**Title**
Method of joint assembly and joint release mechanism

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ABSTRACT

An edge protection assembly for a join between two concrete slabs, including:

- a first edge protection rail ("the first rail"),
- a second edge protection rail ("the second rail"),
- a plurality of frangible connectors for fastening the rails together in back-to-back relationship when the rails are in alignment, and
- locating means on the first rail and/or the second rail, for locating the first rail in alignment with the second rail.
METHOD OF JOINT ASSEMBLY AND JOINT RELEASE MECHANISM

[0001] The present invention relates to joints in concrete and has particular application (but is not limited) to edge protection for concrete in high load areas including warehouse floors and the like.

[0002] Previously known edge protection joints may employ back-to-back U-shaped steel rails which have top flanges which sit flush with the floor surface in the completed slabs. The rails are retained in the slab by various means including projecting bolts, apertured extensions and any means adapted to secure the rail to the slab so that any slab movement has the rail move with the slab.

[0003] A dowel of some sort may be employed between the slabs. The rails may be connected together using spaced frangible connectors so that upon contraction of the adjacent slabs the rails may separate.

[0004] The rails, connected together by the frangible connectors are often set together atop a lost formwork or a strippable timber form.

[0005] There are a number of problems with previous arrangements, including that the gap formed between the rails must be filled and this can give rise to an uneven filling unless some extra support is positioned below the rails at the time of pouring. Also in the case of stripping formwork from the rails, it can be difficult to strip the formwork as projecting parts of the rails can interfere with the stripping tools being used by workers.

[0006] In a first aspect the present invention provides an edge protection assembly for a join between two concrete slabs, including: a first edge protection rail ("the first rail"), a second edge protection rail ("the second rail"), a plurality of frangible connectors for fastening the rails together in back-to-back relationship when the rails are in alignment, and locating means on the first rail and/or the second rail, for locating the first rail in alignment with the second rail.
[0007] In preferred embodiments, the locating means includes locating portions of the frangible connectors which project beyond the first rail and cooperate with respective apertures of the second rail. Each said frangible connector may be received in an aperture of the first rail such that the locating portions project through said apertures of the first rail. Each said frangible connector may include a plug body with a locating portion extending therefrom, the plug body having a shoulder configured to abut against the first rail at the aperture of the first rail through which the locating portion project.

[0008] Preferably, the assembly includes caps which are attachable over respective locating portions to hold the frangible connectors in position on the first rail.

[0009] In certain embodiments, the locating means include spaced opposed projecting tongues and slots on the rails, each tongue bridging between the rails and projecting into a corresponding slot. The tongues and slots may alternate from one rail to the other along the assembly.

[0010] In a second aspect, the present invention provides a method of installing an edge protection assembly at a joint between concrete slabs, the method including: setting a first edge protection rail ("the first rail") in a first concrete slab, the first edge protection rail having a plurality of frangible connectors, each said frangible connector being partially embedded in the first concrete slab; locating a second edge protection rail ("the second rail") in alignment with the first rail, using locating means on the first rail and/or the second rail; fastening the first rail to the second rail using the frangible connectors; and pouring a second slab up to the second rail.

[0011] Said locating may include aligning apertures of the second rail with locating portions of the frangible connectors which project beyond the first rail.

[0012] Preferred embodiments include providing said frangible connectors in respective apertures of the first rail such that the locating portions project through said apertures
of the first rail to thereby provide said locating means.

[0013] Preferably, each said frangible connector includes a plug body with a shoulder and a locating portion extending from the plug body, and the method further includes pressing respective shoulders into abutment against the first rail at respective apertures of the first rail through which the locating portions project.

[0014] The method may further include attaching caps over respective locating portions to hold the frangible connectors in position on the first rail.

[0015] In preferred embodiments, the locating means include spaced opposed projecting tongues and slots on the rails, each tongue bridging between the rails and projecting into a corresponding slot. The tongues and slots may alternate from one rail to the other along their respective lengths.

[0016] In a third aspect the present invention provides a kit for an edge protection assembly for a join between two concrete slabs, including: a first edge protection rail ("the first rail"), a second edge protection rail ("the second rail"), a plurality of frangible connectors for fastening the rails together in back-to-back relationship when the rails are in alignment, and locating means on the first rail and/or the second rail, for locating the first rail in alignment with the second rail.

[0017] In another aspect the present disclosure provides a concrete edge protection rail assembly comprising back-to-back rails having spaced opposed projecting tongues and slots, each tongue bridging between the rails and projecting into a corresponding slot and having frangible connectors at spaced intervals so the rails may be assembled in-situ.

[0018] Preferably, the frangible connector comprises a plug body adapted to receive a screw fastener used to secure the rails together which screw strips the plug body as the rails separate as the concrete contracts at the joint. Preferably, the projection is an extension of the plug body and there is a shoulder on the plug body adapted to abut
against the first rail in the region of a hole in the rail through which the projection projects. Typically a cap is employed over the projection to hold the frangible fastener in position on the first rail. Preferably, the tongues and slots alternate from one rail to the other along the assembly.

[0019] In order that the present invention may be more readily understood and put into practical effect reference will now be made to the accompanying drawings which illustrate preferred embodiments of the invention and wherein:

Figure 1 is a perspective view showing two typical rails aligned before connection;
Figure 2 is an exploded view of a typical frangible connector according to a preferred embodiment of the invention;
Figure 3 is a section showing the rails secured together;
Figures 4A, 4B and 5 show the pouring of adjacent slabs using a strippable timber form;
Figure 6 shows the destruction of the frangible connector as the rails separate;
Figure 7 shows the use of a grinder to remove the screws from the joint for filling; and
Figure 8 shows the use of a metal in-fill in the joint between the rails.

[0020] Referring to the drawings and initially to Figure 1, there is illustrated a pair of rails 10 and 11 aligned before being pushed together so that they are in back-to-back relation in an assembled form. Holes 12 and 13 are aligned and are used to secure the rails together with a frangible connector (not shown). The rail 10 has a slot 14 and a tongue 15. The tongue 15 is made by cutting and punching the tongue out of the rail material. The rail 11 has a slot 16 opposite tongue 15 and a tongue 17 opposite slot 14. When the rails are operatively secured in back-to-back relation the tongues project through the slots. Matching tongues and slots are positioned at spaced intervals. In order to make sure the rails are fixed in the concrete, heads welded to the rails rods 18 are used. Each rail has a web section 19 and flanges 20 and 21 and it will be appreciated that the rails can be right and left handed or can be identical and simply reversed and offset. In this regard the holes 12 and 13 are elongated so that they are in part overlapping so that a frangible fastener may fit through the overlapping sections.
The tongues may be wider than shown and other variations will be apparent it being appreciated that the tongues serve to support an infill bar between the rails. These rails are typical but the present use of frangible connector assembly in-situ can be used with any rails.

[0021] Referring to Figure 2 there is illustrated a connector assembly 22 comprising a plug 23 and cap 24, and a screw and washer fastener 25.

[0022] In use the rail 11 is secured to a timber form, atop the form with the plug 23 on the flange side of the rail 11 projecting through hole 13. The cap 24 fits on the opposite side on the projecting part of the plug to seal it. Rail 11 is used first and any formwork is usually removed before the rail 10 is secured to the rail 11 and then a second slab is poured. This is basically the method by which the rails are secured in-situ between slab pours.

[0023] The plug 23 has a flange (shoulder) 26 and a bullet shaped body 27. A projection 28 of each connector fits through holes 13. The cap 24 fits on to this and itself has a projection 29 similar to the projection 28. This means all these projecting parts automatically locate the rail 10. The projections 29 can sit loosely in holes 12, or can form an interference fit. During installation once the second rail 10 is located on the first rail 11 and in alignment with it, a worker simply moves along the first slab and using a battery operated screwdriver (for example) applies the washer and screw to each connector 22.

[0024] It is important to note that the cap 24 may remain or be removed before the rail 10 is placed in position on the rail 11 and the projection 29 or 28 may project enough to provide an automatic alignment of the rail 10 with the rail 11 bearing in mind there are spaced ones of these connectors along the rail assembly. The main point is that the rails may be assembled in the factory or may be provided as a kit to be assembled in-situ.

[0025] It will be appreciated that if a tongue-and-slot arrangement as shown in Figure 1 is employed, then the projection 28 or 29 is not strictly necessary for alignment purposes,
since that function could be performed solely by tongues 15, 17 and slots 14, 16. It will be appreciated, though, that the locating effect of the projection 28 or 29 is very useful, and may serve as locating means (in cooperation with holes 12 and 13) if tongues 15, 17 and slots 14, 16 are not used. Thus a first slab may be poured with plug 23, rail 11 and cap 24 in place. Afterwards the timber formwork is removed and then rail 10 is located over the projecting part of 28 or 29 and then the washers and screws 25 used to self tap into the plastics body 23 via holes 30 and 31.

[0026] If the cap 24 is to be removable to expose hole 30 it need not have a hole 31.

[0027] Once all components of the assembly are secured together as described above, it appears as in the section of Figure 3 (slabs omitted).

[0028] Figures 4A, 4B, 5 and 6 show the formation of a joint between slabs 32 and 33. First a timber formwork 34 has rail 11 secured in position as shown. The rail 11 may have spaced nailing brackets for this purpose so the rail is nailed to the timber. After slab 32 is poured and dried enough the timber 34 is stripped away.

[0029] It will be appreciated from Figure 4A that the rails 10 and 11 are shown assembled before form 34 is stripped away. This would be the case if the rails were assembled in the factory, for example. However, it will also be appreciated that the use of the washer and screw type fastener 26 would make it a simple process to couple the rails together in-situ after the timber is stripped.

[0030] Thus in relation to Figure 4A it can also be assumed that the rail 11 and the plug 23 are secured to the timber 34 absent the rail 10 and screw and washer fasteners 26. The slab 32 is then poured, allowed to set and the timber 34 then stripped away. The rail 10 is then placed in position and fastened using screw and washer fasteners 25 which are screwed into plugs 23 of connectors 22 along the rails 10 and 11. This is represented by Figure 4B where like numerals illustrate like features.

[0031] Slab 33 is then poured.
[0032] As the slabs dry, they contract. As the slabs separate the screws strip the interiors of the plugs 23 as shown in Figure 6.

[0033] As shown in Figure 7 once the gap 38 becomes wide enough the use of a grinder 39 allows a worker to cut the screws and then an infill in the form of a metal bar 40 may be used to fill the gap as shown in Figure 8. Many other types of infill are possible. For example, a strip of a polymeric material may be used.

[0034] In the Figure 8 embodiment the metal bar 40 fills the whole gap but it will be appreciated that if tongues 15 and 17 are used then these can provide a seat for the bar 40, and a thinner bar may be employed.

[0035] Whilst the above has been given by way of illustrative example many variations and modifications will be apparent to those skilled in the art without departing from the broad ambit and scope of the invention as herein set forth. For example, dowels may be employed at the join between the slabs, in a manner known in the art.

[0036] Throughout this specification, unless the context requires otherwise, the word "comprise", and variations such as "comprises" and "comprising", will be understood to imply the inclusion of a stated integer or step or group of integers or steps but not the exclusion of any other integer or step or group of integers or steps.

[0037] The reference in this specification to any prior publication (or information derived from it), or to any matter which is known, is not, and should not be taken as an acknowledgment or admission or any form of suggestion that that prior publication (or information derived from it) or known matter forms part of the common general knowledge in the field of endeavour to which this specification relates.
THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. An edge protection assembly for a join between two concrete slabs, including:
   a first edge protection rail ("the first rail"),
   a second edge protection rail ("the second rail"),
   a plurality of frangible connectors for fastening the rails together in back-to-back relationship when the rails are in alignment, and
   locating means on the first rail and/or the second rail, for locating the first rail in alignment with the second rail.

2. An edge protection assembly according to claim 1, wherein the locating means includes locating portions of the frangible connectors which project beyond the first rail and cooperate with respective apertures of the second rail.

3. An edge protection assembly according to claim 2, wherein each said frangible connector is received in an aperture of the first rail such that the locating portions project through said apertures of the first rail.

4. An edge protection assembly according to claim 3, wherein each said frangible connector includes a plug body with a locating portion extending therefrom, the plug body having a shoulder configured to abut against the first rail at the aperture of the first rail through which the locating portion projects.

5. An edge protection assembly according to claim 3 or 4, including caps which are attachable over respective locating portions to hold the frangible connectors in position on the first rail.

6. An edge protection assembly according to any one of the preceding claims, wherein the locating means include spaced opposed projecting tongues and slots on the rails, each tongue bridging between the rails and projecting into a corresponding slot.
7. An edge protection assembly according to claim 6, wherein the tongues and slots alternate from one rail to the other along the assembly.

8. A method of installing an edge protection assembly at a joint between concrete slabs, the method including:
   setting a first edge protection rail ("the first rail") in a first concrete slab, the first edge protection rail having a plurality of frangible connectors, each said frangible connector being partially embedded in the first concrete slab;
   locating a second edge protection rail ("the second rail") in alignment with the first rail, using locating means on the first rail and/or the second rail;
   fastening the first rail to the second rail using the frangible connectors; and
   pouring a second slab up to the second rail.

9. A method according to claim 8, wherein said locating includes aligning apertures of the second rail with locating portions of the frangible connectors which project beyond the first rail.

10. A method according to claim 9, including providing said frangible connectors in respective apertures of the first rail such that the locating portions project through said apertures of the first rail.

11. A method according to claim 10, wherein each said frangible connector includes a plug body with a shoulder and a locating portion extending from the plug body, the method further including pressing respective shoulders into abutment against the first rail at respective apertures of the first rail through which the locating portions project.

12. A method according to claim 10 or 11, including attaching caps over respective locating portions to hold the frangible connectors in position on the first rail.

13. A method according to any one of claims 8 to 12, wherein the locating means include spaced opposed projecting tongues and slots on the rails, each tongue bridging between the rails and projecting into a corresponding slot.
14. A method according to claim 13, wherein the tongues and slots alternate from one rail to the other along their respective lengths.

15. A kit for an edge protection assembly for a join between two concrete slabs, including:
   a first edge protection rail ("the first rail"),
   a second edge protection rail ("the second rail"),
   a plurality of frangible connectors for fastening the rails together in back-to-back relationship when the rails are in alignment, and
   locating means on the first rail and/or the second rail, for locating the first rail in alignment with the second rail.

16. An edge protection assembly for a join between two concrete slabs, substantially as hereinbefore described with reference to the drawings.

17. A method of installing an edge protection assembly at a joint between concrete slabs, substantially as hereinbefore described with reference to the drawings.

18. A kit for an edge protection assembly for a join between two concrete slabs, substantially as hereinbefore described with reference to the drawings.
Fig. 3