A CONNECTING ARRANGEMENT

FIELD OF INVENTION

The present invention relates to a connecting arrangement, for connecting the reinforcement bars of adjacent concrete elements so that when adjoined, the individual reinforcement bars are connected such that they perform like a single reinforcement bar throughout the entire assembled concrete elements.

BACKGROUND OF THE INVENTION

Concrete is the most commonly used material in the construction industry. However, concrete is a brittle material, which performs well under compression, but not in tension. This is unacceptable in the construction, and especially building industry. To enhance the performance of concrete, steel is usually introduced, as a means of reinforcement.

Steel reinforcement bars used in concrete construction often need to be joined end to end so as to make up a longer bar length. It is desired to connect the reinforcement bars in such a way that the mechanical characteristics of the spliced bars approximate that of a single continuous bar of equal length.

Therefore, special attention needs to be given to the connection details where the reinforcement bars are joined together.

Currently, reinforcement bars are joined up either by lap splicing, mechanical connections or welding.

Lap splicing is performed by arranging the reinforcement bars side by side and wires tied together so that the bar ends are axially offset. As bars need to be lapped in accordance to relevant design codes, more steel material is used to form the lap

length. Further, lapping of bars may sometimes cause severe congestion problems at the connection areas.

The common mechanical connectors available are the threaded connectors and the grouted connectors.

The threaded connectors are made by means of an internally threaded sleeve, which makes screwing engagement with each of two bar ends to be joined. Due to the introduction of bar threading, there is a reduction in the effective bar size for the reinforcement. Tests have also indicated that there is a high possibility for the system failing by fatigue failure with time.

For grouted connectors, the precision in positioning these connectors is crucial for proper and ease of installation.

Finally, welding quality is dependent on the environmental conditions and ability of the worker, to produce a good connection weld. Disadvantage of this method is that the heat introduced to the joint during welding may alter the material characteristic, and in some cases, weaken the bar. This is not acceptable.

It is an object of the present invention to overcome or at least ameliorate one or more of the above problems in the prior art.

Discussion of any one of the prior art mentioned above is not to be taken as an admission of the state of common general knowledge of the skilled addressee.

SUMMARY OF THE INVENTION

The present invention relates to a connecting arrangement, for connecting a first reinforcement bar to a second reinforcement bar.

According to a first aspect of the invention, there is provided a connecting arrangement, for connecting a first reinforced concrete element to a second reinforced concrete element including a first concrete element having a first reinforcement bar extending therefrom, a second concrete element having a second reinforcement bar extending therefrom, said first and second reinforcement bars having enlarged end portions, an enclosure between the interface of said first and second concrete elements to contain a bonding medium, a helical structure, dimensioned to receive the first reinforcement bar and the second reinforcement bar, said helical structure further including at least one bar extending throughout the length of the helical structure along the inner periphery of the helical structure and said first or second concrete element having a bore therethrough the enclosure to allow the bonding medium to be introduced.

When in tension, the interaction between the helical structure, the first and second reinforcement bars, and the bonding medium interact to provide a strong connection.

Preferred aspects of the present invention are in accordance with the subject matter of subsidiary claims of the appended claims, and are imported into the description by reference.

According to first embodiment of the invention, a trough is formed on the surface where the second reinforcement bar is extending from of the second reinforced concrete element so that when arranged and in connection with the first concrete element, an enclosure is formed.

According to a second embodiment of the invention a trough is formed on the surface of the first reinforced concrete element where the first reinforcement bar is

extending from, so that when arranged and in connection with the second concrete element, an enclosure is formed.

According to a third embodiment of the invention, a trough is formed on the surface of both the first and second reinforced concrete element so that when arranged and in connection with each other, an enclosure is formed.

According to a first aspect of the invention, there is provided a connecting arrangement, for connecting a first reinforcement bar to a second reinforcement bar in a concrete structure, including a first reinforcement bar, a second reinforcement bar, said first and second reinforcement bars having enlarged end portions, a helical structure, dimensioned to receive the first reinforcement bar and the second reinforcement bar, said helical structure further including at least one bar extending throughout the length of the helical structure along the inner periphery of the helical structure and an enclosed space to receive the helical structure having the first and second reinforcement bar therein, said enclosure having at least an inlet to allow a bonding medium to be introduced.

In a preferred embodiment of the invention, the helical structure is cylindrical in form.

In an alternative embodiment of the invention, the helical structure is frustro-conical in form.

DESCRIPTION OF FIGURES

In order that the invention might be more fully understood, embodiments of the invention will be described by way of example only, with reference to the accompanying drawings, in which:

Figure 1 shows a first embodiment of the connecting arrangement of the present invention;

Figure 2 shows a force flow diagram of the connecting arrangement in tension;

Figure 3 shows the connector to be used in the present arrangement;

Figure 4 shows the reinforcement bars to be used in the present arrangement;

Figure 5 shows a second embodiment of the connector of the present invention;

Figure 6 shows a third embodiment of the connecting arrangement of the present invention;

Figure 7 shows a fourth embodiment of the connecting arrangement of the present invention; and

Figure 8 shows an alternative arrangement of the helical structure to be used in the present arrangement.

The attached drawings are not necessarily drawn to scale.

DESCRIPTION OF EMBODIMENTS OF THE INVENTION

Reference will now be made in detail to the preferred embodiments of the invention, examples of which are illustrated in the accompanying drawings. The preferred embodiments of the invention are not intended to limit the invention in its broadest aspect to these embodiments. On the contrary, the invention is intended to cover alternatives, modifications and equivalents, which may be included within the spirit and scope of the invention as defined by the appended claims. Furthermore, in the following detailed description of the embodiments, numerous specific details are set forth in order to provide an understanding of the present embodiments.

Referring to the drawings, an embodiment of a connecting arrangement 100 is seen in Figure 1. This connecting arrangement 100 is used primarily in the construction industry to connect adjoining reinforced concrete structures or pre-cast concrete

structures. Therefore, as seen in Figure 1, the connecting arrangement 100 is used to connect a first reinforcement bar 30 of a first concrete element 40 to a second reinforcement bar 50 of a second concrete element 60 thereby connecting the first concrete element 40 to the second concrete element 60.

Figure 1 shows the example of the connecting arrangement 100 used in a pre-cast concrete element arrangement.

Steel bars (known as reinforcement bars) are introduced into concrete elements to reinforce the concrete elements or blocks so that they may perform well under both compression and tension. Concrete elements with steel bars introduced are known as reinforced concrete elements.

The reinforcement bars, in the form of a first and second reinforcement bar 30, 50, may be introduced into the first and second concrete elements 40, 60 via any known methods.

The connecting arrangement 100 includes a connector 10 shaped in the form of a helical structure 96. The helical structure 96 provides the connection between the first and second reinforcement bar. When in use, the first and second reinforcement bars are positioned within the helical structure. To complete the connection, a bonding medium 20 needs to be introduced, through an orifice, to provide a bond between the first and second reinforcement bar, and the helical structure 96. The advantages of this arrangement will be subsequently described.

To retain the bonding medium 20 such that the connecting arrangement is achieved, an enclosure 98 is necessary to retain the bonding medium 20, in interaction with the helical structure 96, and the first and second reinforcement bars 30, 50. The enclosure 98 is to be provided between the interface of the first and second concrete elements 40, 60. In other words, the enclosure 98 is to be provided in between the first and second concrete elements 40, 60 and between the surface where the first reinforcement bar 30 extends from the first concrete element 40, and where the

second reinforcement bar extends from the second concrete element 60 when arranged in a connecting arrangement.

The first, second, third and fourth embodiments of the invention differ in that different forms of enclosures are provided for the invention.

In a first embodiment shown in Figure 1, the connecting arrangement 100 is used to connect a first reinforcement bar 30 of a first concrete element 40 to a second reinforcement bar 60 of a second concrete element 60.

In a first embodiment of Figure 1, the second concrete element 60 is provided with a recess, forming a trough 90 and sidewalls 91 on the surface of the second concrete element 60. This surface of the second concrete element is the surface where the second reinforcement bar 50 extends therefrom. Arbitrarily and as shown in Figure 1, the second concrete element 60 is provided with the trough 90 and sidewalls 91. Only either one of the concrete elements needs to be provided with a recess, for a pre-cast concrete arrangement, so that when in position, an enclosure 98 may be formed in between the concrete elements for the connecting arrangement 100 to be positioned.

As seen in Figure 1, the second reinforcement bar 50 extends from the trough 90 of the second concrete element 60. The second concrete element 60 further includes at least one orifice, in the form of a bore 41 through the sidewalls 91 to allow bonding medium 20 to be introduced.

The inner periphery of the connector 10 is provided with at least one bar 95 extending throughout the length of the helical structure 96. An embodiment of the helical structure 96 is seen in greater detail, in Figure 3.

Also as seen in Figure 1, the ends 31, ~~32~~ 51 of the first and second reinforcement bars 30, 50, that approach each other are provided with enlarged ends 32, 52, more clearly seen in Figure 4. The advantages of the enlarged ends 32, 52, will be described subsequently.

When positioned for use according to the present invention, the first and second reinforcement bars 30, 50, are received within the confines of the helical structure 96, as seen in Figure 1.

When in use, the second concrete element 60 is placed with the trough 90 facing towards the first reinforcement bar 30 to be in connection with. The helical structure 96 is then placed over the upwardly extending first reinforcement bar 30 so that the first reinforcement bar 30 is positioned within the internal confines of the helical structure 96.

Next, the second concrete element 60 is positioned over the first concrete element 40 thereby forming an enclosure 98, and so that the second reinforcement bar 50 is positioned within the confines, and in close or abutting relationship with the first reinforcement bar 30.

As seen in Figure 1 and 4, the ends 31 and 51 are provided with enlarged ends 32 and 52. The enlarged ends 32 and 52 are shown integral to the first and second reinforcement bars 30, 50, but may also be affixed onto the ends 31 and 51 so that they are distinct. For example, discs or knobs dimensioned larger than the diameter of the end 31 and 51, is affixed to the ends. Further, the enlarged ends 32, 52, may even be of different material composition from the reinforcement bars 30, 50.

The second concrete element 60, further includes at least one bore 41 extending through the sidewall 91. When the first and second concrete elements are positioned to be adjoined, as seen in Figure 1, the first and second reinforcement bars 30, 50, are in a closely spaced relationship, or in an abutting engagement.

When the first and second concrete elements 40, 60 are in position, bonding medium 20 is introduced through the at least one bore 41 into the cavity 98. The bonding medium 20 may be introduced, using high-pressure sources or otherwise. When pressure is introduced, a second bore 42 is preferably provided, as an outlet, so that a build up of pressure within the enclosure 98 will not be experienced. Further,

having a second outlet allows the enclosure 98 to be completely filled with bonding medium 20. Once the bonding medium 20 sets, the connecting arrangement 100 is complete.

The purpose of the connecting arrangement 100 is such that when the discrete concrete elements are assembled one to another, the individual reinforcement bars are connected such that they perform like a single reinforcement bar throughout the entire assembly of concrete elements.

When tensile force is experienced, the tensile forces are imparted to the connecting arrangement 100.

The enlarged ends 32, 52 are advantageous as it prevents the first and second reinforcement bars 30, 50 from slipping away from the connecting arrangement 100, which is undesirable.

Figure 2 shows the force diagrams depicting the advantage of the connecting arrangement of the present invention. As seen in Figure 2, the interaction between the bonding medium 20 and the enlarged ends 32, 52 is such that the bonding medium 20 provides an opposed force to the tensile forces such that the first and second reinforcement bars are maintained in position within the confines of the helical structure 96 when an external tensile force is exerted.

Further, in the force flow diagram as seen in Figure 2, the enlarged ends 32, 52 direct the forces towards the at least one bar 95, known as a force transfer bar, which in turn directs the force back towards the first and second reinforcement bars, or more specifically the first and second enlarged ends, so that, again, the externally exerted tensile forces are internally opposed, within the enclosure 98. In Figures 1, 2, 3, 6 and 7, there are 2 force transfer bars as arranged in the helical structure 96.

The helical structure 96 is also advantageous as the internal edges of the helix provide a radial inward compression so that the inward compression further provides

a cohesive force to prevent the first and second reinforcement bars 30, 50 from slipping away, when an external tensional force is experienced.

Therefore, when the bonding medium 20 is introduced into the enclosure 98, the helical structure 96, the force transfer bar 95 and the enlarged ends 32, 52 co-operate such that the external tensional force is effectively resisted.

The connecting arrangement 100 therefore effectively resists tensional forces. Compressional forces are similarly resisted.

Further embodiments described differ only in the alternative forms of enclosures provided for the connecting arrangement to be positioned.

The second embodiment as seen in Figure 5 describes an alternative form of an enclosure 98. As seen in Figure 5, the first concrete element 40 is provided with a recess, forming a trough 90 on the surface of the first concrete element 40. The first concrete element 40 includes the features as described in the second concrete element 60 of the first embodiment.

When in use, the first concrete element 40 is positioned with the first reinforcing bar 30 extending upwards. The helical structure 96 is then placed over the upwardly extending first reinforcement bar 30 so that the first reinforcement bar 30 is positioned within the internal confines of the helical structure 96.

Next, the second concrete element 60 is positioned over the first concrete element 40 with the trough 90 facing towards the first concrete element 40. This arrangement thereby forming an alternative enclosure 98, and positioned so that the second reinforcement bar 50 is positioned within the confines, and in close or abutting relationship with the first reinforcement bar 30.

In a third embodiment of the invention, and as seen in Figure 6, an alternative arrangement, where both the first and second concrete elements 40, 60, are provided with troughs 90 and sidewalls 91, so that a larger enclosure 98 is provided.

In this embodiment, the at least one bore 41 may be provided either on the first concrete element or the second concrete element, or both on either concrete elements, as long as the bore 41 provides a through access into the enclosure 98.

In a fourth embodiment of the invention seen in Figure 7, the connecting arrangement 100 is applied in an in-situ casting construction. In this construction, neither the first nor the second concrete element has a requirement of having a recess, as concrete is poured in directly, within an enclosure provided for the formation of in-situ casting.

Figure 8 shows an alternative embodiment of the helical structure 96, where the helix is not columnar, and is in the form of a frusto-conical arrangement.

CLAIMS

1. A connecting arrangement, for connecting a first reinforcement bar to a second reinforcement bar in a concrete structure, including

a first reinforcement bar;

a second reinforcement bar;

said first and second reinforcement bars having enlarged end portions,

a helical structure, dimensioned to receive the first reinforcement bar and the second reinforcement bar, said helical structure further including at least one bar extending throughout the length of the helical structure along the inner periphery of the helical structure; and

an enclosed space to receive the helical structure having the first and second reinforcement bar therein, said enclosure having at least an inlet to allow a bonding medium to be introduced.

2. A connecting arrangement, for connecting a first reinforced concrete element to a second reinforced concrete element, including

a first concrete element having a first reinforcement bar extending therefrom;

a second concrete element having a second reinforcement bar extending therefrom;

said first and second reinforcement bars having enlarged end portions,

an enclosure between the interface of said first and second concrete elements to contain a bonding medium;

a helical structure, dimensioned to receive the first reinforcement bar and the second reinforcement bar, said helical structure further including at least one bar extending throughout the length of the helical structure along the inner periphery of the helical structure; and

said first or second concrete element having a bore therethrough the enclosure to allow the bonding medium to be introduced.

3 A connecting arrangement, for connecting a first reinforced concrete element to a second reinforced concrete element according to claim 2, wherein a trough is

formed on the surface of the first reinforced concrete element where the first reinforcement bar is extending from, so that when arranged and in connection with the second concrete element, an enclosure is formed.

4. A connecting arrangement, for connecting a first reinforced concrete element to a second reinforced concrete element according to claim 2, wherein a trough is formed on the surface where the second reinforcement bar is extending from of the second reinforced concrete element so that when arranged and in connection with the first concrete element, an enclosure is formed.

5. A connecting arrangement, for connecting a first reinforced concrete element to a second reinforced concrete element according to claim 2, wherein a trough is formed on the surface of both the first and second reinforced concrete element so that when arranged and in connection with each other, an enclosure is formed.

6. A connecting arrangement, for connecting a first reinforced concrete element to a second reinforced concrete element according to claim 2, wherein the helical structure is cylindrical in form.

7. A connecting arrangement, for connecting a first reinforced concrete element to a second reinforced concrete element according to claim 2, wherein the helical structure is frustro-conical in form.