left.

[088] The vertical connection bars 32a and the horizontal connection bars 32b may be arranged on the outer side of the horizontal main steel members 31.

[089] The vertical connection bars 32a and the horizontal connection bars 32b may each be formed in an L-shaped cross-section, such that the outer surface of one leg is bolted to the outer surface of the horizontal main steel member 31.

[090] The lightweight permanent form 33 may be joined to the exterior of the vertical connection bars 32a and the horizontal connection bars 32b.

[091] In other words, the lightweight permanent form 33 may be coupled to the outer surfaces of the upper and lower horizontal main steel members 31 and to the bottom surfaces of the lower left and right horizontal main steel members 31, thereby forming an overall U-shape with an open top.

[092] An L-shaped or T-shaped locking projection portion may be formed on the rear surface of the lightweight permanent form 33. The vertical connection bar 32a and the horizontal connection bar 32b may be provided with locking grooves in which the locking projection portion is inserted and engaged, so as to be mutually coupled.

[093] The vertical connection bars 32a and the horizontal connection bars 32b interconnect the horizontal main steel members 31 to maintain the structural form and to fix the lightweight permanent form 33 in place, and separate the lightweight permanent form 33 from the horizontal main steel members 31 to secure concrete covering.

[094] Braces 34 may be provided on both side surfaces of the hybrid mounting bracket 3 to connect the upper and lower horizontal main steel members 31.

[095] Ends of each brace 34 may be joined at points where the vertical connection bars 32a and the horizontal main steel

members 31 are joined, thereby forming a truss structure.

[096] Through the vertical connection bars 32a and the braces 34 that connect the upper and lower horizontal main steel members 31, the load of the beam 2 may be distributed to the upper and lower horizontal main steel members 31.

[097]

[098] FIG. 9 is a side cross-sectional view illustrating a state in which the beam is placed on a seating bar.

[099] As illustrated in FIG. 9, a seating bar 35 may be provided between the pair of lower horizontal main steel members 31, and the beam 2 is placed on the seating bar 35. The bearing supporting device 21 of the beam 2 may be arranged inside the seating bar 35 such that the bearing supporting device 21 is spaced apart from the seating bar 35.

[0100] After concrete 4 is filled inside the hybrid mounting bracket 3 and integrated with the end of the beam 2, such that the concrete bears the load. However, until concrete is poured, the horizontal main steel members 31 must be capable of supporting the load of the beam 2 by their own bending stiffness.

[0101] In this case, the beam 2 may be placed on the upper side of the horizontal connection bar 32b, so that the load of the beam 2 is transferred to the lower horizontal main steel members 31 via the horizontal connection bar 32b. However, the horizontal connection bars 32b connect the horizontal main steel members 31 and are embedded in the concrete 4 inside the hybrid mounting bracket 3 to function as a stirrup, acting as a tension member. Therefore, the horizontal connection bar 32b does not need to have a large cross-sectional area and may lack sufficient bending and shear strength, making it difficult to support the load of the beam 2 and to transfer the load to both lower horizontal main steel members 31.

[0102] Accordingly, in order to support the beam 2 that is

placed inside the hybrid mounting bracket 3, the seating bar 35 may be fixedly installed to span across the pair of lower horizontal main steel members 31.

[0103] At this time, the bearing supporting device 21 provided at the end of the beam 2 is positioned toward the inside of the seating bar 35, i.e., closer to the column 1, such that concrete 4 is filled between the bearing supporting device 21 and the seating bar 35.

[0104] Therefore, when tensile force is generated at the bottom of the end of the beam 2, the tensile force can be resisted by the compressive force of the concrete 4 between the bearing supporting device 21 and the seating bar 35.

[0105] The seating bar 35 may be formed of a C-shaped steel member, an H-shaped steel member, or an H-shaped cross-section formed by closely assembling a pair of C-shaped steel members side by side.

[0106] A support pad may be provided on the top surface of the seating bar 35 to prevent damage or slippage of members when the beam 2 is placed on top.

[0107] When the load of the beam 2 is not large or the cross-section of the horizontal connection bar 32b is sufficient, the horizontal connection bar 32b may be used as the seating bar.

[0108]

[0109] FIG. 10 is a side cross-sectional view showing a state in which a horizontal anchoring member is joined, FIG. 11 is a perspective view illustrating a state in which first and second joint plates are joined by a fastening bolt, and FIG. 12 is a plan view showing a state in which first and second joint plates are coupled by fastening bolts.

[0110] As illustrated in FIGS. 10 to 12, a horizontal anchoring member 36, one end of which is joined to the column 1, is provided in an inner upper portion of the hybrid mounting

bracket 3 in a longitudinal direction, a first joint plate 37 is coupled to the outer end of the horizontal anchoring member 36, and a second joint plate 22 is provided on the upper side of the end of the beam 2 at a position corresponding to the first joint plate 37, such that the first joint plate 37 and the second joint plate 22 can be joined together by fastening bolts 5.

[0111] When the column 1 has a closed cross-section, such as a CFT column, it is difficult to anchor an upper reinforcement for resisting negative moment at a column-beam joint part to the column 1.

[0112] Therefore, the horizontal anchoring member 36 is preassembled to the inner upper portion of the hybrid mounting bracket 3, and the end of the beam 2 can be joined and connected to the horizontal anchoring member 36.

[0113] The horizontal anchoring member 36 has one end fixed or anchored to the column 1.

[0114] If the column 1 is a CFT column, one end of the horizontal anchoring member 36 may be fixed to one side surface of the column 1 by welding or the like.

[0115] If the column 1 is a PSRC column, the horizontal anchoring member 36 may penetrate the inside of the PSRC column and be anchored therein.

[0116] To join the upper end of the beam 2 to the horizontal anchoring member 36, the first joint plate 37 may be provided at the outer end of the horizontal anchoring member 36, and a second joint plate 22 may be provided on the upper end of the beam 2 at a corresponding position.

[0117] Accordingly, after the beam 2 is installed, a plurality of fastening bolts 5 can be fastened to the first joint plate 37 and the second joint plate 22 so that the plates are joined to each other.

[0118] The first joint plate 37 and the second joint plate 22 may each be formed with a plurality of through-holes through which the fastening bolts 5 pass.

[0119] The horizontal anchoring member 36 may be made of a steel frame such as an L-shaped steel, rebar, or a steel plate as illustrated in FIG. 17, which will be described later.

[0120]

[0121] As illustrated in FIGS. 11 and 12, the first joint plate 37 and the second joint plate 22 are provided to be spaced apart from each other, and a compression bolt 6 having one end supported by the opposite joint plate is joined through either the first joint plate 37 or the second joint plate 22.

[0122] In the present invention, the beam 2 is lifted in the state in which the pair of columns 1 spaced apart from each other and hybrid mounting brackets 3 have been installed. Then, the end of the beam 2 is inserted through the open upper space of the hybrid mounting bracket 3.

[0123] In this instance, if there is no gap between the first joint plate 37 and the second joint plate 22, it is difficult to lower and install the beam 2 between the opposing first joint plates 37. Therefore, a gap should be formed between the first joint plate 37 and the second joint plate 22 by shortening the length of the horizontal anchoring member 36.

[0124] However, in this case, when the fastening bolts 5 are tightened to join the first joint plate 37 and the second joint plate 22, the horizontal anchoring member 36 is pulled due to the gap, which causes deformation of the column 1.

[0125] Accordingly, the compression bolt 6 may be provided so that the first joint plate 37 and the second joint plate 22 can remain spaced apart for installation of the beam 2 while still allowing the fastening bolts 5 to be sufficiently tightened.

[0126] As illustrated in the drawings, the compression bolt 6 may pass through the second joint plate 22 and have one end supported on the rear surface of the first joint plate 37 (see FIG. 12). Alternatively, the compression bolt 6 may pass through the first joint plate 37 and have one end supported on the front surface of the second joint plate 22.

[0127] When the fastening bolts 5 are tightened, the first joint plate 37 and the second joint plate 22 can be joined without deformation due to the support provided by the compression bolt 6.

[0128] At this time, the fastening bolts 5 are tension bolts that transfer loads through tensile force. Unlike friction bolts, which require the use of an impact wrench, the tension bolts (fastening bolts 5) can be easily tightened by a worker using a hand tool such as a general wrench, thereby offering excellent workability.

[0129] In particular, unlike standard bolts, which have large heads requiring large bolt spacing and consequently wide joint plates, KS bolts with hexagonal recesses formed in the heads can be used as the fastening bolts 5, thereby minimizing both the bolt spacing and the width of the joint plates.

[0130] The compression bolts 6 can be provided on the second joint plates 22 of both ends of the beam 2.

[0131] However, for construction convenience, the compression bolt 6 may be provided only on one side of the beam 2. In this case, on the other side of the beam 2, the second joint plate 22 and the first joint plate 37 come into contact with each other and the fastening bolts 5 are fastened. On the side where the compression bolt 6 is provided, the second joint plate 22 and the first joint plate 37 are spaced apart from each other to absorb the gap.

[0132]

[0133] FIG. 13 is a perspective view illustrating a guide plate, and FIG. 14 is a cross-sectional view illustrating a state in which the beam is installed between the guide plates.

[0134] As illustrated in FIGS. 8, 13, and 14, a guide plate 38 that is inclined inward and downward may be provided on each of the lower inner sides of the hybrid mounting bracket 3 so as to guide the lower end of the beam 2.

[0135] In the present invention, after the end of the beam 2 is inserted into the hybrid mounting bracket 3 having a U-shaped cross-section, concrete 4 is poured into the hybrid mounting bracket 3, so that the end of the beam 2 is embedded in the concrete 4, thereby joining the beam 2.

[0136] Accordingly, the outer surface of the beam 2 and the inner surface of the hybrid mounting bracket 3 must be spaced apart at a predetermined interval.

[0137] In such a case, due to the gap on both sides of the beam 2, it may be difficult for the beam 2 to be precisely positioned at the center inside the hybrid mounting bracket 3 when the beam 2 is inserted.

[0138] Therefore, the guide plates 38 may be provided on both lower inner sides of the hybrid mounting bracket 3 to accurately guide the beam 2 toward the center of the hybrid mounting bracket 3.

[0139] The guide plates 38 may be formed with inclined surfaces sloping inward and downward, such that the spacing between the two guide plates 38 is wider at the top and narrower at the bottom.

[0140] Accordingly, after the bottom of the beam 2 enters between the two guide plates 38, when the beam 2 further descends, the beam 2 is guided by the inclined surfaces of the guide plates 38 and accurately positioned at the center of the hybrid mounting bracket 3.

[0141] When the hybrid mounting bracket 3 includes the horizontal main steel members 31, the guide plates 38 may be provided on the inner sides of the lower horizontal main steel members 31.

[0142] A stopper 381 may be protrudingly formed behind the guide plates 38 to prevent the beam 2 from being inserted beyond a predetermined length into the hybrid mounting bracket 3.

[0143]

[0144] FIG. 15 is a perspective view showing the joining relationship of end forms, and FIG. 16 is a perspective view showing a joined state of the end forms.

[0145] As illustrated in FIGS. 15 and 16, a fixed end form 39a is provided at the front end of the hybrid mounting bracket 3, and is formed in a U-shape including a bottom plate 391 and side plates 392 protruding from both upper sides of the bottom plate 391, wherein inner surfaces of the side plates 392 are spaced apart from the side surfaces of the beam 2. A variable end form 39b may be provided on the front surfaces of the side plates 392 of the fixed end form 39a to be slidably coupled in the left-right direction.

[0146] The front side of the hybrid mounting bracket 3 is open to allow the insertion of the beam 2.

[0147] Accordingly, when concrete 4 is poured into the hybrid mounting bracket 3, a separate form must be installed in front of the space between the beam 2 and the hybrid mounting bracket 3.

[0148] Accordingly, it is preferable to preassemble the end form at the front open portion of the hybrid mounting bracket 3 to minimize on-site work.

[0149] However, in this case, since the end form must be in close contact with the side surfaces of the beam 2, it may be difficult to insert the beam 2 if the form is preassembled.

[0150] Therefore, the end form may be divided into the U-shaped fixed end form 39a that is fixedly coupled to the front end of the hybrid mounting bracket 3, and the variable end form 39b that is coupled to the front surface of the fixed end form 39a.

[0151] The fixed end form 39a may include the bottom plate 391 that closes the lower open portion of the beam 2, and a pair of side plates 392 that protrude from both upper sides of the bottom plate 391 to close the open side portions of the beam 2.

[0152] The bottom plate 391 and the side plates 392 may be integrally formed or separately constructed.

[0153] The bottom plate 391 may be configured to be in close contact with the bottom of the beam 2, and the side plates 392 may be spaced apart wider than the width of the beam 2 to allow insertion of the beam 2. That is, the inner surfaces of the side plates 392 may be provided to be spaced from the side surfaces of the beam 2 at a predetermined distance.

[0154] Since the side plates 392 are spaced from the beam 2 and the side surfaces of the beam 2 are partially opened, the variable end form 39b can be coupled thereto.

[0155] The variable end form 39b may be joined to the side plates 392 to be laterally movable. To this end, the variable end form 39b may be provided with elongated holes 393 extending in the left-right direction, and fixing bolts 394 may be fastened through the elongated holes 393.

[0156] When the beam 2 is inserted into the hybrid mounting bracket 3, the variable end form 39b may be moved outward to increase the gap between both variable end forms 39b. After the beam 2 is inserted, the variable end form 39b may be moved inward to be in close contact with the side surfaces of the beam 2, and the fixing bolts 394 may be tightened to fix the variable end form 39b to the fixed end form 39a.

[0157] To prevent leakage of paste between the inner ends of the variable end form 39b and the beam 2, the inner end of the variable end form 39b may be bent into an L-shape to be in close contact with the side surface of the beam 2.

[0158] A support angle 39c may be provided on the front surface of the bottom plate 391 of the fixed end form 39a to be in close contact with the bottom surface of the beam 2 and prevent leakage of paste.

[0159]

[0160] FIG. 17 is a plan view illustrating an embodiment in which a hybrid mounting bracket having a trapezoidal shape is provided, and FIG. 18 is a plan view illustrating a state in which beams are coupled to all four sides of a column by means of the hybrid mounting bracket.

[0161] As illustrated in FIGS. 17 and 18, the hybrid mounting bracket 3 may be formed such that the width of the hybrid mounting bracket increases toward the column 1 when viewed in plan.

[0162] When the gap between the beam 2 and the lightweight permanent form 33 of the hybrid mounting bracket 3 is narrow, it becomes difficult to pour concrete 4 into the interior of the lightweight permanent form 33. To secure a space for concrete placement, if the width of the hybrid mounting bracket 3 is increased, the outward protrusion width of the beam 2 becomes larger, reducing usability.

[0163] Accordingly, to facilitate concrete placement between the beam 2 and the lightweight permanent form 33 and minimize the laterally protruding portion of the beam 2, the hybrid mounting bracket 3 may be formed in a trapezoidal shape when viewed in plan.

[0164] That is, the hybrid mounting bracket 3 may be formed to be wider on the side facing the column 1 to secure space for

concrete placement, and to be narrower on the side facing the beam 2, thereby minimizing the difference from the width of the beam 2.

[0165] As illustrated in FIG. 18, when trapezoidally shaped hybrid mounting brackets 3 are installed on all four sides of the column 1 to form an approximately octagonal shape, the entire surface of the column-beam joint may be enclosed by the hybrid mounting brackets 3, eliminating the need to install a column form at a column joint part.

Industrial Applicability

[0166] The column-beam joint structure using the hybrid mounting bracket according to the present invention allows the omission or minimization of joint processes such as bolting during column-beam joining, enables installation without separate temporary supports since the end of the beam is placed inside the hybrid mounting bracket, and does not need on-site fireproofing work as the joint part is not exposed to the outside. Therefore, the column-beam joint structure using the hybrid mounting bracket is industrially applicable.

Claims

【Claim 1】

A column-beam joint structure using a hybrid mounting bracket for installing a beam (2) between a pair of columns (1) arranged to be spaced apart from each other, comprising:

a hybrid mounting bracket (3) which is placed at one side of the column (1) and has a U-shaped cross-section with an open top and in which an end of the beam (2) is placed; and

bearing supporting devices (21) which are provided at both ends of the beam (2) such that lower portions thereof protrude downward beyond the bottom of the beam (2),

wherein concrete (4) is poured inside the hybrid mounting bracket (3) so that the beam (2) is joined to the hybrid mounting bracket (3).

【Claim 2】

The column-beam joint structure according to claim 1, wherein the hybrid mounting bracket (3) comprises: four horizontal main steel members (31) spaced apart vertically and horizontally and having one end joined to one side of the column (1); vertical connection bars (32a) connecting the horizontal main steel members (31) located at upper and lower portions thereof; horizontal connection bars (32b) connecting the horizontal main steel members (31) located right and left at the lower portion thereof; and a lightweight permanent form (33) joined to the outer sides of the vertical connection bars (32a) and to the lower side of the horizontal connection bars (32b).

【Claim 3】

The column-beam joint structure according to claim 2, wherein a seating bar (35) on which the beam (2) is placed is

provided between the pair of lower horizontal main steel members (31), and the bearing supporting device (21) of the beam (2) is arranged inside the seating bar (35) such that the bearing supporting device (21) is spaced apart from the seating bar (35).

【Claim 4】

The column-beam joint structure according to claim 1, wherein a horizontal anchoring member (36), one end of which is joined to the column (1), is provided in an inner upper portion of the hybrid mounting bracket (3) in the longitudinal direction, a first joint plate (37) is coupled to the outer end of the horizontal anchoring member (36), and a second joint plate (22) is provided on the upper side of the end of the beam (2) at a position corresponding to the first joint plate (37), such that the first joint plate (37) and the second joint plate (22) are joined together by fastening bolts (5).

【Claim 5】

The column-beam joint structure according to claim 4, wherein the first joint plate (37) and the second joint plate (22) are provided to be spaced apart from each other, and a compression bolt (6), having one end supported by the opposite joint plate, is joined through either the first joint plate (37) or the second joint plate (22).

【Claim 6】

The column-beam joint structure according to claim 1, wherein guide plates (38), each inclined downward and inward to guide the lower end of the beam (2), are provided on both lower sides inside the hybrid mounting bracket (3).

【Claim 7】

The column-beam joint structure according to claim 1, wherein a fixed end form (39a), formed in a U-shape including a bottom plate (391) and side plates (392) protruding from both

upper sides of the bottom plate (391), is provided at the front end of the hybrid mounting bracket (3) and configured to have inner surfaces of the side plates (392) spaced apart from the side surfaces of the beam (2), and a variable end form (39b) is provided on the front surfaces of the side plates (392) of the fixed end form (39a) to be slidably coupled in the left-right direction.

【Claim 8】

The column-beam joint structure according to claim 1, wherein the hybrid mounting bracket (3) is formed such that the width thereof increases toward the column (1) when viewed in plan.