

A LOAD TRANSFER CONNECTOR FOR A SUPPORT MEMBER ASSEMBLY

Background and Field of the Invention

5 The invention relates to a load transfer connector for a support member assembly.

Support member systems for supporting walls are known, for example in WO 03/102321 in which there is disclosed a horizontal stiffener supported at its
10 ends by two vertical stiffeners. By using these stiffeners, the whole wall to be built is divided into smaller "panels" supported by the horizontal and vertical stiffeners which strengthen the walls against "horizontal load" such as wind or earth quakes. However, such a support member system may be improved to withstand heavier loads.

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It is an object of the present invention to provide a load transfer connector which alleviates at least one of the disadvantages of the prior art and/or to provide the public with a useful choice.

20 Summary of the Invention

In accordance with a first aspect of the present invention, there is provided a load transfer connector for a support member assembly, the connector comprising

a connector body; a set of interlocking members configured to interlock with corresponding interconnecting elements of a first elongate member for transferring a load bearing on the first elongate member to the connector body; a set of engagement members configured to cooperate with corresponding interconnecting members of a second elongate member for transferring the load from the connector body to the second elongate member.

“Interlock” or “lock” is used in the present specification to mean that the interlocking members and the corresponding interconnecting elements are secured to each other and fixed in position, and cannot be separated (unless through the use of a machine).

An advantage of the described embodiment is by using the load transfer connector, load bearing on the first elongate member may be transferred to the second elongate member thus, relieving the load acting on the first elongate member. As a result, the first elongate member may withstand heavier loads. Specifically, if the first elongate member is arranged as a horizontal stiffener and the second elongate member as a vertical stiffener, the load transfer connector enables a vertical load acting on the first elongate member to be transferred to the second elongate member. It should be appreciated that it may not be the entire load but some or at least partial load is transferred to the connector body and then to the second elongate member.

“Vertical load” is used in this specification to mean the weight or force caused by a wall supported by a stiffener, such as weight of a wall portion above and

acting on a horizontal stiffener. "Horizontal load" is used in this specification to mean force caused by wind, earthquake or external forces acting on the masonry wall.

5 Preferably, the set of interlocking members is formed along two opposing peripheral edges of the connector body. The set of interlocking members may comprise a plurality of fingers projecting in a first direction, and wherein adjacent ones of the plurality of fingers define a space for receiving respective interconnecting elements of the first elongate member.

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The plurality of fingers may comprise top and bottom fingers which are configured to contact the first elongate member for transferring a horizontal load bearing on the wall to the connector body. The set of engagement members may be configured to transfer the horizontal load from the connector body to the
15 second elongate member.

The set of engagement members may include a plurality of projecting lugs projecting in a second direction. The plurality of projecting lugs may be arranged to be inserted into the corresponding interconnecting members of the
20 second elongate member.

According to a second aspect, there is provided a support member assembly for supporting a wall, the support member assembly comprising a load transfer connector as described above, and first and second elongate members.

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Preferably, one end of the first elongate member includes interconnecting elements configured to interlock with the set of interlocking members of the load transfer connector to transfer the load bearing on the first elongate member to the connector body.

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The first elongate member may comprise an elongate support member for supporting a wall. In an alternative, the first elongate member may comprise an elongate support member and an elongate member engagement portion for engaging with one end of the elongate support member to extend the member's effective length, the elongate support member being arranged to support a wall and wherein the interconnecting elements are formed at a free end of the elongate member engagement portion.

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Preferably, the second elongate member includes interconnecting members to cooperate with the set of engagement members of the load transfer connector for transferring transfer load from the connector body to the second elongate member.

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The interconnecting members may include slots.

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The second elongate member may be in the form of an elongate support member for supporting a wall. The second elongate member may comprise an elongate support member and an elongate member engagement portion for engaging with one end of the elongate support member to extend the member's effective length.

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The first elongate member may be arranged in a horizontal orientation and the second elongate member may be arranged in a vertical orientation.

- 5 In a third aspect, there is provided a method of assembling a support member assembly according to the second aspect discussed above, the method comprising the steps of:

aligning the connector with an end of the first elongate member so that at least some of the interlocking members of the load transfer connector is
10 interleaved between the interconnecting elements of the first elongate member, and bending the interconnecting elements of the first elongate member to interlock the interconnecting elements with the interlocking members of the load transfer connector.

- 15 The method may comprise the step of engaging the set of engagement members with the interconnecting members of the second elongate member.

Brief Description of the Drawings

- 20 An example of the invention will now be described with reference to the accompanying drawings, in which:

Figure 1a is a simplified view showing a wall supported by a support member assembly comprising first and second vertical stiffeners and a
25 horizontal stiffener interconnecting the first and second vertical stiffeners ;

Figure 1b is a simplified view showing another application of the vertical and horizontal stiffeners of Figure 1a but assisted by improved connectors;

Figure 2a is an enlarged front view of one of the improved connectors of Figure 1b;

5 Figures 2b-2d are respective sectional views along directions A-A, B-B and C-C of Figure 2a;

Figure 3 is a close-up enlarged view showing how the improved connector of Figure 2a is configured to connect between the second vertical stiffener and the horizontal stiffener of Figure 1b;

10 Figures 4a to 4c show steps for connecting the horizontal stiffener to the two vertical stiffeners of Figure 1b using the improved connector of Figure 2a;

Figure 5 is a close-up view of one end of the horizontal stiffener of Figure 3;

Figures 6 and 7 illustrate variations of the horizontal stiffener of Figure 5;

15 Figures 8a and 8b are close-up views to illustrate how the improved connector interfaces between the horizontal stiffener and one of the vertical stiffeners of Figure 4a;

Figure 9a is a simplified and enlarged view of one end of the horizontal stiffener interlocked with the improved connector of Figure 3; and

20 Figure 9b is a view of the horizontal stiffener and the improved connector of Figure 9a flipped or rotated 180°.

Detailed Description of Preferred Embodiment

Figure 1a shows a support member assembly 100 comprising first and second vertical stiffeners 120,140 and a horizontal stiffener 160 interconnecting the two vertical stiffeners 120,140. The support assembly 100 and the stiffeners 120,140,160 are similar to those described in WO 03/102321, the contents of which are incorporated herein by reference, although they are shown in the figures in simplified form. The stiffeners 120,140,160 are arranged to support a wall 102. The wall 102 includes an opening 104 and the stiffeners 120,140,160 divide the wall 102 up into two side wall portions 106, a top wall portion 108 and two lower wall portions 110. As shown by arrows A, the weight of the top wall portion 108 creates a vertical load acting on the horizontal stiffener 160. If the gap or size of the opening 104 is considerably narrow, the weight of the top wall portion 108 is transferred to the two lower portions 110 on either side of the opening 104 via the horizontal stiffener 160. As a result, due to the presence of the lower wall portions 110, the horizontal stiffener 160 is able to perform a dual role of providing horizontal stiffening and yet supports the vertical load due to the weight of the top wall portion 108.

Figure 1b shows another application of the support assembly 100 of Figure 1a in which like elements are referenced using the same reference numbers with an addition of 1000, and including a load transfer connector 200. The support assembly 1100 is arranged to support a wall 1102 and includes a horizontal stiffener 1160 configured to support a top masonry wall portion 1108 between two vertical stiffeners 1120,1140. The vertical stiffeners 1120,1140 are

configured to provide horizontal support to side wall portions 1106. The wall 1102 includes an opening 1104 below and throughout the entire length of the horizontal stiffener 1160 (in other words, there is no wall portions below the horizontal stiffener 1160). As a result, the connector 200 is used to transfer a vertical load (see arrows B in Figure 1b) acting on the horizontal stiffener 1160 to the vertical stiffeners 1120, 1140. In this way, this relieves the load acting on the horizontal stiffener 1160.

The preferred embodiment of this invention will be further described with reference to Figure 1b.

Figure 2a is an enlarged front view of the load transfer connector 200 of Figure 1b. Figures 2b-2d are sectional views of the load transfer connector 200 of Figure 2a in the direction A-A, B-B and C-C respectively. In this embodiment, the connector 200 is made of galvanized steel and is press-formed into a desired size and shape. The connector 200 includes a generally rectangular planar body 202 having two long edges 204 and two short edges 206a, 206b. The connector 200 includes a plurality of interlocking fingers 208 formed along the two long edges 204 and which are bent at about 90° with respect to the plane of the planar body 202 so that each free end of the interlocking fingers 208 point in a first direction. Each adjacent pair of interlocking fingers 208 defines an interleaving space 210 for receiving one of a plurality of interlocking lugs 1162 of the horizontal stiffener 1160 (see Figure 3).

The planar body 202 of the connector 200 includes a plurality of engagement members in the form of projecting lugs 212 formed at designated locations and in this embodiment, there are four projecting lugs 212. One of these lugs 212 is shown in Figure 2d. Outlines of the four projecting lugs 212 are cut out from the planar body 202 at the designated locations as each projecting lug 212 is pushed out by a machine with an edge 212a fixedly attached to the planar body 202. The projecting lugs 212 are configured to point generally in a second direction, opposite the first direction of the interlocking fingers 208. Each of the projecting lugs 212 has an outer portion 212b which is longer than an inner portion 212c to form a generally T-shape planar body.

Figure 3 is a close-up view to show how the connector 200 of Figure 2 is configured to connect between the second vertical stiffener 1140 and the horizontal stiffener 1160 of Figure 1b. Both vertical stiffeners and the horizontal stiffener 1120, 1140, 1160 are similar to those described in WO 03/102321 and are shown in the figures in simplified form. Each vertical stiffener 1120, 1140 includes a plurality of engagement means in the form of slots 1122, 1142 and the designated locations of the projecting lugs 212 of the connector 200 are arranged to correspond to the locations of the slots 1122, 1142 on the vertical stiffeners 1120, 1140.

As explained earlier, the horizontal stiffener 1160 is similar to the one described in WO 03/102321 (and thus, includes the engagement means 1163 just like the second vertical stiffener, although they are not shown in Figure 3 but in Figure 5) except that one end 1166 of the horizontal stiffener 1160 is formed with the

plurality of interlocking lugs 1162 to cooperate with the interlocking fingers 208 of the connector 200. The plurality of interlocking lugs 1162 are shown more clearly in Figure 5 which is a side view at the end 1166 of the horizontal stiffener 1160 of Figure 3. As shown in Figure 5, adjacent pairs of the interlocking lugs 1162 are separated by openings 1164 which receive a corresponding one of the interlocking fingers 208 of the connector 200. The size and shape of the planar body 202 of the connector 200 is adapted to correspond to the size and shape of the horizontal stiffener 1160 to enable the interlocking lugs 1162 of the horizontal stiffener 1160 to be received by the spaces 210 so that the interlocking lugs 1162 interleave between the interlocking fingers 208 of the connector 200. The interlocking lugs 1162 are then bent to lock with the respective interlocking fingers 208. Once locked, the interlocking lugs 1162 and interlocking fingers 208 are not releasable from each other, unless through the use of a machine which may damage these parts. As it can be appreciated from Figure 3, the plurality of interlocking fingers includes a top and bottom pair of interlocking fingers 208a, 208b, 208c, 208d which extend beyond the body of the horizontal stiffener 1160.

To connect the other end 1168 (see Figure 4a) of the horizontal stiffener 1160 to the first vertical stiffener 1120, a second connector 1200 similar to the one described above and shown in Figure 2 is used and like reference numerals are used for like parts with the addition of 1000.

For ease of installing the horizontal stiffener 1160 and to allow for adjustments, the support assembly 1100 includes a sleeve member 180, such as the one

described in WO 2007/032746, the contents of which are incorporated by reference, to extend the effective length of the horizontal stiffener 1160. In this embodiment, one end of the sleeve member 180 is also preformed with interconnecting lugs 182 similar to the interconnecting lugs 1162 of the horizontal stiffener 1160 of Figure 5 so that the interconnecting lugs 182 of the sleeve member 180 is able to lock with interlocking fingers 1208 of the second connector 1200. The second connector 1200 also includes projecting lugs 1212 for engaging with the slots 1122.

To use the connectors 200,1200, the two vertical stiffeners 1120,1140 are installed in place according to design requirements as described in WO 03/102321. Next, the horizontal stiffener 1160 with the end 1166 locked to the connector 200 as explained above and the other end 1168 inserted with the sleeve member 180 (the free end being locked with the second connector 1200) is located to a desired position between the two vertical stiffeners 1120,1140. This is shown in Figure 4a (with the two vertical stiffeners 1120,1140 shown in simplified form without showing the slots 1122).

The four projecting lugs 212 of the connector 200 are then inserted into corresponding slots 1142 of the vertical stiffener 1140 so that the projecting lugs 212 and the corresponding slots 1142 are engaged as show in Figure 4b. Figure 8a shows a close-up sectional plan view of the engagement between one of the projecting lugs 212 and the corresponding slot 1142 to show the engagement more clearly. Figure 8b is a sectional view of Figure 8a in the direction D-D. As shown in Figure 8b, the outer portion 212b of the projecting

lug 212 is pushed into the slot 1142 of the vertical stiffener 1140 and pushed to one edge of the slot 1142 so that one end of the outer portion 212b engages the edge of the slot 1142. With the vertical stiffener 1140 in a vertical orientation as shown in Figure 8b, the edge of the slot acts as a catch to engage the outer portion 212b so as to hold the projecting lug 212 and thus, the connector 200 in place.

It would be appreciated that, unlike the connection between the interlocking fingers 208 and the interlocking lugs 1162 which are locked, the engagement between the projecting lugs 212 and the corresponding slots 1142 allows the load transfer connector 200 (and thus, the horizontal stiffener 1160) to be released from the slots 1142 of the vertical stiffener 1140 since the slots are longer than the projecting lugs 212 as shown in Figure 8b.

Next, as shown in Figure 4c, the sleeve member 180 is extended in a horizontal direction until the projecting lugs 1212 of the second connector 1200 are inserted and engaged with the corresponding slots 1122 on the first vertical stiffener 1120, similar to the engagement illustrated in Figure 8b. Once the horizontal stiffener 1160 is held in place, the masonry wall 1102 is constructed as what has been described in WO 03/102321 and the end configuration is shown in Figure 1b.

With the top wall portion 1108 constructed, the top wall portion 1108 creates a load which bears on the horizontal stiffener 1160. The load bearing on the horizontal stiffener 1160 is transferred, at least in part, at the end 1166 via the

interlocking lugs 1162 and the interlocking fingers 208 to the connector body 202 and at the other end 1168 via the sleeve member 180, the interlocking lugs 182 of the sleeve member 180, and the interlocking fingers 1208 to the body of the second connector 1200.

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The connector 200 then transfers the load from its body 202 to the second vertical stiffener 1140 via the projecting lugs 212 and slots 1142, and to the body of the second vertical stiffener 1140. Likewise, the second connector 1200 transfers the load from its body to the first vertical stiffener 1120 via the projecting lugs 1212, slots 1122 to the body of the first vertical stiffener 1120.

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The horizontal stiffener 1160 transfers horizontal loads to the connector 200 via at least the top or the bottom interlocking lugs 208a,208b,208c,208d (and the second connector via lugs 1208a,1208b,1208c,1208d); and then the connector 200 transfers the load to the second vertical connector 1140 via the projecting lugs 212 and the slots 1142 as explained above. It should be mentioned that either the top interlocking lugs 208a,208b or the bottom interlocking lugs 208c,208d contributes to the transfer of the horizontal loads although all the top and bottom interlocking lugs 208a,208b,208c,208d may contribute depending on the arrangement. Further, the other lugs 208 may also contribute. It should be appreciated that the horizontal loads acting on a panel of masonry wall (such as the wall portion 1108) is typically resisted by surrounding supports such as the vertical and horizontal stiffeners 1120,1140,1160 on all edges of the panel. With the presence of the horizontal stiffener 1160, the load is transferred to the body of the horizontal stiffener 1160 throughout its length, which then relies on

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the connectors 200, 1200 to transfer the horizontal load to the vertical stiffeners 1120,1140.

As it can be appreciated from the described embodiment, the load transfer connector 200,1200 enables vertical and horizontal loads to be transferred from the horizontal stiffener 1160 to the vertical stiffeners 1120,1140. Further, the support assembly 1100 with the load transfer connector 200,1200 is simple to install on site. To lock or secure the load transfer connector 200 to the horizontal stiffener 1160 or the sleeve member 180, no site welding is needed, since this is easily accomplished by bending the interlocking lugs 1162,182 to engage the surface of the load transfer connector 200,1200. The load transfer connector 200 is also compatible with existing support member assemblies such as the Stiflex™ system from Dyntek™ Pte Ltd. The load bearing connector 200,1200 is conveniently mass produced since conventional punching and pressing techniques may be used to produce it.

Together with the support member assembly disclosed in WO 2007/032746, adjustments may be made to allow for variations on site since the effective length of the horizontal stiffener 1160 may be adjusted by adjusting the sleeve member 180. The height of the horizontal member 1160 with respect to the vertical stiffeners 1120,1140 may be adjusted either (i) by selecting the corresponding slots 1122,1142 for coupling of the projecting lugs 212,1212 of the connectors 200,1200, preferably in 100mm increments; or (ii) the configuration of the connector 200,1200 enables a 11mm nominal adjustment to the height by installing the horizontal stiffener 1160 flipped by 180°, and Figures

9a and 9b illustrate further what this means. Figure 9a is a simplified and enlarged view of the end 1166 of the horizontal stiffener 1160 locked to the connector 200 of Figure 3. Figure 9a also shows the distance (in mm) from the first edge 206a of the connector 200 to its nearest projecting lug 212 is not the same as the distance from the second edge 206b to its nearest projecting lug 212. In other words, it can be appreciated that the distance to the projecting lugs 212 from the edges 206a, 206b are not symmetrical about the centre of the connector 200. If the horizontal stiffener 1160 together with the connector 200 is flipped or rotated 180° as shown in Figure 9b, this creates 11mm offset adjustment for mounting the connector 200 to the vertical stiffener 1140.

The described embodiment is not to be construed as limitation. For example, in the preferred embodiment, the material for the load transfer connector 200, 1200 is made of galvanized steel but other suitable material such as stainless steel, may be used. Also, in the described embodiment, it is described that the load (as depicted by arrows B in Figure 1b) acting on the horizontal stiffener 1160 is transferred to the two vertical stiffeners 1120, 1140. It is envisaged that the load may be transferred to just one of the vertical stiffeners 1120, 1140. Further, it is also envisaged that in certain configurations, load acting on a vertical stiffener may be transferred to a horizontal stiffener using the load transfer connector 200, 1200. In the described embodiment, the connection between the load transfer connector 200, 1200 and the horizontal stiffener 1160 is locked or fixed, whereas the connection between the load transfer connector 200, 1200 and the vertical stiffeners 1120, 1140 is releasable. However, it is envisaged that the type of connection may be interchanged.

Although the preferred embodiment is described with respect to the configuration shown in Figure 1b, needless to say, the connector 200,1200 may be used in other configurations or applications for supporting different wall configurations. For example, if the opening 104 of Figure 1a is substantially wide, and it is necessary to transfer the load bearing on the horizontal stiffener 160, the connector 200,1200 may also be used to interface the horizontal stiffener 160 and the two vertical stiffeners 120,140.

The number of interlocking fingers 208, projecting lugs 212 of the connector 200 and the interlocking lugs 1162,182 may vary depending on the size and type of the stiffener. Figures 6 and 7 show other types of stiffeners 300,400 which may be used as a horizontal stiffener or a vertical stiffener which has a different number of interlocking lugs 302,402.

Having now fully described the invention, it should be apparent to one of ordinary skill in the art that many modifications can be made hereto without departing from the scope as claimed.

CLAIMS

1. A load transfer connector for a support member assembly, the connector comprising

5 a connector body;

a set of interlocking members configured to interlock with corresponding interconnecting elements of a first elongate member for transferring a load bearing on the first elongate member to the connector body;

a set of engagement members configured to cooperate with
10 corresponding interconnecting members of a second elongate member for transferring the load from the connector body to the second elongate member.

2. A load transfer connector according to claim 1, wherein the set of interlocking members is formed along two opposing peripheral edges of the
15 connector body.

3. A load transfer connector according to claim 1 or 2, wherein the set of interlocking members comprises a plurality of fingers projecting in a first direction, and wherein adjacent ones of the plurality of fingers define a space for
20 receiving respective interconnecting elements of the first elongate member.

4. A load transfer connector according to claim 3, wherein the plurality of fingers comprises top and bottom fingers which are configured to contact the first elongate member for transferring a horizontal load bearing on the wall to
25 the connector body.

5. A load transfer connector according to claim 4, wherein the set of engagement members is configured to transfer the horizontal load from the connector body to the second elongate member.

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6. A load transfer connector according to any of claims 3 to 5, wherein the set of engagement members includes a plurality of projecting lugs projecting in a second direction.

10 7. A load transfer connector according to claim 6, wherein the plurality of projecting lugs are arranged to be inserted into the corresponding interconnecting members of the second elongate member.

15 8. A support member assembly for supporting a wall, the support member assembly comprising a load transfer connector according to any preceding claim, and first and second elongate members.

9. A support member assembly according to claim 8, wherein one end of the first elongate member includes interconnecting elements configured to
20 interlock with the set of interlocking members of the load transfer connector to transfer the load bearing on the first elongate member to the connector body.

10. A support member assembly according to claim 8 or 9, wherein the first elongate member comprises an elongate support member for supporting a
25 wall.

11. A support member assembly according to claim 8 or 9, wherein the first elongate member comprises an elongate support member and an elongate member engagement portion for engaging with one end of the elongate support member to extend the member's effective length, the elongate support member being arranged to support a wall and wherein the interconnecting elements are formed at a free end of the elongate member engagement portion.

12. A support member assembly according to any of claims 8 to 11, wherein the second elongate member includes interconnecting members to cooperate with the set of engagement members of the load transfer connector for transferring transfer load from the connector body to the second elongate member.

13. A support member assembly according to claim 12, wherein the interconnecting members includes slots.

14. A support member assembly according to any of claims 8 to 13, wherein the second elongate member is in the form of an elongate support member for supporting a wall.

15. A support member assembly according to any of claims 8 to 13, wherein the second elongate member comprises an elongate support member and an elongate member engagement portion for engaging with one end of the elongate support member to extend the member's effective length.

16. A support member assembly according to any of claims 8 to 15, wherein the first elongate member is arranged in a horizontal orientation and the second elongate member is arranged in a vertical orientation.

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17. A method of assembling a support member assembly according to any of claims 8 to 16, the method comprising the steps of:

aligning the connector with an end of the first elongate member so that at least some of the interlocking members of the load transfer connector is
10 interleaved between the interconnecting elements of the first elongate member, and bending the interconnecting elements of the first elongate member to interlock the interconnecting elements with the interlocking members of the load transfer connector.

15 18. A method of assembling a support member according to claim 17, further comprising the step of engaging the set of engagement members with the interconnecting members of the second elongate member.