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A STRUCTURAL CONNECTION COMPRISING OVERLAPPING
REINFORCING BARS

The present invention generally relates to a structural connection having a splice sleeve receiving a pair of overlapping reinforcing bars as may be utilised in various types of structures in which steel reinforcing bars are utilised and it is desired to connect the overlapping end portions of the reinforcing bars. The splice sleeve includes a tubular sleeve receiving the overlapped ends of the reinforcing bars with the tubular sleeve being filled with hardenable material to resist axial tension exerted on the reinforcing bars. The sleeve may be vertically or horizontally oriented or inclined with one end of the sleeve being optionally closed by a rubber grommet having an opening receiving one of the reinforcing bars and the other end of the sleeve being optionally outwardly flared or trumpeted and preferably being provided with a ring or hat-shaped cap welded thereto for receiving a tapered or flat end of one of the reinforcing bars with the sleeve confining the hardenable material and resisting radial outward forces imparted to the hardenable material when axial tension is exerted on the reinforcing bars.

Splice sleeves for reinforcing bars are well known as exemplified in US Patent No 3 540 763. In this patent, the reinforcing bars connected by a sleeve and cementitious material are in axial alignment. While this type of sleeve is effective in the arrangement disclosed, the present invention includes a structure connecting reinforcing bars having overlapping ends.

An object of the present invention is to provide a structure having a splice sleeve for overlapping reinforcing bars in the form of a rigid tubular sleeve which may be in the form of a section of steel pipe with the overlapping ends of the reinforcing bars positioned in the sleeve and the space between the reinforcing bars and between the bars and the sleeve being filled with hardened

material, for example cementitious material such as grouting or the like, so that the sleeve will restrain any radial displacement of the cementitious material thereby developing a confinement of the cementitious material and preventing it from outward movement thereby resulting in substantial resistance to axial tension failure or displacement of the lapped reinforcing bars.

Preferably, a closure member is provided for the lower end of the sleeve in the form of a grommet of rubber or other resilient material having an aperture therethrough closely receiving the upper end of a lower reinforcing bar with the upper end portion of the sleeve including a rigid ring welded thereto for engaging the terminal upper end of the lower reinforcing bar thereby positioning the lower reinforcing bar and sleeve in predetermined fixed relation to each other with the lower end of the upper reinforcing bar being inserted into the sleeve into contact with the closure at the lower end thereof to ensure complete overlapping relationship of the reinforcing bars within the sleeve.

The upper end of the sleeve may be outwardly flared or trumpeted to facilitate assembly of the reinforcing bars and sleeve and the periphery of the sleeve may be provided with vertically spaced holes to enable insertion of hardenable material by connection with suitable tubes or other supply means in order to fill the sleeve with said material.

The splice sleeve may be in the form of a corrugated pipe section or an internally grooved pipe section in which the corrugations or grooves are spiral or annular.

The invention will be further described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 is an elevational view of the splice sleeve and reinforcing bars connected thereby.

Figure 2 is a vertical sectional view, on an enlarged scale, taken along section line 2--2 on Figure 1 illustrating further structural details of the splice sleeve and the relationship of the splice sleeve to the axially oriented and overlapping ends of the reinforcing bars and the cementitious medium filling the sleeve.

Figure 3 is a longitudinal sectional view illustrating a splice sleeve in the form of a corrugated pipe section.

10 Figure 4 is a longitudinal sectional view illustrating a splice sleeve in the form of an internally grooved pipe.

Referring now specifically to the drawings, ^athe splice sleeve of the present invention is generally designated by numeral 10 and includes a short section of rigid steel tubing or pipe forming a sleeve 12 of cylindrical configuration. The sleeve 12 receives the upper end portion 14 of a lower reinforcing bar 16 having longitudinally spaced peripheral ribs or projections 18 thereon. The sleeve 12 also receives the lower end portion 20 of an upper reinforcing bar 22 which also has longitudinally spaced peripheral ribs or projections 24 thereon with the reinforcing bars being
20 conventional and normally employed in various types of structures utilizing concrete with reinforcing bars. As illustrated in Figure 2, the upper end portion 14 of the lower reinforcing bar 16 and the lower end portion 20 of the upper reinforcing bar 22 are received in the sleeve 12 in spaced and overlapping relation and the space between the portions 14 and 20 of the reinforcing bars and between the sleeve 12 and the reinforcing bars is filled with a cementitious medium 26 in the form of grouting or the like which has non-shrink and slightly expansive properties.

The sleeve 12 is vertically oriented and is provided with a closure in the lower end thereof in the form of a grommet 28 of rubber or similar
30 resilient material having an opening 30 therethrough adjacent the periphery

13 thereof and adjacent the wall of the sleeve 12 as illustrated in Figure 2 for receiving therethrough the upper end portion 14 of the lower reinforcing bar 16 with the terminal upper end of the reinforcing bar 16 preferably being provided with a conical or pointed end 32 for reception in an annular ring 34 of suitable rigid metal that is secured to the interior of the sleeve 12 as by welding or by any other suitable rigid fastening means. Thus, when the upper end portion 14 of the lower reinforcing bar 16 is inserted through the aperture 30, the sleeve and lower reinforcing bar are continued to be assembled until the pointed end 32 comes to rest in engagement with the ring 34 thereby accurately positioning the reinforcing bar 16 and sleeve 12 in desired relationship to each other with the grommet 28 forming a substantial closure for the lower end of the sleeve 12 to retain the cementitious medium therein until it hardens.

The rubber grommet 28 also prevents leakage of surrounding cement/concrete into the sleeve 12. The upper surface of the rubber grommet 28 may be provided with a recess 36 spaced from the aperture 30 for receiving the pointed lower end 38 of the lower end portion 20 of the upper reinforcing bar 22. Alternatively, the pointed end 38 of the upper reinforcing bar 22 may be lowered into contact with the rubber grommet and form its own recess due to the force with which the pointed end 38 engages the rubber grommet 28. As illustrated, the upper end of the sleeve 12 can be outwardly flared or trumpeted as at 40 in order to provide easier insertion of the upper reinforcing rod 22 into the interior of the sleeve 12. Also, the purpose for the tapering or pointed ends 32 and 38 is to facilitate easier fitting of the reinforcing bars into the splice sleeve. The sleeve 12 includes holes 42 and 44 adjacent the lower and upper end thereof to supply cementitious material, grouting or the like into the interior of the sleeve and completely fill the interior of the sleeve and completely embed the overlapping ends of the reinforcing bars so that the deformations, rings or projections 18 and 24 will be intimately engaged and contacted by the cementitious medium.

When the cementitious medium hardens and axial tension is exerted on the reinforcing bars 16 and 22 as illustrated by the force arrows in Figure 2, the forces perpendicular to the longitudinal axis to the reinforcing bars due to the deformations, ribs or projections acting on the cementitious material will be confined within the sleeve with the sleeve imposing an opposite force in order to create a very secure frictional engagement between the reinforcing bars and cementitious medium.

Thus, the sleeve and its association with the reinforcing bars and cementitious medium provides a confinement to the forces perpendicular to axial tension exerted on the reinforcing bars with the confinement providing an opposite force imposed on the reinforcing bars to create the secure frictional engagement of the reinforcing bars with the cementitious material thereby effectively connecting the reinforcing bars.

As shown in Figure 3, the splice sleeve is a section of corrugated pipe 50 having a series of internal and external ribs or ridges 52 and valleys 54, either spiral or annular, for interlocking engagement with the hardenable material ²⁶~~46~~ which receive the overlapping ends of the reinforcing bars and functions in generally the same manner as the sleeve in Figure 2. Figure 4 illustrates another embodiment in which the splice sleeve 60 is a pipe section having internal grooves 62 and ridges 64, either spiral or annular, for interlocking engagement with the hardenable material which receives the overlapping ends of the reinforcing bars. A hat-shaped cap or bottle cap 66 of sheet metal may be tack welded to the interior of any of the sleeves to receive the end of a reinforcing bar.

The reinforcing bars are conventional items used in reinforcing various types of concrete/cement structures and the sleeve may be a section of conventional steel pipe capable of resisting the radial forces perpendicular to the tension forces exerted on the reinforcing bars with the steel pipe or sleeve restraining any perpendicular displacement of the cementitious medium thereby developing a confinement and resulting resistance to any tension

failure or displacement of the lapped splice.

The various embodiments may be oriented vertically, horizontally or inclined depending on the connections to be made between overlapping reinforcing bars. Also, the splice sleeve may be optionally provided with an outwardly flared end or ends. Hardenable material other than cementitious grouting, such as epoxy material, can be used. In some uses, the hardenable material can be placed into the sleeve through the end thereof before inserting the bars thereby eliminating the filler holes in the sleeve.

C L A I M S

1. A structural connection comprising, in combination, a pair of axially extending reinforcing bars having peripheral projections thereon, said bars having overlapping ends disposed in adjacent, generally parallel spaced relation, a rigid splice sleeve with means locating said end portions of the axially extending reinforcing bars therein, and hardened medium enclosing the overlapping ends of the reinforcing bars and filling the transverse cross-sectional area of the sleeve for resisting forces perpendicular to the longitudinal axes of the reinforcing bars generated as the result of the exertion of axial tension on the overlapping reinforcing bars with the sleeve imposing opposite forces toward the overlapping ends of the reinforcing bars to develop a secure frictional engagement between the reinforcing bars and the hardened medium securely to retain the overlapping ends of the reinforcing bars in overlapped relation.

2. Structure as claimed in claim 1, wherein one end of said sleeve is provided with a closure plug having an opening therein receiving an end portion of one of the reinforcing bars.

3. Structure as claimed in claim 2, wherein said closure plug is in the form of a grommet of resilient material with the inner surface of the grommet receiving and engaged by the terminal end of the other reinforcing



bar in order to position the end portions of the reinforcing bars in spaced overlapped relation.

4. Structure as claimed in claim 2 or 3, wherein the other end portion of the sleeve includes a guide ring rigidly fixed to the interior surface thereof for receiving the terminal end of the reinforcing bar inserted through the opening in the closure plug for the sleeve, said terminal end being tapered.

5. Structure as claimed in claim 1, 2 or 3, wherein a or the one end portion of the sleeve includes a shallow cap forming an inwardly facing socket receiving a flat ended portion of a reinforcing bar.

6. Structure as claimed in any preceding claim, wherein said sleeve is a section of corrugated pipe.

7. Structure as claimed in any one of claims 1 to 5, wherein said sleeve is a section of pipe having internal grooves.

8. Structure as claimed in any preceding claim, wherein said sleeve has an outwardly flared end to guide a reinforcing bar into the sleeve.

9. Structure as claimed in any preceding claim, wherein the hardened material is cementitious material.

10. Structure as claimed in any preceding claim, wherein said sleeve includes openings adjacent the ends thereof for receiving tubes through which hardenable material has been supplied into the interior of the sleeve.



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11. A structural connection constructed and arranged substantially as hereinbefore described with reference to, and as illustrated in, the accompanying drawings.



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