A joint between two adjacent faces of concrete elements is formed by overlapping headed bar with transverse studs between the bars.
JOINTS BETWEEN PRECAST CONCRETE ELEMENTS

[0001] The present invention relates to the use of headed anchor reinforcement bars in the creation of joints between precast concrete elements.

[0002] Headed deformed bars are deformed reinforcing bars, such as ribbed carbon steel reinforcing bars, with a head attached at one or both ends. Smooth reinforcing bars are also used with heads. In this specification a reinforcing bar with a head attached at both ends is described as a double headed stud whether or not the shank is deformed for better anchorage.

[0003] The use of lap splices anchored by headed bars in creating joints between precast elements is described in a technical paper entitled Lap Splices Anchored by Headed Bars by M. Keith Thompson, Antonio Ledesma, James O. Jirsa, and John E. Breen published in ACI Structural Journal V 103, No 2 March-April 2006. This primarily addresses their use in bridge structures. This paper describes the mechanics of such joints. A more detailed report by the same authors from May 2002 has been published by the Center for Transportation and Research, The University of Texas, Austin as Report 1855-3. These documents are herein referred to as the Texas papers. A typical joint width under consideration in these documents is 10 inches (0.254 m).

[0004] Headed bars are also used in the reinforcement of flat slabs, particularly to deal with localized high shear stresses around column heads. The RFA-Tech SHEARTEC system proposes the use of double headed shear studs welded to carrier/spacer rails. These stud carrying rails are designed to be placed liked rays within the slab surrounding a column in order to provide shear reinforcement. The studs are positioned vertically within the surrounding slab parallel to the axis of the column. There are other proprietary systems for use around column heads offered by Halfen and Max Frank of Germany.

[0005] The present invention is particularly concerned with the problems of the construction of floors within large multi-storey structures requiring flat slab constructions to create a framework defining multiple floors. These floors can be assembled from precast concrete planks. The joints between these planks and between other structural elements such as concrete columns, beams, walls which are used in a variety of configurations, must be structurally robust. It is also desirable to minimise the use of high strength concrete in making of these joints.

[0006] The present invention provides a longitudinal joint between two precast concrete elements each having headed bars projecting from adjoining faces of the elements to be joined; the elements being positioned so that their respective headed bars are interleaved and overlap but are not in contact with one another; and headed studs positioned transversely to a length of the joint and transversely to and between the headed bars, the bars and studs being enclosed in concrete. Preferably a joint structure is employed in which headed bars are interlaced in the manner of a lap joint as described in the Texas papers with the addition of a stud carrying rail along the length of the joint supported on the overlapping headed bars and suspending double headed studs between them. When such a reinforcement structure is embedded in high-strength concrete, a robust structural joint of relatively small dimensions can be constructed. In analytical terms, the transfer of forces can be considered as a series of compression struts and tension ties according to normal strut and tie theory, with the strength of the compression struts enhanced by the confining effect of the intermediate studs on their carrying rail.

[0007] Where joints are required to be formed above a steel beam element, single headed studs can be pre-welded to the beam top flange to provide the intersecting studs between the overlapping headed bars.

[0008] Using this form of joint construction, the precast structural elements of the system can be manufactured as large elements. The elements will be typically produced using lightweight concrete to reduce their weight and ease handling and transportation logistics.

[0009] Joints of the system between adjacent slab elements, beam and slab elements, wall and slab elements and other similar scenarios, require temporary supporting of one element from the other element. This is typically provided by temporary steel channels bolted on top of one element and which rest on the adjacent element through cantilevering action.

[0010] In order that the invention may be well understood, an embodiment of a joint between adjacent floor planks will now be described by reference to the accompanying diagrammatic drawings, in which:

[0011] FIG. 1 shows a perspective view of an embodiment of a partly constructed floor using the joint of the present invention;

[0012] FIG. 2 shows a perspective view of adjacent planks with reinforcement to construct a joint in accordance with the invention in place;

[0013] FIG. 3 shows a view of the joint from above; and

[0014] FIG. 4 shows a perspective view of an alternative embodiment of a partly constructed floor using the joint of the present invention.

[0015] A floor in a multi-storey construction is assembled from precast lightweight concrete (LWC) planks 10. The planks 10 are supported by concrete beams 26 and columns 28 and prior to the construction of the joints between the beams and planks and adjoining planks, the elements are supported by means of steel channels 30.

[0016] Joints 12 are constructed as shown in FIGS. 2 to 3. Each edge face 14 of a beam or plank 10 has a series of headed bars 16 projecting from it. In this example, the bars are shown in two vertically spaced layers. The reinforcement is precast into the planks so that they can be laid edge to edge with the headed bars of one plank interlaced and overlapping with those of the adjacent plank without the bars coming into contact or conflict with one another. The edge faces of both the beams and planks have similar arrays of headed bars at the same spacing so that joints of the same form can be made between all the elements.

[0017] Two longitudinal bars 18 are laid along the length of the joint and a rail 20 which supports a series of double headed studs 22 rests on the uppermost headed bars. The studs are spaced along the rail so that they can be positioned centrally between the headed bars. The double headed studs 22 hang vertically from the rail 20.

[0018] In this embodiment, the rail comprises two rods to which the heads 24 of the double headed studs are welded. The rail is there to keep the double headed studs 22 in position at the required spacing and performs no structural part of the joint. It may be relatively lightweight. The lowermost head of the double headed studs lies within the joint.

[0019] Shuttering is provided beneath the joint so that concrete can be poured into the gap to surround the reinforcement and bring the surface of the joint up to the level of the adjourn-
After joints have been completed, the channels 30 are removed.

- It is envisaged that a joint width typically of 200 mm can be employed with a lap length of 100 mm using reinforcing bars of a typical diameter of 16 to 25 mm.

- In FIG. 4, a steel framework 4 is made up of steel beams 6 that define a perimeter of the floor and at least one horizontal beam 8 within it. This framework 4 is used to support a plurality of lightweight concrete (LWC) planks 10, which are laid on the framework 4 and connected to it. The joints are then made as previously described.

- Where a joint overlies a beam 6, the rail supported double headed studs, can be replaced by a series of single headed studs welded to the top of the beam. These perform the same function within the joint.

1. A longitudinal joint between two precast concrete elements each having headed bars projecting from adjoining faces of the elements to be joined; the elements being positioned so that their respective headed bars are interleaved and overlap but are not in contact with one another; and headed studs positioned transversely to a length of the joint and transversely to and between the headed bars, the bars and studs being enclosed in concrete.

2. A joint as claimed in claim 1, wherein the headed studs are double headed studs supported on a rail which rests on the overlapped headed bars.

3. A joint as claimed in claim 1, wherein the headed studs are welded to a beam beneath the joint.

4. A joint as claimed in claim 1 wherein each element edge has a double row of headed bars.

5. A joint as claimed in claim 1, wherein at least one longitudinal bar is positioned along the length of the joint.

6. A joint between two precast concrete elements substantially as herein described with reference to the accompanying drawings.

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