

APPARATUS AND METHOD FOR EXTENDING FORMWORK

Field of Invention

The present invention relates to an apparatus and method for extending formwork for casting concrete. In particular, this apparatus and method is suitable for, but not limited to, extending the side formwork used for precasting concrete components such as floor slabs or walls.

Background Art

The following discussion of the background to the invention is intended to facilitate an understanding of the present invention only. It should be appreciated that the discussion is not an acknowledgement or admission that any of the material referred to was published, known or part of the common general knowledge of the person skilled in the art in any jurisdiction as at the priority date of the invention.

Conventionally in the precast industry, prefabrication is introduced when concrete components such as walls, columns or slabs are repetitive. A specific mould is custom made for each type of precast concrete components. The precast concrete components which are usually of specific shapes and sizes will then be assembled at the construction site. The main drawback to this approach is that there is a limitation to the types of concrete components in which prefabrication can be applied for construction projects. Non-standard or non-repetitive components would not be economical and are costly for prefabrication.

One approach to maximize prefabrication for concrete elements and allows economical prefabrication of non-standard and non-repetitive concrete components in construction projects without the need to fabricate many moulds is to use a customizable formwork that is adaptable to many different shapes and sizes. To precast a concrete slab, the customizable formwork is first assembled in a modular manner by arranging at least one side formworks (also colloquially known as "side-forms") to define the perimeter of the concrete slab. Each of these side-forms are preferably steel plates (also known as "formwork plate") mounted on a C-Channel (or any backing formwork profile or backing member) and may have different dimensions in length which can be mixed and matched to accommodate a wide variety of slab component dimensions. The side-form may also have different

vertical cross-sections to cater to different side-profiles as required for each concrete slab component (herein, “vertical” should be understood in the context of the orientation when the side-form is in use during precasting). The C-channel (or any backing formwork profile or backing member) mounted side-forms are then secured in place to existing brackets using wing nuts.

An inherent limitation for customizable formwork is the presence of shortfalls in the assembled formwork which lead to gaps. These shortfalls typically arise under at least two situations. In the first situation as illustrated in Fig. 1, a shortfall arises when a side-form or combination of side-forms along an edge is too short and is unable to perfectly match the required edge length. As precast products come in infinite possible combination of dimensions or sizes, it is not economical and near impossible to envisage and produce so many combination of formwork lengths to mix and match to get the exact dimension required on site. As such, the common practice is to have some standard lengths and get the best possible length combination, and make up for any shortfalls by insertion of infill material. By way of a non-limiting example to illustrate the foregoing concept, if the required edge length is 1.3 metres (m) and the pre-fabricated side-forms are only available in lengths of 1 m and 0.2 m, a shortfall of 0.1 m will result after the combination of one 1 m side-form and one 0.2 m side-form.

In the second situation, a gap may arise at a corner if the matching surface of at least one of the two adjacent side-forms has a non-planar side-profile. As shown by way of an example in Fig. 2, the planar matching surface of the adjacent side-form on the left is unable to properly match the non-planar side-profile of the side-form on the right, leading to the formation of a formwork shortfall at the corner.

As mentioned above, an existing method for making up the shortfall in the formwork involves cutting of infill materials such as polystyrene, polyfoam, timber etc. to the required size and inserting them into these gaps as shown in Fig. 3. For example in the first situation as illustrated in Fig. 1, a small incremental length may be made up using the polyfoam instead of cutting or making formwork of that exact length. However, the process of sealing up the gaps using infill material is time consuming. Further, certain infill material, such as the polyfoam has a tendency of attaching to the concrete during casting which may result in imperfections around

the gaps that requires additional man-hours for repair or touch ups by hacking, grinding and patching.

Another method of making up the shortfall in the formwork is to place a steel plate over the gap. However, there is difficulty in securing the steel plate which may dislodge or move out of position when concrete is poured into the formwork.

For customizable concrete formwork or moulds, there exists a need to have the flexibility of extending a dimension of a pre-fabricated concrete mould or formwork along at least one axis so that the mould can be easily adapted for use in concrete components with slightly different dimensions. Having a means to extend the dimension of a pre-fabricated concrete mould would thus greatly enhance cost efficiency.

Therefore, there exists a need for a better solution to ameliorate the aforementioned problems relating to mould extensions and shortfalls in pre-existing formwork dimensions.

Summary of the Invention

Throughout the specification, unless the context requires otherwise, the word “comprise” or variations such as “comprises” or “comprising, will be understood to imply the inclusion of a stated integer or group of integers but not the exclusion of any other integer or group of integers.

Furthermore, throughout the specification, unless the context requires otherwise, the word “include” or variations such as “includes” or “including” will be understood to imply the inclusion of a stated integer or group of integers but not the exclusion of any other integer or group of integers. The use of relative directional words “top”, “bottom”, “front”, “back”, “inside”, “outside”, “horizontal” and “vertical” are to be understood in context of the referred figure.

This invention seeks to provide an apparatus and method for extending formwork for casting concrete. In particular, this apparatus and method is suitable for, but not limited to, extending the side-formwork used for precasting concrete components such as floor slabs or walls.

In accordance with a first aspect of the invention, there is an apparatus for extending a portion of a formwork comprising:-

a frame attachable to the formwork; and

a securing means operable to secure the frame at a requisite position,

where in the requisite position, a first part of the frame extends the portion of the formwork along an axis of the formwork by a required length and a second part of

5 the frame is secured to the portion of the formwork by the securing means.

Preferably, the formwork is used for casting a material, wherein the material comprises at least one of the following: concrete, resin, metal, plaster.

Preferably, the frame is slidable along the axis of the formwork.

10 Preferably, the securing means comprises at least one of the following: a clamp, a nut and bolt system, a weight attached to the frame, self-weight of the frame.

Preferably, the securing means is effected during casting when a second part of the frame is sandwiched between the material and the portion of the formwork.

Preferably, the formwork and/or the frame are made of metal.

Preferably, the metal comprises steel, aluminium and metallic alloys.

15 Preferably, the formwork and/or the frame are made of composite materials.

Preferably, the formwork comprises at least one side formwork for casting a slab or wall component.

20 Preferably, the frame is operable to slide along a first side formwork among the at least one side formwork, wherein the axis of the formwork is a longitudinal axis of the first side formwork.

Preferably, in the requisite position, the first part of the frame extends a portion of the first side formwork along the longitudinal axis of the first side formwork by the required length.

Preferably, the frame substantially encases the first side formwork.

25 Preferably, each of the at least one side formwork is attached to a backing member.

Preferably, the backing member comprises at least one of the following: a C-channel, L-angle channel or a hollow section channel.

Preferably, the second part of the frame is secured on the portion of the first side formwork at least by way of the backing member and the securing means comprises at least one of the following: a clamp, a nut and bolt system, a weight attached to the frame, self-weight of the frame.

- 5 In accordance with a second aspect of the invention, there is a composite frame for connecting a first side formwork and a second side formwork wherein a longitudinal axis of a first part of the composite frame is inclined at an angle with respect to a longitudinal axis of the second part of the composite frame, and the longitudinal axes of the integral add-on frame and elongated frame are substantially parallel to
10 a horizontal plane.

Preferably, the first part of the composite frame is securable to the first side formwork by a first securing means and the second part of the composite frame is securable to the second side formwork by a second securing means to align the first side formwork and the second formwork at said angle.

- 15 In accordance with a third aspect of the invention, there is a method for extending a portion of a formwork comprising the steps of:-

attaching a frame to the formwork at a requisite position; and

securing the frame onto the formwork at the requisite position,

- wherein in the requisite position, a first part of the frame extends the portion of the
20 formwork along an axis of the formwork by a required length and a second part of the frame is secured to the portion of the formwork.

Preferably, the formwork is used for casting a material, wherein the material comprises at least one of the following: concrete, resin, metal, plaster.

- Preferably, the frame is slidable along the formwork along the axis of the formwork
25 to the requisite position.

Preferably, the formwork and/or the frame are made of metal.

Preferably, the formwork and/or the frame are made of composite materials.

Preferably, the step of securing the frame onto the formwork is performed at least by way of one of the following: clamping, bolting, screwing, weighting.

Preferably, the step of securing the frame onto the formwork is effected during casting when the second part of the frame is sandwiched between the material and the portion of the formwork.

5 Preferably, the formwork comprises at least one side formwork for casting a slab or wall component.

Preferably, the frame is slidable on a first side formwork among the at least one side formwork along the axis, wherein the axis is the longitudinal axis of the first side formwork.

10 Preferably, in the requisite position, the first part of the frame extends a portion of the first side formwork along the longitudinal axis by the required length.

Preferably, the frame substantially encases the first side formwork.

Preferably, each of the at least one side formwork is attached to a backing member.

15 Preferably, the backing member comprises at least one of the following: a C-channel, L-angle channel or a hollow section channel.

Preferably, the step of securing the frame onto the first side formwork is performed at least by way of the backing member and at least one of the following: a clamp, a nut and bolt system, a weight attached to the frame, self-weight of the frame.

20 In accordance with a fourth aspect of the invention, there is an apparatus for matching a first end of a first formwork to a second formwork comprising:-

a frame operable to slide on a surface of the first formwork along a sliding axis near the first end towards a receiving surface of the second formwork,

25 wherein a profile of a matching end of the frame sliding towards the receiving surface of the second formwork is substantially complementary to a profile of the receiving surface of the second formwork; and

a securing means operable to fix the frame at a requisite position along the sliding axis of the first formwork,

where in the requisite position, the matching end of the frame is substantially near or in contact with the receiving surface of the second formwork.

Preferably, the first and second formworks are used for casting a material, wherein the material comprises at least one of the following: concrete, resin, metal, plaster.

Preferably, the securing means comprises at least one of the following: a clamp, a nut and bolt system, a weight attached to the frame, self-weight of the frame.

- 5 Preferably, the securing means is effected during casting when part of the frame is sandwiched between concrete and the formwork.

Preferably, the first and second formwork and/or the frame are made of metal.

Preferably, the first and second formwork and/or the frame are made of composite materials.

- 10 Preferably, the first formwork and the second formwork are a first and a second side formworks respectively, wherein the first and second side formworks are part of a formwork for casting a slab or wall component.

Preferably, the frame substantially encases the first side formwork.

- 15 Preferably, the first and second side formworks are each attached to a backing member.

Preferably, the backing member comprises at least one of the following: a C-channel, L-angle channel or a hollow section channel.

- 20 Preferably, the frame is secured on the first formwork by way of at least the backing member of the first side formwork and the securing means comprising at least one of the following: a clamp, a nut and bolt system, a weight attached to the frame, self-weight of the frame

Preferably, the matching end of the frame comprises a protrusion or a slit cut.

In accordance with a fifth aspect of the invention, there is a method for matching a first end of a first formwork and a second formwork comprising the steps of:-

- 25 sliding a frame on the first formwork along a sliding axis of the first formwork near the first end towards a receiving surface of the second formwork,

wherein a profile of a matching end of the frame approaching the second side formwork is substantially complementary to a profile of the receiving surface of the second side formwork; and

securing the frame at a requisite position along the sliding axis of the first formwork,

where in the requisite position, the matching end of the frame is substantially near or in contact with the receiving surface of the second formwork.

- 5 Preferably, the first and second formworks are used for casting a material, wherein the material comprises at least one of the following: concrete, resin, metal, plaster.

Preferably, the first and second formwork and/or the frame are made of metal.

Preferably, the first and second formwork and/or the frame are made of composite materials.

- 10 Preferably, the step of securing the frame onto the first formwork is performed at least by way of one of the following: clamping, bolting, screwing, weighting.

Preferably, the step of securing the frame onto the first formwork is effected during casting when part of the frame is sandwiched between concrete and the formwork.

- 15 Preferably, the first formwork and the second formwork are a first and a second side formworks respectively, wherein the first and second side formworks are part of a formwork for casting a slab or wall component.

Preferably, the frame substantially encases the first side formwork.

Preferably, the first and second side formworks are each attached to a backing member.

- 20 Preferably, the backing member comprises at least one of the following: a C-channel, L-angle channel or a hollow section channel.

Preferably, the step of securing comprises at least using the backing member of the first side formwork and at least one of the following: a clamp, a nut and bolt system, a weight attached to the frame, self-weight of the frame.

- 25 Preferably, the matching end of the frame comprises a protrusion or a slit cut.

Other aspects of the invention will become apparent to those of ordinary skilled in the art upon review of the following description of specific embodiments of the invention in conjunction with the accompanying figures.

Brief Description of the Drawings

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

5 Fig. 1 shows a shortfall existing between two substantially perpendicular side formworks.

Fig. 2 shows a gap existing between two substantially perpendicular side formworks due to non-planar side-profile or cross-section of one of the side formworks.

10 Fig. 3 shows the sealing of a gap between two side formworks using infill material such as polyfoam.

Fig. 4 shows the sealing of a gap between two side formworks using an add-on side formwork.

Fig. 5 shows schematic drawings of an add-on side formwork with a planar side-profile.

15 Fig. 6 shows schematic drawings of an add-on side formwork with a non-planar side-profile.

Fig. 7 shows the complementary nature of two adjacent add-on side formworks.

Fig. 8 shows another complementary nature of two adjacent add-on side formworks.

20 Fig. 9 shows the use of a clamp to secure the frame to the C-channel.

Fig. 10 shows the use of a wing nut and wing bolt system to secure the frame to the C-channel through an open slot in the frame.

Fig. 11 shows the use of a flat steel plate as side formwork.

Description of Embodiments of the Invention

25 In accordance with various embodiments of the invention and as shown in Fig. 4, there is an apparatus for extending a side formwork to seal a gap in a customized formwork for precasting a concrete element. Examples of such concrete element include slabs, walls/wall components or any other 2 dimensional elements. The apparatus is also otherwise known as an extendable side formwork 100.

Referring to Fig. 5, the apparatus 100 comprises a frame 102 and a securing means 104. The frame 102 is attachable to an existing mounted side formwork 106 and the securing means 104 is operable to hold or secure the frame 102 at a requisite position along an axis of the mounted side formwork 106, such that in the requisite position, a first part of the frame 102 extends the portion of the mounted side formwork 106 along the axis of the mounted side formwork 106 by a required length, and a second part of the frame is secured to the portion of the mounted side formwork 106 at least by way of the securing means.

In various embodiment, the frame 102 is an elongated frame. The elongated frame 102 has a sleeve-like structure with a substantially inverted U-shape vertical cross-section that is designed to substantially encase and be slidably received on a mounted side formwork 106 along an axis, such as the longitudinal axis of the mounted side formwork 106.

In various embodiments, the mounted side formwork 106 comprises a formwork plate 108 and a C-channel 110. The formwork plate 108 may be substantially flat and elongated, and is attachably mounted on the web 128 of the C-channel 110 such that the longitudinal axis of both the formwork plate 108 and C-channel 110 are substantially parallel. Further, the formwork plate 108 is attachably mounted on the surface of the web that is opposite to the side in which the top and bottom flanges 124 and 126 are located. The vertical element of the top 124 and bottom 126 flanges allow the mounted side formwork 106 to be secured to a bracket using a wing nut for the purpose of assembling the customized formwork as shown in Fig. 4.

In various embodiments, a lateral dimension of the formwork plate 108 is substantially equal to the depth of the C-channel's web 128 such that when the formwork plate 108 is mounted on the web 128, the top surface along the thickness direction of the formwork plate 108 is substantially flushed with the top surface of the top flange 124 to provide a substantially flat or smooth sliding surface for the inner surface of a top plate 114 of the elongated frame 102.

In various embodiments, the sleeve-like elongated frame 102 comprises an add-on formwork plate 112, the top plate 114 and an open-slotted plate 116. A first end of the add-on formwork plate 112 is attached to a first end of the top plate 114 such

that the normal axis of both plates are substantially orthogonal and the longitudinal axis of both plates are substantially parallel. The second end of the top plate 114 is attached to a first end of the open-slotted plate 116 such that the normal axis of both the open-slotted plate 116 and the top plate 114 are substantially orthogonal and the longitudinal axis of both plates are substantially parallel. In addition, the open-slotted plate 116 extends downwardly from the top plate 114 in substantially the same direction as the add-on formwork plate 112 such that the add-on formwork plate 112 and open-slotted plate 116 are substantially opposite facing. The elongated frame 102 may have an internal lateral dimension that is wider than the outer lateral dimension of the mounted side formwork 106 which allows the elongated frame to substantially encase the mounted side formwork 106. In various embodiments, the bottom surfaces of add-on formwork plate 112 and open-slotted plate 116 may be flushed to allow sliding on a horizontal ground.

In various embodiments, the sleeve-like elongated frame 102 may also be fabricated by pre-bending a single metal sheet to form the add-on formwork plate 112, the top plate 114 and an open-slotted plate 116.

In various embodiments, the securing means 104 of the apparatus 100 comprises a wing nut 118 and a wing bolt 120 system. To secure or fasten the elongated frame 102 onto the mounted side formwork 106, the wing nut 118 and wing bolt 120 system is first inserted into the slot of the open-slotted plate 116 through the open end such that the head of the wing bolt 120 and the wing nut 118 is located respectively on the inside and outside of the elongated frame 102. Thereafter, the wing nut 118 is screwed along the longitudinal axis of the wing bolt 120 towards the head of the wing bolt 120 such that the opposing surface of the head of the wing bolt 120 and the wing nut 118 clamp the vertical element of the top 124 and bottom 126 flanges against the open-slotted plate 116 as in the cross-section schematic of Fig. 5.

In various embodiments as shown in Fig. 6, the formwork plate 210 may have a non-planar profile, depending on the required side-profile for the precast concrete slab component. Consequently, the add-on formwork plate 204 of the elongated frame 202 is required to have a substantially similar profile as the formwork plate 210. In addition, the top plate 206 of the elongated frame 202 may be protruded in

the lateral direction so as to accommodate the non-planar profile of the add-on formwork plate 204.

As described above and as shown in Fig. 2, a gap may arise at a corner of a precast concrete slab component where two adjacent mounted side formworks meet, where one of the formwork plates has a non-planar profile. This problem may be mitigated by introducing, to the opposite or matching side formwork, an elongated frame comprising a matching end that has a shape complementary to the vertical cross-section of the non-planar profile.

Referring back to Fig. 5 and Fig. 6 by way of an example, the problem related to the non-planar side-profile of the side formwork 212 as shown in Fig. 6 may be overcome by using the elongated frame 102 as shown in Fig. 5 when the two side formworks 106 and 212 are arranged substantially perpendicular with respect to each other. Herein, the elongated frame 102 comprises a protrusion or a protruded plate 122 in the longitudinal direction from the front add-on formwork plate 112 at the matching end of the elongated frame 102. As illustrated schematically further in Fig. 7, the protruded plate 122 has a shape or contour that is complementary to a profile or vertical cross-section of the receiving surface (either formwork plate 210 or add-on formwork plate 204) with the non-planar profile. This enables the add-on formwork plate 112 to be matched with the non-planar receiving surface of the adjacent side formwork without leaving gaps.

The present invention will now be described in terms of one embodiment of its operation with reference to Fig. 5, 6 and 7. It is to be appreciated herein that the extendable side formworks 100 and 200 in Fig. 5 and 6 respectively are designed to be complementary. When there is a shortfall or gap in the formwork, the user first identifies the mounted side formwork which requires a longitudinal extension, hereafter known as the “short mounted side formwork”. To illustrate by way of an example, the short mounted side formwork 106 is assumed to be similar to that as represented in Fig. 5 and the receiving mounted side formwork 212 is similar to that as represented in Fig. 6.

Then, the user chooses an elongated frame 102 comprising an add-on formwork plate 112 that has a substantially similar planar profile as the formwork plate 108 of the short mounted side formwork 106; the vertical cross-section of the elongated

frame 102 is substantially similar to the vertical cross-section of the short mounted side formwork 106. In various embodiments as described above, the elongated frame 102 may be designed to substantially encase the short mounted side formwork 106.

- 5 In various operation embodiments, the elongated frame 102 is also chosen based on the shape or contour of the protruded plate 122 at a matching end to facilitate matching to the formwork plate 210 ("receiving surface") of the receiving mounted side formwork 212; a shape or contour of the protruded plate 122 being complementary to a profile or cross-section of the receiving surface of the receiving
10 formwork plate 210 as illustrated in Fig. 7.

In various embodiments, the receiving formwork plate 108 may be substantially planar during operation, such as that as shown in Fig. 5. In this case, the protruded plate 122 may not be required for matching to the substantially planar receiving formwork plate 108. In various embodiments as shown in Fig.5 and Fig. 8, the
15 receiving formwork plate 108 which is planar may comprise a horizontal top plate 130 that is attached to the top such that the longitudinal axes of both the receiving formwork plate 108 and the horizontal top plate 130 are substantially aligned; the horizontal top plate 130 may be used as a guide for the casting level of concrete for the purpose of varying the thickness of the concrete panel. In this case, the
20 matching end of the add-on formwork plate may contain a slit cut to match and avoid contacting the horizontal top plate 130 at the top of the plate 108. An example is the slit cut 214 of the add-on formwork plate 204 in Fig. 6.

Following which, the user places the chosen elongated frame 102 on the short mounted side formwork 106 and slides the elongated frame 102 along an axis,
25 such as the longitudinal axis (also be known as the "sliding axis"), of the short mounted side formwork 106 towards the receiving formwork plate 210 until a matching end of the elongated frame 102 comprising the protruded plate 122 is substantially near or is in contact with the receiving surface or the receiving formwork plate 210 (or add-on formwork plate 204 if the receiving side formwork is also extended). At the requisite position as described in the foregoing, a portion of
30 the short mounted side formwork 106 is extended by a first part of the elongated

frame 102 along the longitudinal axis by a required length or distance to cover the gap.

Once the above requisite position is attained, the user proceeds to secure or fix a second part of the elongated frame 102 to the short mounted side formwork 106 by inserting a wing bolt 120 and wing nut 118 system through the open-slotted plate 116 before tightening the wing nut 118 by screwing it along the longitudinal axis of the wing bolt 120 towards the head of the wing bolt 120 until the vertical element of the top 124 and bottom 126 flanges are substantially clamped against the open-slotted plate 116. The means of securing the elongated frame 102 may ensure that the elongated frame 102 does not dislodge from the requisite position when concrete is poured into the customized formwork during the casting process.

It should be further appreciated by the person skilled in the art that variations and combinations of features described above, not being alternatives or substitutes, may be combined to form yet further embodiments falling within the intended scope of the invention. In particular:

- It should be appreciated that the present invention is not limited to precasting concrete. The present invention may also be used to extend a formwork or mould in any particular direction by a required length in any on-site concrete casting.
- Further, the present invention may also be applied to extend or modify formwork or mould for casting any materials not limited to concrete. Examples of these materials are metal (metalworking), resin, plaster, glass and any other materials that are typically used in a casting manufacturing process.
- While in various embodiments, the elongated frame 102 is slidable on the mounted side formwork 106, it is to be appreciated that sliding may not be required in certain cases to effect the invention as the elongated frame 102 can be placed into the requisite position instead of sliding it into the requisite position.
- In the described embodiments, the extendable formwork is applied in the context of extending a mounted side formwork for precasting a precast concrete slab component horizontally in the longitudinal direction. However,

it is to be appreciated that the concept is equally applicable to other types of formwork for casting concrete components not limited to precast concrete slab component, both in the context of precasting or on-site casting.

For example, a frame may be applied to extend a formwork or mould in the horizontal direction for casting a concrete wall. Hence, the frame will be useful for re-using the horizontal moulds for different construction projects with different wall width or length requirements.

- In various embodiments, the extendable formwork may also be applied to as an add-on formwork to an existing formwork for casting a 3-dimensional component.

- Although only two types of side-profile are shown in Fig. 5 and 6, it is to be appreciated that the side-profile for a precast concrete elements may have many different profiles or designs and are not limited to only those that are shown in the Figures. Similarly, the protrusion or protruded plate 122 may also have different designs for matching purposes and are not limited to only those that are shown in the Figures.

- It is to be appreciated that the protruded plate 122 may similarly be present in add-on formwork plates that are substantially non-planar, as it may be possible that the formwork plates of two meeting side formworks are substantially non-planar.

- Although the securing means is described in the context of a wing nut and wing bolt system, other forms of fastening device such as a clamp may also be used to secure the elongated frame 102 to the mounted side formwork 106. Other non-limiting examples of a fastening device include: C-clamp 902 (see Fig. 9), magnetic clamp, F-clamp, miter clamp, pipe clamp, set screw and spring clamp, a slot 1002 coupled with nut 1004 and bolt 1006 system 1004 (see Fig. 10) and a conventional nut and bolt system. In the case of a slot coupled with a nut 1004 and bolt 1006 system as shown in Fig. 10, one end of the bolt 1006 may be welded or attached to the top surface of the top flange of the C-Channel 110 of the mounted side formwork 106 and the slot 1002 of the elongated frame 1008 facilitates the sliding of the elongated frame 1008 on the mounted side formwork 106 along the common longitudinal axis. It may also be appreciated that the securing means may

also be achieved by a weight attached to the elongated frame 102 or self-weight of the elongated frame 102. In various embodiments as shown in Fig. 11, the frame may comprise of a steel plate 1102 with a protruded plate 1104 and the securing means may be effected during the casting process when concrete is poured into the mould and a second part of the frame (in this case it is a steel plate 1102) which does not play a role in extending the length of the mounted side formwork 106 becomes sandwiched between the casting material (for e.g. concrete) and the mounted side formwork 106. The protruded plate 1104 and the first part of the steel plate 1102 extends the mounted side formwork 106 by the required length, wherein the first part of the steel plate 1102 is the part that is not sandwiched between the casting material and the mounted side formwork 106.

- While the frame and formworks may be preferably made from steel, it is to be appreciated that they may also be made from any types of metals such as steel, aluminium and metallic alloys or any composite materials.

- It may also be appreciated that the elongated frame 102 can have an integral add-on frame wherein the longitudinal axis of the add-on frame is inclined at an angle with respect to the longitudinal axis of the elongated frame 102, and wherein both the longitudinal axes of the add-on frame and elongated frame 102 are substantially parallel to the horizontal plane. The add-on frame may be attached to the elongated frame 102 by welding or any other relevant techniques. Alternatively, it may be formed as a single entity with the elongated frame 102 using a pre-bending process or other relevant process. The add-on frame may further comprise a means to be secured to a side formwork in a manner similar to the elongated frame (for e.g. an open slotted plate and a wing nut and wing bolt system). The above-described composite frame (add-on frame with elongated frame 102) will be useful in applications where it can act as an adaptor to join two side formworks at said angle.

- The embodiments described above use the C-channel as a backing member for the formwork plate. It is to be appreciated that other types of backing members can be used as well. Non-limiting examples include L-angle or a Hollow Structural section. The Hollow Structural section is a member with a

hollow tubular section. The hollow tubular section can have a cross-section that is substantially circular, square, rectangular or elliptical. However, the cross-section may have other shapes and is not limited to the foregoing.

Claims:

1. An apparatus for extending a portion of a formwork comprising:-
a frame attachable to the formwork; and
a securing means operable to secure the frame at a requisite position,
where in the requisite position, a first part of the frame extends the portion of the formwork along an axis of the formwork by a required length and a second part of the frame is secured to the portion of the formwork by the securing means.
2. The apparatus according to claim 1, wherein the formwork is used for casting a material,
wherein the material comprises at least one of the following: concrete, resin, metal, plaster.
3. The apparatus according to claims 1 or 2, wherein the frame is slidable along the axis of the formwork.
4. The apparatus according to any one of claims 1 to 3, wherein the securing means comprises at least one of the following: a clamp, a nut and bolt system, a weight attached to the frame, self-weight of the frame.
5. The apparatus according to claim 2, wherein the securing means is effected during casting when the second part of the frame is sandwiched between the material and the portion of the formwork.
6. The apparatus according to any one of the preceding claims, wherein the formwork and/or the frame are made of metal.
7. The apparatus according to claim 6, wherein the metal comprises steel, aluminium and metallic alloys.
8. The apparatus according to any one of claims 1 to 5, wherein the formwork and/or the frame are made of composite materials.
9. The apparatus according to any one of claims 1 to 8, wherein the formwork comprises at least one side formwork for casting a slab or wall component.

10. The apparatus according to claim 9, wherein the frame is operable to slide along a first side formwork among the at least one side formwork, wherein the axis of the formwork is a longitudinal axis of the first side formwork.
11. The apparatus according to claim 10, where in the requisite position, the first part of the frame extends a portion of the first side formwork along the longitudinal axis of the first side formwork by the required length.
12. The apparatus according to any one of claims 9 to 11, wherein the frame substantially encases the first side formwork.
13. The apparatus according to any one of claims 9 to 12, wherein each of the at least one side formwork is attached to a backing member.
14. The apparatus according to claim 13, wherein the backing member comprises at least one of the following: a C-channel, L-angle channel or a hollow section channel.
15. The apparatus according to claims 13 or 14, wherein the second part of the frame is secured on the portion of the first side formwork at least by way of the backing member and the securing means, and
wherein the securing means comprises at least one of the following: a clamp, a nut and bolt system, a weight attached to the frame, self-weight of the frame.
16. A composite frame for connecting a first side formwork and a second side formwork wherein a longitudinal axis of a first part of the composite frame is inclined at an angle with respect to a longitudinal axis of the second part of the composite frame, and the longitudinal axes of the integral add-on frame and elongated frame are substantially parallel to a horizontal plane.
17. The apparatus according to claim 16, wherein the first part of the composite frame is securable to the first side formwork by a first securing means and the second part of the composite frame is securable to the second side formwork by a second securing means to align the first side formwork and the second formwork at said angle.
18. A method for extending a portion of a formwork comprising the steps of:-

attaching a frame to the formwork at a requisite position; and
securing the frame onto the formwork at the requisite position,
wherein in the requisite position, a first part of the frame extends the portion
of the formwork along an axis of the formwork by a required length and a
second part of the frame is secured to the portion of the formwork.

19. The method according to claim 18, wherein the formwork is used for casting a material,
wherein the material comprises at least one of the following: concrete, resin, metal, plaster.
20. The method according to claims 18 or 19, wherein the frame is slidable along the formwork along the axis of the formwork to the requisite position.
21. The method according to any one of claims 18 to 20, wherein the formwork and/or the frame are made of metal.
22. The method according to any one of claims 18 to 20, wherein the formwork and/or the frame are made of composite materials.
23. The method according to claim 18 to 22, wherein the step of securing the frame onto the formwork is performed at least by way of one of the following: clamping, bolting, screwing, weighting.
24. The method according to claim 19, wherein the step of securing the frame onto the formwork is effected during casting when the second part of the frame is sandwiched between the material and the portion of the formwork.
25. The method according to any one of claims 18 or 19, wherein the formwork comprises at least one side formwork for casting a slab or wall component.
26. The method according to claim 25, wherein the frame is slidable on a first side formwork among the at least one side formwork along the axis, wherein the axis is the longitudinal axis of the first side formwork.
27. The method according to claim 26, where in the requisite position, the first part of the frame extends a portion of the first side formwork along the longitudinal axis by the required length.

28. The method according to any one of claims 25 to 27, wherein the frame substantially encases the first side formwork.
29. The method according to any one of claims 25 to 28, wherein each of the at least one side formwork is attached to a backing member.
30. The method according to claim 29, wherein the backing member comprises at least one of the following: a C-channel, L-angle channel or a hollow section channel.
31. The method according to claims 29 or 30, wherein the step of securing the frame onto the first side formwork is performed at least by way of the backing member and at least one of the following: a clamp, a nut and bolt system, a weight attached to the frame, self-weight of the frame.
32. An apparatus for matching a first end of a first formwork to a second formwork comprising:-
a frame operable to slide on a surface of the first formwork along a sliding axis near the first end towards a receiving surface of the second formwork,
wherein a profile of a matching end of the frame sliding towards the receiving surface of the second formwork is substantially complementary to a profile of the receiving surface of the second formwork; and
a securing means operable to fix the frame at a requisite position along the sliding axis of the first formwork,
where in the requisite position, the matching end of the frame is substantially near or in contact with the receiving surface of the second formwork.
33. The apparatus according to claim 32, wherein the first and second formworks are used for casting a material,
wherein the material comprises at least one of the following: concrete, resin, metal, plaster.
34. The apparatus according to claims 32 or 33, wherein the securing means comprises at least one of the following: a clamp, a nut and bolt system, a weight attached to the frame, self-weight of the frame.

35. The apparatus according to claim 33, wherein the securing means is effected during casting when part of the frame is sandwiched between concrete and the formwork.
36. The apparatus according to any one of claims 32 to 35, wherein the first and second formwork and/or the frame are made of metal.
37. The apparatus according to any one of claims 32 to 36, wherein the first and second formwork and/or the frame are made of composite materials.
38. The apparatus according to claim 32, wherein the first formwork and the second formwork are a first and a second side formworks respectively, wherein the first and second side formworks are part of a formwork for casting a slab or wall component.
39. The apparatus according to claim 38, wherein the frame substantially encases the first side formwork.
40. The apparatus according to claims 38 or 39, wherein the first and second side formworks are each attached to a backing member.
41. The method according to claim 40, wherein the backing member comprises at least one of the following: a C-channel, L-angle channel or a hollow section channel.
42. The apparatus according to claims 40 or 41, wherein the frame is secured on the first formwork by way of at least the backing member of the first side formwork and the securing means, and
wherein the securing means comprises at least one of the following: a clamp, a nut and bolt system, a weight attached to the frame, self-weight of the frame
43. The apparatus according to any one of claims 32 to 42, wherein the matching end of the frame comprises a protrusion or a slit cut.
44. A method for matching a first end of a first formwork and a second formwork comprising the steps of:-
sliding a frame on the first formwork along a sliding axis of the first formwork near the first end towards a receiving surface of the second formwork,

wherein a profile of a matching end of the frame approaching the second side formwork is substantially complementary to a profile of the receiving surface of the second side formwork; and

securing the frame at a requisite position along the sliding axis of the first formwork,

where in the requisite position, the matching end of the frame is substantially near or in contact with the receiving surface of the second formwork.

45. The method according to claim 44, wherein the first and second formworks are used for casting a material,
wherein the material comprises at least one of the following: concrete, resin, metal, plaster.
46. The method according to claims 44 or 45, wherein the first and second formwork and/or the frame are made of metal.
47. The method according to claims 44 or 45, wherein the first and second formwork and/or the frame are made of composite materials.
48. The method according to any one of claims 44 to 47, wherein the step of securing the frame onto the first formwork is performed at least by way of one of the following: clamping, bolting, screwing, weighting.
49. The method according to claims 44 or 45, wherein the step of securing the frame onto the first formwork is effected during casting when part of the frame is sandwiched between concrete and the formwork.
50. The method according to any one of claims 44 to 49, wherein the first formwork and the second formwork are a first and a second side formworks respectively, wherein the first and second side formworks are part of a formwork for casting a slab or wall component.
51. The method according to claim 50, wherein the frame substantially encases the first side formwork.
52. The method according to claims 50 or 51, wherein the first and second side formworks are each attached to a backing member.

53. The method according to claim 52, wherein the backing member comprises at least one of the following: a C-channel, L-angle channel or a hollow section channel.
54. The method according to claims 52 or 53, wherein the step of securing comprises at least using the backing member of the first side formwork and at least one of the following: a clamp, a nut and bolt system, a weight attached to the frame, self-weight of the frame.
55. The method according to any one of claims 44 to 54, wherein the matching end of the frame comprises a protrusion or a slit cut.