

**L-SECTION STEEL SYNTHETIC STRUT FOR EARTH RETAINING
STRUCTURE**

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] The present application claims priority under 35 U.S.C. 119 and 35 U.S.C. 365 to Korean Patent Application No. 10-2016-0034800(filed on March 23, 2016), which is hereby incorporated by reference in its entirety.

BACKGROUND

[0002] The present invention relates to a strut used when an earth retaining wall is constructed, and more particularly, to an L-section steel synthetic strut for an earth retaining structure, in which a square connection flange is bonded to both ends of each of four L-section steels of the strut disposed on an edge of a waling of an earth retaining wall, a connection bolt passes through and is coupled to each of four corners of the connection flange to increase a geometrical moment of inertia and improve buckling and torsional

resistance, a protruding portion of the connection flange is removed to quickly and easily perform a work for moving the strut, and a fixing bracket that is adjustable in angle is installed at each of edges having various angles to reduce the number of bolts and nuts, thereby to secure structural stability and reduce construction period and costs and storage and logistical costs.

[0003] Generally, in case of excavation construction by a foundation work such as a building base or a bridge pier, which have a construction reference surface under the ground, an earth retaining work for preventing the surrounding ground of the excavation from being collapsed.

[0004] The earth retaining work is performed to form an earth retaining wall that directly contacts earth and a structure supporting the earth in an excavated space.

[0005] The structure may be called a timbering or an earth retaining timbering including the earth retaining wall.

[0006] The earth retaining wall may be formed by using various construction methods according to structures,

materials, and construction methods of a sheet pile and a slurry wall.

[0007] An H-section steel is mainly used as the structure supporting the earth in the excavated space, which includes a waling, an angle brace, and a post pile.

[0008] Among these, an H-pile soil cement wall method is one of methods that are widely used because the construction is simple, the cost of construction is inexpensive, and construction materials are reusable.

[0009] The H-pile soil cement wall method is a method in which H piles are driven or punched to be inserted at a predetermined interval around a construction reference surface to install a plurality of soldier piles, and a soil retaining plate is inserted between the soldier piles while performing the excavation to backfill earth.

[0010] Here, each of the soldier pile undergoes an earth pressure. Thus, to prevent the soldier pile from collapsing by the earth pressure, a waling is coupled and installed to the inside of the soldier pile, and a strut is connected

between the walings facing each other to reinforce the soldier pipe.

[0011] The method using the strut belongs to a method in which safety supervision is easy because stress and deformation are easily confirmed through the strut. Also, since the method using the strut is relatively easy in construction and largely undeterred by the underground conditions, the method is most widely used. An H-section steel is used as the strut. In case of the H-section steel, the H-section steel has a strong shaft and a weak shaft on characteristics in section. As a result, the H-section steel is unfavorable with respect to buckling in both lateral directions, and thus, a bracing such as a bracing has to be designed together with the H-section steel. If the bracing is installed, a danger in which a worker directly installs the bracing in a state in which the worker goes up on the strut may occur, and also, a risk in which the bracing is suddenly destroyed in both shaft directions may occur.

[0012] In comparison, since a steel pipe strut has a

structural section that is advantageous in bulking and torsion because of no division of the strong shaft and the weak shaft and is advantageous in construction cost, construction period, constructability (the installation/deconstruction of the strut, the underground excavation, and the construction of the main structure), and the like are relatively advantageous than the H-section steel because a vertical bracing is unnecessary, the method using the strut is widely used in foreign countries.

[0013] However, the steel pipe strut has to be increase in diameter to improve hardness in section, and a strut connection part has to be developed.

[0014] Korean Patent Registration No. 10-0581610 (Registration Date: 2006.05.12.), titled "Coupling Structure of Supporting Beam" (hereinafter, referred to as 'Prior Art 1') and Korean Utility Model Registration No. 20-0399886 (Registration Date: 2005.10.24.), titled "Connecting Structure of Strut" (hereinafter, referred to 'Prior Art 2') are disclosed as Prior Arts that provide a backdrop for the

present invention.

[0015] Prior Art 2 is to provide a connecting structure of a strut, in which a unit for adjusting a length between a jack and a strut or between the jack and a waling is provided to adjust a length while the jack is coupled to the strut or the waling, and thus, the connection structure is simplified, and the jack is coupled to the strut or the waling for a short time to easily install the jack for connecting.

[0016] In the prior arts, the strut is manufactured in an H-section steel or a circular steel pipe. In case of the H-section steel, the H-section steel has to be constructed in consideration of an installation position according to a strong shaft and a weak shaft, and an additional installation of a bracing is needed. Also, in case of the circular steel pipe, a joint part protrudes, and the circular steel pipe has to increase in diameter so as to improve bulking and torsional resistance.

[0017] Korean Patent Registration No. 10-1354857 (Registration Date: 2014.01.24.), titled "Strut having Angle

Pipe Section Symmetrical with Neural Axis" (hereinafter, referred to 'Prior Art 3') is disclosed as Prior Art for solving the foregoing limitations.

[0018] However, in Prior Art 3, since a rectangular steel pipe is bonded to four corners of each of flanges, if each of the flanges has a square shape, a connection bolt is not coupled because the connection bolt is disposed inside the rectangular steel pipe even though the connection bolt passes through the flanges.

[0019] Thus, in Prior Art 3, an extension part extends from the four corners of the connection flange to allow the connection bolt to pass through the extension part and to couple a connection nut to a protruding end of the connection bolt, thereby improving the bulking and torsional resistance of the strut and also connecting the struts to each other, the strut to a fixing bracket, or the strut to a screw jack.

[0020] In an earth retaining construction site, the strut moves to the installation position by using small-scaled equipment such as a backhoe (called an "excavator"). In

Prior Art 3, the extension part formed on each of the four corners of the connection flange interferes in this process to cause a limitation in which the movement of the strut is restricted. When the strut is loaded, a loading volume increases due to the extension part. Also, when the strut is stored and carried, an occupying space increases to cause a limitation in which the storage and logistical costs increase.

[0021] Also, when the strut is connected between the walings facing parallel to each other to form a right angle therebetween, it is enough to install only a fixed type fixing bracket connected between the strut and the waling and between the waling and the screw jack.

[0022] The strut is installed between the walings that are perpendicular to each other at the corner of the earth retaining wall. In this case, since the waling and the screw jack are connected to each other at an angle of about 45 degrees, it is impossible to connect the strut to the waling and the waling to the screw jack by using only the fixed type fixing bracket. Thus, an angle-adjustable fixing bracket

that is adjustable in angle in addition to the fixed type fixing bracket has to be additionally installed.

[0023] Thus, since the fixed type fixing bracket and the angle-adjustable fixing bracket have to be doubly installed, the number of connection parts connected by using bolts/nuts may increase by the added angle-adjustable fixing bracket in addition to the fixed type fixing bracket, the screw jack, and the strut as members connecting both walings to each other, and structural instability may occur. In addition, an overall installation process may be cumbersome, and construction costs may increase.

[PRIOR ART DOCUMENTS]

[PATENT DOCUMENTS]

Korean Patent Registration No. 10-0581610 (Registration Date: 2006.05.12.), titled "Coupling Structure of Supporting Beam"

Korean Utility Model Registration No. 20-0399886 (Registration Date: 2005.10.24.), titled "Connecting Structure of Strut"

Korean Paten Registration No. 10-1354857 (Registration Date: 2014.01.24.), titled "Strut having Angle Pipe Section Symmetrical with Neural Axis"

SUMMARY

[0024] An object of the present invention is to provide an L-section steel synthetic strut for an earth retaining structure, in which four L-section steels are disposed so that an edge thereof at which a vertical part and a horizontal part meet each other is disposed at each of vertexes of a square, a connection flange formed in a square shape having vertexes corresponding to the edge of each of the four L-section steels is bonded to both ends of each of the four L-section steels, and a connection bolt passes through each of four corners of the connection flange to couple a connection nut to the connection bolt to increase a geometrical moment of inertia, thereby improving buckling and torsional resistance.

[0025] Another object of the present invention is to

provide an L-section steel synthetic strut for an earth retaining structure, in which a protruding portion is removed from a connection flange of a strut to quickly and easily move the strut by using small-scaled equipment such as a backhoe.

[0026] Another object of the present invention is to provide an L-section steel synthetic strut for an earth retaining structure, in which a fixing bracket is applicable when a strut is connected perpendicular to a waling and when the strut and the waling are connected to each other at various angles so that the strut or a screw jack is connected to the waling in various situations.

[0027] Another object of the present invention is to provide an L-section steel synthetic strut for an earth retaining structure, in which one fixing bracket is adjustable in angle without doubly connecting a fixed type fixing bracket and an angle-adjustable fixing bracket to reduce the number of connection parts connected by using bolts/nuts, thereby securing structural stability and

reducing construction period and costs.

[0028] Another object of the present invention is to provide an L-section steel synthetic strut for an earth retaining structure, in which a protruding portion such as an extension part is removed from a strut to reduce a loading volume when the strut is loaded, and when the strut is stored and carried, an occupying space is reduced to reduce storage and logistical costs.

[0029] In an embodiment, an L-section steel synthetic strut for an earth retaining structure includes: a strut having both ends connected between walings 20 coupled to a soldier pile through a fixing bracket, wherein the strut includes four L-section steels disposed symmetrical to each other in up/down and left/right directions so that a vertical part and a horizontal part are integrated with each other in an L shape, and an edge at which the vertical part and the horizontal part meet each other is disposed at each of vertexes of a square and a square connection flange having a vertex corresponding to the edge of each of the four L-

section steels bonded to both ends of each of the L-section steels; and four corner bolt through holes defined in the connection flange to correspond to positions between the vertical part and the horizontal part of the L-section steel and the edge and four edge bolt through holes defined in an edge of the connection flange to correspond to positions between the four bolt through holes.

[0030] The strut may further include a stiffener bonded to the four L-section steels to reinforce strength, and the stiffener may include a stiffener body provided as a square plate having an edge contacting inner surfaces of the vertical part and the horizontal part of the L-section steel and a reinforcing bent part bent at a right angle on the edge of the stiffener body.

[0031] The fixing bracket may include: a strut-side flange corresponding to the connection flange; a waling-side flange disposed to be spaced apart from the strut-side flange in a longitudinal direction of the strut; a pair of first vertical rotation pieces including a first rotation piece body having

a bottom side bonded to the strut-side flange and an oblique side angled at an angle of about 45 degrees on each of both left and right sides of the bottom side and a first circular plate integrated with the first rotation piece body and provided as a circular plate using a point meeting a virtual extension line of the oblique side as a center; a pair of second vertical rotation pieces disposed on a plane located under the first rotation pieces by a thickness of the first rotation piece, the pair of second vertical rotation pieces including a second rotation piece body having a bottom side bonded to a waling-side flange and an oblique side angled at an angle of about 45 degrees on each of both left and right sides of the bottom side and a second circular plate integrated with the second rotation piece body and provided as a circular plate using a point meeting a virtual extension line of the oblique side as a center; a pair of third vertical rotation pieces disposed on the same plane as the second rotation pieces, the pair of third vertical rotation pieces including a third rotation piece body having a bottom

side bonded to the strut-side flange, an oblique side angled at an angle of about 45 degrees on each of both sides of the bottom side, and a top side parallel to the bottom side and a first semicircular guide groove disposed on a front end of the third rotation piece body to surround the second circular plate; a pair of fourth vertical rotation pieces disposed on the same plane as the first rotation pieces, the pair of fourth vertical rotation pieces including a fourth rotation piece body having a bottom side bonded to the strut-side flange, an oblique side angled at an angle of about 45 degrees on each of both sides of the bottom side, and a top side parallel to the bottom side and a second semicircular guide groove disposed on a front end of the fourth rotation piece body to surround the first circular plate; a connection shaft inserted into shaft holes defined in centers of the first circular plate and the second circular plate; and a fixing bolt passing through fixing bolt through holes defined in the first circular plate and the second circular plate at both left and right sides with respect to the shaft holes and

a fixing nut coupled to a protruding end of the fixing bolt.

[0032] The strut-side flange may have the same size as the connection flange of the strut, and a corner bolt through hole and an edge bolt through hole, which respectively correspond to a corner bolt through hole and an edge bolt through hole of the connection flange of the strut, are provided in the strut-side flange.

[0033] The first and third rotation pieces may respectively have the bottom sides bonded to the strut-side flange and are bonded to each other and integrated with the strut-side flange, and the second and fourth rotation pieces may respectively have the bottom sides bonded to the waling-side flange and are bonded to each other and integrated with the waling-side flange.

[0034] The fixing bracket may further include stopping pins on which the top sides of the fourth and third rotation pieces are hung when both walings are coupled to the third and fourth rotation pieces to meet each other at an acute angle that is less than 90 degrees, a meeting angle between

the waling and the strut are above about 45 degrees, and an angle between the strut-side flange and the waling-side flange is below about 45 degrees.

[0035] The details of one or more embodiments are set forth in the accompanying drawings and the description below. Other features will be apparent from the description and drawings, and from the claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0036] FIGS. 1 to 10 are views of an L-section steel synthetic strut for an earth retaining structure according to a first embodiment of the present invention.

[0037] FIG. 1 is a perspective view of a timbering constructed according to the present invention.

[0038] FIG. 2 is a perspective view illustrating a state in which a strut, a waling, a fixing bracket, and a screw jack are separated.

[0039] FIG. 3 is an exploded perspective view of the strut, the fixing bracket, and the screw jack.

[0040] FIG. 4 is an exploded perspective of the strut.

[0041] FIG. 5 is a longitudinal sectional front view of the strut.

[0042] FIG. 6 is an exploded perspective view of the fixing bracket.

[0043] FIG. 7 is an exploded perspective of the screw jack.

[0044] FIG. 8 is a side view illustrating processes of installing the screw jack, adjusting a length of the screw jack, and applying a preload to the screw jack.

[0045] FIG. 9 is a plan view illustrating a state in which the strut is installed between walings that are parallel to each other.

[0046] FIG. 10 is a plan view illustrating a state in which the strut is installed between the walings that are perpendicular to each other.

[0047] FIGS. 11 and 12 are views of an L-section steel synthetic strut for an earth retaining structure according to a second embodiment of the present invention.

[0048] FIG. 11 is an exploded perspective view of a fixing

bracket.

[0049] FIG. 12 is a plan view when both walings meet each other at an acute angle.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0050] Hereinafter, an L-section steel synthetic strut for an earth retaining structure according to embodiments of the present invention will be described in detail with reference to the accompanying drawings.

[0051] While the present invention has been described in detail in connection with certain exemplary embodiments described in the accompanying drawings, the embodiments are intended to be illustrative for helping understanding of the present invention, and thus the present invention is not limited thereto.

[0052] FIGS. 1 to 10 are views of an L-section steel synthetic strut for an earth retaining structure according to a first embodiment of the present invention.

[0053] FIG. 1 is a perspective view of a timbering

constructed according to the present invention. A timbering according to the current embodiment includes a soldier pile 10, a waling 20 horizontally bonded to the soldier pile 10, a strut 100 connected to the waling 20 to support the soldier pile 10 and the waling 20, a fixing bracket 200 connected between the waling 20 and the strut 100, and a screw jack 300 connected between the strut 100 and the fixing bracket 200.

[0054] An H-section steel constituted by each of webs 11 and 21 and a pair of flanges 12 and 22 that are symmetrically disposed on both sides of each of the webs 11 and 21 is used as the soldier pile 10 and the waling 20, like a general timbering.

[0055] Although a method in which a sheet pile 30 is bonded to the outside of the soldier pile 10 is exemplified in the current embodiment, the current embodiment may be applicable to a method in which several soil retaining plates are inserted between the web 11 and the flange 12.

[0056] In FIG. 1, non-explained reference symbol Ba represents a bolt for coupling the waling 20 to the soldier

pile 10, non-explained reference symbol Na represents a nut for coupling the waling 20 to the soldier pile 10, and non-explained reference numeral 23 represents a stiffener for reinforcing the waling 20. A plurality of bolt through holes 24 for coupling the fixing bracket 200 are defined in the inner flange 22 of the waling 20.

[0057] The sheet pile 30 is omitted in the drawings except for FIG. 1.

[0058] The strut 100 includes four L-section steels 110 disposed symmetrical to each other in up/down and left/right directions so that a vertical part 111 and a horizontal part 112 are integrated with each other in an L shape, and an edge 113 at which the vertical part 111 and the horizontal part 112 meet each other is disposed at each of vertexes and a square connection flange 120 having a vertex corresponding to the edge 113 of each of the four L-section steels 110 bonded to both ends of each of the L-section steels 110.

[0059] A plurality of bolt through holes are defined in the connection flange 120. The bolt through holes include

four corner bolt through holes 121 defined in positions corresponding to positions between the vertical part 111 and the horizontal part 112 of the L-section steel 110 and the edge 113 and four edge bolt through holes 122 defined between the four corner bolt through holes 121.

[0060] The strut 100 may further include a stiffener 130 bonded to the four L-section steels 110 to reinforce strength.

[0061] The stiffener 130 includes a stiffener body 131 provided as a square plate having an edge contacting inner surfaces of the vertical part 111 and the horizontal part 112 and a reinforcing bent part 132 bent at a right angle on the edge of the stiffener body 131.

[0062] A cutoff part 133 is disposed on each of four corners of the stiffener 130 to bent the reinforcing bent part 132. That is, an iron plate may be cut in a “+” shape having a square part corresponding to the stiffener body 131 and an extension part, which extends from an edge of the square part to correspond to the reinforcing bent part 132, to bend the extension part so that the stiffener body 131,

the reinforcing bent part 132, and the cutoff part 133 are provided, thereby manufacturing the stiffener 130.

[0063] As illustrated in FIG. 6, the fixing bracket 200 includes a strut-side flange 210 corresponding to the connection flange 120; a waling-side flange 220 disposed to be spaced apart from the strut-side flange 210 in a longitudinal direction of the strut 100; a pair of first vertical rotation pieces 230 including a first rotation piece body 231 having a bottom side 232 bonded to the strut-side flange 210 and an oblique side 233 angled at an angle of about 45 degrees on each of both left and right sides of the bottom side 232 and a first circular plate 234 integrated with the first rotation piece body 231 and provided as a circular plate using a point meeting a virtual extension line of the oblique side 233 as a center; a pair of second vertical rotation pieces 240 disposed on a plane located under the first rotation pieces 230 by a thickness of the first rotation piece 230, the pair of second vertical rotation pieces 240 including a second rotation piece body

241 having a bottom side 242 bonded to a waling-side flange 220 and an oblique side 243 angled at an angle of about 45 degrees on each of both left and right sides of the bottom side 242 and a second circular plate 244 integrated with the second rotation piece body 241 and provided as a circular plate using a point meeting a virtual extension line of the oblique side 243 as a center; a pair of third vertical rotation pieces 250 disposed on the same plane as the second rotation pieces 240, the pair of third vertical rotation pieces 250 including a third rotation piece body 251 having a bottom side 252 bonded to the strut-side flange 210, an oblique side 253 angled at an angle of about 45 degrees on each of both sides of the bottom side 252, and a top side 254 parallel to the bottom side 252 and a first semicircular guide groove 255 disposed on a front end of the third rotation piece body 251 to surround the second circular plate 244; a pair of fourth vertical rotation pieces 260 disposed on the same plane as the first rotation pieces 230, the pair of fourth vertical rotation pieces 260 including a fourth

rotation piece body 261 having a bottom side 262 bonded to the strut-side flange 220, an oblique side 263 angled at an angle of about 45 degrees on each of both sides of the bottom side 262, and a top side 264 parallel to the bottom side 262 and a second semicircular guide groove 265 disposed on a front end of the fourth rotation piece body 261 to surround the first circular plate 234; a connection shaft 270 inserted into shaft holes 235 and 245 defined in centers of the first circular plate 234 and the second circular plate 244; and a fixing bolt 281 passing through fixing bolt through holes 236 and 246 defined in the first circular plate 234 and the second circular plate 244 at both left and right sides with respect to the shaft holes 235 and 245 and a fixing nut 282 coupled to a protruding end of the fixing bolt 281.

[0064] The strut-side flange 210 is bonded to the connection flange 120 of the strut 100 and has the same size as the connection flange 120. Also, the strut-side flange 210 has four corner bolt through holes 211 corresponding to the bolt through holes 121 and the edge bolt through holes

122 of the connection flange 120 of the strut 100 and four edge bolt through holes 212 defined between the four corner bolt through holes 211.

[0065] The strut-side flange 210 and the third rotation piece body 251 may be reinforced by a reinforcing rib 213.

[0066] The waling-side flange 220 is bonded to one side flange 22 of the waling 20 and has a plurality of bolt through holes 221 defined in upper and lower sides thereof.

[0067] The first and third rotation pieces 230 and 250 have the bottom sides 232 and 252 bonded to the strut-side flange 210, respectively. In addition, the first and third rotation pieces 230 and 250 are bonded to each other and integrated with the strut-side flange 210.

[0068] The second and fourth rotation pieces 240 and 260 have the bottom sides 242 and 262 bonded to the waling-side flange 220, respectively. In addition, the second and fourth rotation pieces 240 and 260 are bonded to each other and integrated with the waling-side flange 220.

[0069] Although the first and third rotation pieces 230

and 250 and the second and fourth rotation pieces 240 and 260 are respectively provided one by one on centers of sections of the strut-side flange 210 and the waling-side flange 220, as illustrated in the drawings, the first and third rotation pieces 230 and 250 and the second and fourth rotation pieces 240 and 260 may be disposed vertically symmetrical to each other with respect to the centers of the sections of the strut-side flange 210 and the waling-side flange 220.

[0070] The first and fourth rotation pieces 230 and 260 may be relatively rotatably supported by the first circular plate 234 and the second semicircular guide groove 265, respectively, and the second and third rotation pieces 240 and 250 may be relatively rotatably supported by the second circular plate 244 and the first semicircular guide groove 255, respectively. Furthermore, since the first to fourth rotation pieces 230, 240, 250, and 260 are relatively rotatably connected to each other by the connection shaft 270 inserted into the shaft holes 235 and 245 defined in the centers of the first and second circular plates 234 and 244,

angles between the first to fourth rotation pieces 230, 240, 250, and 260 and the strut-side flange 210 and the waling-side flange 220 may be adjusted according to an angle between both walings 20 to be supported by the strut 100.

[0071] Thus, when both walings 20 to be supported by the strut 100 are disposed parallel to each other, when both walings 20 are perpendicular to each other, and when both walings 20 are angled at an angle of about 90 degree or less, the strut 100 and the walings 20 may be adequately connected to each other by using the fixing bracket 200.

[0072] As illustrated in FIG. 7, the screw jack 300 includes a pressure plate 320 corresponding to the strut-side flange 310 corresponding to the connection flange 120 of the strut 100 and the strut-side flange 210 of the fixing bracket 200, a support plate 330 disposed between the strut-side flange 310 and the pressure plate 320 and having a plurality of screw through holes 331, a plurality of support steel pipes 340 connected between the strut-side flange 310 and the support plate 330 and coaxially disposed with respect to the

screw through holes 331, a screw 350 having one end fixed to the pressure plate 320 and the other end inserted into the support steel pipes 340 through the screw through holes 331, and a locking nut 360 screw-coupled to the screw 350 and fastened to the support plate 330.

[0073] The strut-side flange 310 and the pressure plate 230 may have the same size and shape as the connection flange 120 and the strut-side flange 210.

[0074] A corner bolt through hole 311 and an edge bolt through hole 312 corresponding to the corner bolt through hole 121 and the edge bolt through hole 122 of the connection flange 120 are defined in the strut-side flange 310, and a corner bolt through hole 321 and an edge bolt through hole 322 corresponding the corner bolt through hole 211 and the edge bolt through hole 212 of the strut-side flange 210 are defined in the pressure plate 320.

[0075] The support steel pipes 340 are welded to be coupled to the strut-side flange 310 and the support plate 330. Also, each of the support steel pipes 340 is reinforced

by the reinforcing rib 341 welded between an outer circumferential surfaces of the support steel pipe 340 and the strut-side flange 310.

[0076] Here, the support steel pipe 340 connecting the strut-side flange 310 to the support plate 330 may be provided as a steel pipe having an inner diameter greater than an outer diameter of the screw 350 to satisfy structural strength. Thus, when the screw 350 is inserted into the support steel pipe 340, the screw 350 may be in a very loose state due to a difference between the outer diameter of the screw 350 and the inner diameter of the support steel pipe 340, and thus, the screw 350 may movable.

[0077] To prevent this phenomenon from occurring, a screw guide sleeve 370 having an inner diameter greater by a tolerance as much as a slide fit than the outer diameter of the screw 350 is inserted into a support plate-side end of the support pipe 340. The screw guide sleeve 370 has one end coupled to the support plate 330 through welding.

[0078] The screw 350 may have the other end that is welded

to the pressure plate 320. However, to improve coupling strength, a fixing sleeve 380 may be welded to the pressure plate 320, and the other end of the screw 350 may be inserted into the fixing sleeve 380 to weld the screw 350 to the fixing sleeve 380.

[0079] Also, a hydraulic jack 390 may be inserted between the pressure plate 320 and the support plate 330 to apply a preload. After the preload is applied, the hydraulic jack 390 may be separated after the locking nut 360 screw-coupled to the screw 350 is fastened.

[0080] Hereinafter, a process of installing the L-section steel synthetic strut for the earth retaining structure according to the current embodiment of the present invention will be described.

[0081] The strut 100 may be manufactured with a length of about 0.5 m to about 10 m according to the site conditions, and then one or two or more struts 100 may be used as occasion demands.

[0082] The connection of two or more struts 100 may be

performed by allowing a bolt B to pass through the corner bolt through hole 121 and the edge bolt through hole 122, which are formed in the connection flange 120, in a state in which the connection flanges 120 of both struts 100 face each other to couple a nut N to a protruding end of the bolt B.

[0083] The waling-side flanges 220 of both fixing brackets 200 are coupled to both walings 20 to be supported by the strut 100, the strut-side flange 210 of one side fixing bracket 200 and one side connection flange 120 of the strut 100 are coupled to each other, the other side connection flange 120 of the strut 100 and the strut-side flange 310 of the screw jack 300 are coupled to each other, and the strut-side flange 210 of the other side fixing bracket 200 and the pressure plate 320 of the screw jack 300 are coupled to each other.

[0084] The coupling between both walings 20 and the waling-side flanges 220 of both fixing brackets 200 may be performed by allowing a bolt B1 to pass through the bolt through hole 221 formed in the waling-side flange 220 and the

bolt through hole 24 formed in the waling 20 to couple a nut N1 to a protruding end of the bolt B1.

[0085] The coupling between the strut-side flange 210 of the one side fixing bracket 200 and the one side connection flange 120 of the strut 100 may be performed by allowing a bolt B2 to pass through the corner bolt through holes 121 and 211 and the edge bolt through holes 122 and 212, which are formed in the strut-side flange 210 and the one side connection flange 120 of the strut 100, to couple a nut N2 to a protruding end of the bolt B2.

[0086] The coupling between the other side connection flange 120 of the strut 100 and the strut-side flange 310 of the screw jack 300 may be performed by allowing a bolt B3 to pass through the corner bolt through hole 121 and 311 and the edge bolt through holes 122 and 312, which are formed in the connection flange 120 and the strut-side flange 310, to couple a nut N3 to a protruding end of the bolt B3.

[0087] The coupling between the strut-side flange 210 of the other side fixing bracket 200 and the pressure plate 320

of the screw jack 300 may be performed by allowing a bolt B4 to pass through the corner bolt through holes 211 and 321 and the edge bolt through holes 212 and 322, which are formed in the strut-side flange 210 and the pressure plate 320, to couple a nut N4 to a protruding end of the bolt B4.

[0088] Here, as illustrated in FIG. 5, since the struts 100 are disposed horizontally and vertically symmetrical to each other with respect to a vertical axis Z and a horizontal axis X along which the L-section steel 110 passes through a center 0 of a section of the connection flange 120, center distances L between the center 0 of the section of the connection flange 120 and moduli of sections of L-section steels 110 may be the same. Thus, when compared to the strut according to Prior Art 3, a geometrical moment of inertia and a modulus of section may increase, and bulking and torsional resistance may increase.

[0089] This will be described in comparison with Prior Art 3.

[0090] FIG. 5 is a view comparing the strut 100 according

to the present invention to the strut according to Prior Art 3.

[0091] When the struts according to the present invention and Prior Art 3 have the same section area of about $450\text{ mm} \times 450\text{ mm}$, the L-section steel 110 according to the present invention has a volume of about $130\text{ mm} \times 130\text{ mm} \times 13\text{ mm}(t)$, and the square steel pipe R according to Prior Art 3 has a volume of about $125\text{ mm} \times 125\text{ mm} \times 6\text{ mm}(t)$, a center distance ($L = 187.7\text{ mm}$) between the center O of the section of the connection flange 120 and a modulus O' of the section of the L-section steel 110 according to the present invention is greater than that ($L1 = 162.5\text{ mm}$) between a center $O1$ of the section of the connection flange P and a modulus $O1'$ of the section of the square steel pipe according to Prior Art 3, and a geometrical moment of inertia ($I = 42,709.0\text{ cm}^4$) and a modulus ($Z = 1,898.0\text{ cm}^2$) according to the present invention increase by about 1.33 times than a geometrical moment of inertia ($I1 = 31,887.0\text{ cm}^4$) and a modulus ($Z1 = 1,417.0\text{ cm}^2$) to improve the bulking and torsional resistance.

[0092] Also, since the stiffener 130 for reinforcing the L-section steel 110 of the strut 100 is not provided as a simple plate shape, but provided in a shape in which the reinforcing bent part 132 is provided on each of four sides, the bulking and torsional resistance of the strut 100 may be further improved.

[0093] Also, when the strut 100 is connected, sufficient bulking and torsional resistance may be secured without adding a bracing.

[0094] Also, since the L-section steel 110 is used to the strut 100, the bolt/nut coupling for the connection may be realized while a position of the corner bolt through hole 121 formed in the connection flange 120 approaches the modulus $0'$ of the section of the L-section steel 110.

[0095] That is, the bolt B and the nut N for connecting the connection flanges 120 of the two struts 100 to each other, the bolt B2 and the nut N2 for coupling the connection flange 120 of the strut 100 to the strut-side flange 210, and the bolt B3 and the nut N3 for coupling the connection flange

120 of the strut 100 to the strut-side flange 310 are coupled to each other.

[0096] Thus, the coupling between the bolts B2 and B3 and the nuts N2 and N3 for coupling the connection flange 120 of the strut 100 to the strut-side flange 210 of the fixing bracket 200 and coupling the connection flange 120 of the strut 100 to the strut-side flange 310 of the screw jack 300 may be realized at a position that is most approximate to the modulus $0'$ of the section of the L-section steel 110.

[0097] Also, since the edge bolt through holes 122, 212, and 312 of the connection flange 120 of the strut 100, the strut-side flange 210 of the fixing bracket 200, the strut-side flange 310 of the screw jack 300 are respectively formed in the same line in directions that is perpendicular and parallel to the corner bolt through holes 121, 211, and 311, the bulking and torsional resistance may be maximally maintained. Thus, when several struts 100 are connected to each other, drooping of the struts may be minimized.

[0098] In the results of the experiment, according to the

present invention, a horizontal distance between the struts may increase to about 5 mm than the horizontal distance of about 1 mm to about 2 m according to the related art. Thus, the number of struts and post piles, which are required for the timbering, may be reduced, a work space may be secured, the construction period may be reduced, and the construction costs may be reduced.

[0099] Here, although it is preferred that the corner bolt through holes 121, 211, and 311, which are formed in the connection flange 120 of the strut 100, the strut-side flange 210 of the fixing bracket 200, and the strut-side flange 310 of the screw jack 300, are defined in positions corresponding to the modulus θ' of the section of the L-section steel 110, an embodiment of the present invention shows an example in which the corner bolt through holes 121, 211, and 311 are formed in positions that move inward from the modulus θ' of the section so as to couple the bolts B2 and B3 to the nuts N2 and N3.

[00100] In Prior Art 3, since the square steel pipe R is

used, it is impossible to couple the bolt to the nut when the corner bolt through holes are formed in positions that correspond or approximate to the modulus θ' of the section of the square steel pipe R. As a result, the corner bolt through holes are omitted, and the edge bolt through holes H are formed in two rows. Thus, the coupling force between the strut, the fixing bracket, and the screw jack may be reduced to reduce the bulking and torsional resistance, and thus, a degree of the drooping may increase. For this, since a separate bracing has to be added, and the distance between the struts has to be maintained to about 1 m to about 2 m, the number of post piles may increase, the construction period may be delayed, and the construction costs may increase.

[00101] Also, since the L-section steel 110 is used in the present invention, the bolt coupling may be realized at a position that is approximate to the modulus θ' of the section of the L-section steel 110 without forming an extension part on the connection flange 120. In addition, since a

protrusion such as the extension part is not provided to the connection flange 120, when the strut 100 moves to an installation position by using small-scaled equipment such as a backhoe in the site, a portion that may cause interference may not exist, and thus, the movement of the strut may be quickly and simply performed.

[00102] Also, since the protrusion such as the extension part does not exist on the strut 100 according to the present invention, when the loading volume is reduced when the strut 100 is loaded, and when the strut is stored and carried, the occupying space may be reduced to reduce the storage and logistical costs.

[00103] Hereinafter, processes of adjusting a length of the screw jack and applying a preload to the screw jack will be described.

[00104] First, as illustrated in FIG. 8A, the locking nut 360 is rotated in a release direction thereof to move from the support plate 330 to the pressure plate 320, and the screw 350 becomes a state that is movable within the support

steel pipe 340 through the screw through hole 331 of the support plate 330.

[00105] As illustrated in FIG. 8B, the strut-side flange 310 is disposed to face the connection flange 120 of the strut 100, and the bolt B3 passes through the corner bolt through holes 121 and 311 and the edge bolt through holes 122 and 312 to couple the nut N3 to the protruding end of the bolt B3, thereby coupling the strut-side flange 310 to the connection flange 120 of the strut 100. Furthermore, the pressure plate 310 is disposed to face the strut-side flange 210, and the bolt B4 passes through the corner bolt through holes 321 and 121 and the edge bolt through holes 322 and 122 to couple the nut N4 to the protruding end of the bolt B4, thereby coupling the pressure plate 320 to the strut-side flange 210 of the fixing bracket 200.

[00106] As illustrated in FIG. 8C, the hydraulic jack 390 is inserted between the pressure plate 320 and the support plate 330 and then operates to adjust the length of the screw jack and apply the preload to the screw jack.

[00107] While adjusting the length and applying the preload by using the hydraulic jack 390, the screw 350 moves within the support steel pipe 340 and is inserted into the support steel pipe 340 and fixed to the support plate 330. Since the screw guide sleeve 370 having the inner diameter greater by the tolerance as much as the slide fit than the outer diameter of the screw 350 guides the screw 350, the screw may smoothly move without being shaken.

[00108] As illustrated in FIG. 8D, while the preload is applied by the hydraulic jack 390, the locking nut 360 screw-coupled to the screw 350 is rotated in a fastening direction to fasten the locking nut 360 to the support plate 330.

[00109] In this state, since the screw 350 has one end fixed to the pressure plate 320, and the locking nut 360 coupled to the other end of the screw 350 is hung on the support plate 330, this state may be maintained even though the hydraulic jack 390 is separated.

[00110] Next, as illustrated in FIG. 8E, when the hydraulic jack 390 is contracted and then separated from the pressure

plate 320 and the support plate 330, the screw jack 300 may be fixed between the strut 100 and the fixing bracket 200 in the state in which the length is adjusted, and the preload is applied.

[00111] Hereinafter, an installed state depending on positions of both walings 20 to be supported will be described.

[00112] As illustrated in FIG. 9, in case in which both walings 20 to be supported by the strut 100 are disposed parallel to each other, as described above, when the waling-side flange 220 of the fixing bracket 200 is coupled to both walings 20 by using the bolt B1 and the nut N1, the strut-side flange 210 of one side fixing bracket 200 and one connection flange 120 of the strut 100 are coupled to each other by using the bolt B2 and the nut N2 to couple the other side connection flange 120 of the strut 100 to the strut-side flange 310 of the screw jack 300 by using the bolt B3 and the nut B4, and the pressure plate 320 of the screw jack 300 is coupled to the strut-side flange 210 of the other fixing

bracket 200 by using the bolt B4 and the nut N4, the first to third rotation pieces 230 and 250 and the second and fourth rotation pieces 240 and 260, which are relatively rotatably connected to each other by the first and second circular plates 234 and 244 and the first and second semicircular guide grooves 255 and 265 and the shaft holes 235 and 245 and the connection shaft 270, are naturally rotated to allow the bottom sides 232, 242, 252, and 262 of the first to fourth rotation pieces 230, 240, 250, and 260, the strut-side flange 210, and the waling-side flange 220 to be naturally maintained to the state parallel to both walings 20.

[00113] In this state, the fixing bolt 281 passes through the bolt through holes 236 and 246 formed in the circular plates 234 and 244 of the first and second rotation pieces 230 and 240, and the fixing nut 282 is coupled to the protruding end of the fixing bolt 281. Thus, the first to fourth rotation pieces 230, 240, 250, and 260, the strut-side flange 210, and the waling-side flange 220 may be fixed without being relatively rotated.

[00114] As illustrated in FIG. 10, when both walings 20 to be supported by the strut 100 are disposed perpendicular to each other, while the first and third rotation pieces 230 and 250 and the second and fourth rotation pieces 240 and 260, which are relatively rotatably connected to each other by the first and second circular plates 234 and 244, the first and second semicircular guide grooves 255 and 265 and the shaft holes 235 and 245 and the connection shaft 270, are naturally rotated, the bottom sides 232 and 252 of the first and third rotation pieces 230 and 250 and the strut-side flange 210 become a state that is parallel to the connection flange 120 of the strut 100, and the bottom sides 242 and 262 of the second and fourth rotation pieces 240 and 260 and the waling-side flange 220 become a state that is parallel to the waling 20.

[00115] Here, one side top side 254 of the third rotation piece 250 and one side oblique side 243 of the second rotation piece 240 are hung with respect to each other, and one side top side 264 of the fourth rotation piece 260 and

one side oblique side 233 of the first rotation piece 230 are hung with respect to each other, and thus, they are not rotated any more.

[00116] As a result, since the oblique sides 233 and 243 of the first and second rotation pieces 230 and 240 are angled at an angle of about 45 degrees with respect to the bottom sides 232 and 243, the strut-side flange 210 and the waling-side flange 220 are disposed at an angle of about 45 degrees with respect to each other, and the strut 100 is maintained at an angle of about 45 degrees with respect to the waling 20.

[00117] Here, the fixing bolt through holes 236 and 246 formed in the first and second circular plates 234 and 244 are dislocated with respect to each other, and thus, it is impossible to fix the first and second circular plates 234 and 244 by using the fixing bolt 281 and the fixing nut 282. However, the one side top side 254 of the third rotation piece 250 and the one side oblique side 242 of the second rotation piece 240 are hung with respect to each other, and the one side top side 264 of the fourth rotation piece 260

and the one side oblique side 233 of the first rotation piece 230 are hung with respect to each other, and also, the first to fourth rotation pieces 230, 240, 250, and 260 are supported by the first and second circular plates 234 and 244 of the first and second rotation pieces 230 and 240, the first and second semicircular guide grooves 255 and 265 of the third and fourth rotation pieces 250 and 260, the shaft holes 234 and 244 formed in the first and second circular plates 234 and 244, and the connection shaft 270 inserted into the shaft holes 235 and 245. Thus, the bottom load may be supported.

[00118] In the foregoing first embodiment, when both walings 20 meet perpendicular to each other, each of an angle between the strut-side flange 210 and the waling-side flange 220 and an angle between the oblique sides 233 and 253 of the first and third rotation pieces 230 and 250 and the oblique sides 243 and 263 of the second and fourth rotation pieces 240 and 260 is about 45 degrees, the top side 254 of the third rotation piece 250 and the oblique side 243 of the

second rotation piece 240 are hung with respect to each other, and the top side 264 of the fourth rotation piece 260 and the oblique side 233 of the first rotation piece 230 are hung with respect to each other. On the other hand, when both walings 20 meet each other at an acute angle that is less than 90 degrees, each of an angle between the strut-side flange 210 and the waling-side flange 220 and an angle between the oblique sides 233 and 253 of the first and third rotation pieces 230 and 250 and the oblique sides 243 and 263 of the second and fourth rotation pieces 240 and 260 is about 45 degrees, the top side 254 of the third rotation piece 250 and the oblique side 243 of the second rotation piece 240 are not hung with respect to each other, and the top side 264 of the fourth rotation piece 260 and the oblique side 233 of the first rotation piece 230 are not hung with respect to each other.

[00119] As described above, when the top side 254 of the third rotation piece 250 and the oblique side 243 of the second rotation piece 240 are not hung with respect to each

other, and the top side 264 of the fourth rotation piece 260 and the oblique side 233 of the first rotation piece 230 are not hung with respect to each other, since the strut-side flange 210 and the first and third rotation pieces 230 and 250 and the waling-side flange 220 and the second and fourth rotation pieces 240 and 260 are not hung with each other, force for supporting the load may be reduced somewhat.

[00120] Also, since the fixing bracket 200 is adjustable in angle, the angle may be adjusted by using only one fixing bracket without doubly connecting the fixed type fixing bracket and the angle-adjustable fixing bracket. Thus, the number of connection parts connected by the bolt/nut may be reduced to secure the structural stability. In addition, the construction period may be reduced, and the construction costs may be reduced.

[00121] FIGS. 11 and 12 are views of an L-section steel synthetic strut for an earth retaining structure according to a second embodiment of the present invention.

[00122] In the current embodiment, when both walings 20

meet each other at an acute angle that is less than 90 degrees, a stopping pin 293 on which a top side 264 of a fourth rotation piece 260 is hung is installed on a third rotation piece 250, and a stopping pin 294 on which a top side 254 of a third rotation piece 250 is hung is installed on a fourth rotation piece 260.

[00123] That is, when both walings 20 meet each other at an acute angle that is less than 90 degrees, an angle at which the waling 20 and the strut 100 meet each other is above about 45 degrees. Thus, an angle between a strut-side flange 210 and a waling-side flange 220 may be below about 45 degrees.

[00124] Thus, one side top side 254 of the third rotation piece 250 and one side oblique side 243 of the second rotation piece 240 are not hung with respect to each other, and one side top side 264 of the fourth rotation piece 260 and one side oblique side 233 of the first rotation piece 230 are not hung with respect to each other.

[00125] In the current embodiment, even when both walings 20 meet each other the acute angle that is less than 90

degrees, the first and third rotation pieces 230 and 250 and the waling-side flange 220 and the second and fourth rotation pieces 240 and 260 are not hung with each other by the stopping pins 293 and 294 to prevent the force for supporting the load from being reduced.

[00126] To respectively install the stopping pins 293 and 294 on the third and fourth rotation pieces 250 and 260, stopping pin holes 291 and 292 may be formed in the third and fourth rotation pieces 250 and 260, and then, the stopping pins 293 and 294 may be inserted into the stopping pin holes 291 and 292 at the site.

[00127] The stopping pin holes 291 and 292 may be previously punched according to the site conditions or punched at the site when the fixing bracket 200 is manufactured in the factory.

[00128] Each of the stopping pin holes 291 and 292 may be previously formed at an angle of about 2 degrees or more when the fixing bracket 200 is manufactured in the factory.

[00129] In the foregoing embodiments, although the angle

between both walings 20 is about 60 degrees, the embodiments of the present invention are not limited thereto. For example, both walings 20 may be angled at various angles such as 80 degrees, 75 degrees, 70 degrees, 65 degrees, 55 degrees, 50 degrees, and 45 degrees.

[00130] According to the L-section steel synthetic strut for the earth retaining structure, the four L-section steels may be disposed so that the edge thereof at which the vertical part and the horizontal part meet each other may be disposed at each of the vertexes of the square, the connection flange formed in the square shape having the vertexes corresponding to the edge of each of the L-section steels may be bonded to both ends of each of the L-section steels, and the connection bolt may pass through each of the four corners of the connection flange to couple the connection nut to the connection bolt to increase the geometrical moment of inertia, thereby improving the buckling and torsional resistance.

[00131] According to the L-section steel synthetic strut

for the earth retaining structure, the protruding portion may be removed from the connection flange of the strut to quickly and easily move the strut by using the small-scaled equipment such as the backhoe.

[00132] According to the L-section steel synthetic strut for the earth retaining structure, the fixing bracket may be applicable when the strut is connected perpendicular to the waling and when the strut and the waling are connected to each other at various angles so that the strut or a screw jack is connected to the waling in various situations.

[00133] According to the L-section steel synthetic strut for the earth retaining structure, the one fixing bracket may be adjustable in angle without doubly connecting the fixed type fixing bracket and the angle-adjustable fixing bracket to reduce the number of connection parts connected by using the bolts/nuts, thereby securing the structural stability and reducing the construction period and costs.

[00134] According to the L-section steel synthetic strut for the earth retaining structure, the protruding portion

such as the extension part may be removed from the strut to reduce the loading volume when the strut is loaded, and when the strut is stored and carried, the occupying space may be reduced to reduce the storage and logistical costs.

[00135] While the present invention has been described in detail in connection with certain exemplary embodiments thereof, it should be understood to those skilled in the art that this is simply illustrative, and thus various modifications and other equivalent embodiments are possible. The present invention is not limited to the above-described modification and changes, but limited to the appended claims.

What is claimed is:

1. An L-section steel synthetic strut for an earth retaining structure, comprising:

a strut (100) having both ends connected between walings 20 coupled to a soldier pile (10) through a fixing bracket (200), wherein the strut (100) comprises four L-section steels (110) disposed symmetrical to each other in up/down and left/right directions so that a vertical part (111) and a horizontal part (112) are integrated with each other in an L shape, and an edge (113) at which the vertical part (111) and the horizontal part (112) meet each other is disposed at each of vertexes of a square and a square connection flange (120) having a vertex corresponding to the edge (113) of each of the four L-section steels (110) bonded to both ends of each of the L-section steels (110); and

four corner bolt through holes (121) defined in the connection flange (120) to correspond to positions between the vertical part (111) and the horizontal part (112) of the

L-section steel (110) and the edge (113) and four edge bolt through holes (122) defined in an edge of the connection flange (120) to correspond to positions between the four bolt through holes (121).

2. The L-section steel synthetic strut of claim 1, wherein the strut (100) further comprises a stiffener (130) bonded to the four L-section steels (110) to reinforce strength, and

the stiffener (130) comprises a stiffener body (131) provided as a square plate having an edge contacting inner surfaces of the vertical part (111) and the horizontal part (112) of the L-section steel (10) and a reinforcing bent part (132) bent at a right angle on the edge of the stiffener body (131).

3. The L-section steel synthetic strut of claim 1, wherein the fixing bracket (200) comprises:

a strut-side flange (210) corresponding to the

connection flange (120);

a waling-side flange (220) disposed to be spaced apart from the strut-side flange (210) in a longitudinal direction of the strut (100);

a pair of first vertical rotation pieces (230) comprising a first rotation piece body (231) having a bottom side (232) bonded to the strut-side flange (210) and an oblique side (233) angled at an angle of about 45 degrees on each of both left and right sides of the bottom side (232) and a first circular plate (234) integrated with the first rotation piece body (231) and provided as a circular plate using a point meeting a virtual extension line of the oblique side (233) as a center;

a pair of second vertical rotation pieces (240) disposed on a plane located under the first rotation pieces (230) by a thickness of the first rotation piece (230), the pair of second vertical rotation pieces (240) comprising a second rotation piece body (241) having a bottom side (242) bonded to a waling-side flange (220) and an oblique side (243)

angled at an angle of about 45 degrees on each of both left and right sides of the bottom side (242) and a second circular plate (244) integrated with the second rotation piece body (241) and provided as a circular plate using a point meeting a virtual extension line of the oblique side (243) as a center;

a pair of third vertical rotation pieces (250) disposed on the same plane as the second rotation pieces (240), the pair of third vertical rotation pieces (250) comprising a third rotation piece body (251) having a bottom side (252) bonded to the strut-side flange (210), an oblique side (253) angled at an angle of about 45 degrees on each of both sides of the bottom side (252), and a top side (254) parallel to the bottom side (252) and a first semicircular guide groove (255) disposed on a front end of the third rotation piece body (251) to surround the second circular plate (244);

a pair of fourth vertical rotation pieces (260) disposed on the same plane as the first rotation pieces (230), the pair of fourth vertical rotation pieces (260) comprising a

fourth rotation piece body (261) having a bottom side (262) bonded to the strut-side flange (220), an oblique side (263) angled at an angle of about 45 degrees on each of both sides of the bottom side (262), and a top side (264) parallel to the bottom side (262) and a second semicircular guide groove (265) disposed on a front end of the fourth rotation piece body (261) to surround the first circular plate (234);

a connection shaft (270) inserted into shaft holes (235, 245) defined in centers of the first circular plate (234) and the second circular plate (244); and

a fixing bolt (281) passing through fixing bolt through holes (236, 246) defined in the first circular plate (234) and the second circular plate (244) at both left and right sides with respect to the shaft holes (235, 245) and a fixing nut (282) coupled to a protruding end of the fixing bolt (281).

4. The L-section steel synthetic strut of claim 3, wherein the strut-side flange (210) has the same size as the

connection flange (120) of the strut (100), and a corner bolt through hole (211) and an edge bolt through hole (212), which respectively correspond to a corner bolt through hole (121) and an edge bolt through hole (122) of the connection flange (120) of the strut (100), are provided in the strut-side flange (210).

5. The L-section steel synthetic strut of claim 3, wherein the first and third rotation pieces (230, 250) respectively have the bottom sides (232, 252) bonded to the strut-side flange (210) and are bonded to each other and integrated with the strut-side flange (210), and

the second and fourth rotation pieces (240, 260) respectively have the bottom sides (242, 262) bonded to the waling-side flange (220) and are bonded to each other and integrated with the waling-side flange (220).

6. The L-section steel synthetic strut of claim 3, wherein the fixing bracket (200) further comprises stopping

pins (293, 294) on which the top sides (264, 254) of the fourth and third rotation pieces (260, 250) are hung when both walings (20) are coupled to the third and fourth rotation pieces (250, 260) to meet each other at an acute angle that is less than 90 degrees, a meeting angle between the waling (20) and the strut (100) are above about 45 degrees, and an angle between the strut-side flange (210) and the waling-side flange (220) is below about 45 degrees.