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IN-SITU CONSTRUCTION OF CONCRETE BUILDING

TECHNICAL FIELD

This invention relates to improvements in methods of in-situ or on-site single or multiple storey concrete building construction, concrete buildings constructed by the method and novel wall members for use in the method of construction.

BACKGROUND ART

In situ construction methods of reinforced concrete buildings are well known. In many technologically advanced countries the method has been overtaken by the use of pre-fabricated modular building construction, steel framed structures and so called industrialised building. Nevertheless, in situ or on-site construction methods are still extensively used, particularly in those countries where labour is relatively cheap and/or load bearing steel framing for buildings is relatively expensive.

The most common method of in situ construction of reinforced concrete buildings known to the applicant, consists of the sequential steps of preparing formwork and casting the foundation, preparing formwork and casting the load bearing floor beams together with the floor slab, preparing formwork and casting the ground floor support pillars, preparing formwork and casting the upper floor beams together with the upper floor slab and finally forming the walls by in-filling between the beams and pillars with a wall panel, brick, doors, windows or the like, as desired. The sequence of building is repeated during the construction of additional floors.

DISCLOSURE OF THE INVENTION

One object of the present invention is to provide a useful alternative to the above well known method. Another object is to improve existing methods by making more efficient use of labour and materials during the in situ construction of concrete buildings.

In accordance with one aspect of the invention there is provided a method of in-situ construction of a reinforced concrete building including, first temporarily supporting pre-formed wall members in desired positions on building support means, and then casting the building vertical support pillars utilising suitable surfaces of the wall members as formwork for the pillars.

The wall members preferably include a lower horizontal load bearing reinforced concrete support beam adapted to form at least a part of a load bearing horizontal support beam for the concrete building. Reinforcement means extends from the ends of the beam ready for interconnection with the building support pillars during the casting of the pillars.

During the casting of the floor slabs, suitable surfaces of the wall members may be utilised as part of the slab formwork when casting the floor slab(s).

In floor plans where a pillar is located at the intersection of a plurality of wall members, then suitable surfaces of each wall member can be utilised as formwork when casting the pillar(s).

In accordance with another aspect of the invention, there is provided a method of in-situ construction of a reinforced concrete building including the steps of, first positioning and temporarily supporting pre-formed concrete frame wall members on building support means, said wall members including upper and lower horizontal frame members and vertical frame members located adjacent each end of the horizontal members, said lower horizontal frame member being in the form of a load bearing reinforced concrete support beam adapted to form at least a part of a load bearing horizontal support beam for the reinforced concrete building, casting the building support pillars utilising suitable surfaces of the wall member as part of the formwork for the pillar, and casting the floor slab, utilising suitable surfaces of the wall member as part of the formwork for the building floor slab.

When it is desired to build multi-storey buildings then the invention includes the additional steps of, positioning and temporarily supporting pre-formed upper wall members on the lower wall members,

casting the building support upper pillars utilising suitable surfaces of the upper wall members as part of the formwork for at least one pillar, and casting the upper floor and roof slabs, utilising suitable surfaces of the wall members as part of the formwork for the slabs.

In accordance with another aspect of the invention, there is provided a concrete wall member for use in the in situ construction of a reinforced concrete building having load bearing horizontal support beams, said wall member including upper and lower horizontal frame members and vertical frame members located adjacent each end of the horizontal members, said lower horizontal frame member being in the form of a load bearing reinforced concrete support beam adapted to form at least a part of the load bearing horizontal support beam for the reinforced concrete building.

The wall members may be pre-formed in any suitable location. For example, they could be pre-formed remote from the building site and transported thereto.

A variety of different wall members may be provided. For example, the wall panels may be suitably in-filled and finished with, a hollow concrete panel, and/or bricks, cement, doors, windows or the like.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGS 1 to 8 illustrate the steps in the prior art method of in-situ concrete building construction,

FIG 9 is a front view of a pre-formed wall member constructed in accordance with this invention,

FIGS 10 to 14 illustrate the steps in a method of in-situ concrete building construction, the method being in accordance with this invention,

FIGS 15 to 18 are plan views of the intersection of the wall members with the vertical support pillars, constructed in accordance with this invention,

FIGS 19 to 21 illustrate the steps in the construction of the wall panel of FIG 9, and

FIG 22 is an enlarged cross-sectional view along axis AA of the wall panel of FIG 20.

BEST MODE FOR CARRYING OUT THE INVENTION WITH REFERENCE TO THE FOLLOWING PREFERRED EXAMPLE

FIGS 1 to 8 illustrate the prior art method of the in situ construction of a simple single room per floor, two storey reinforced concrete building.

Referring first to FIG 1, building support means in the form of footings 2 are cast in position. Next, as illustrated in FIG 2, suitable formwork is prepared and reinforced concrete floor beams 4 are cast together with a floor slab 6. Referring now to FIG 3, suitable formwork is prepared and the ground floor pillars 8 are cast in situ. Next, suitable formwork is prepared and the upper floor beams 10 (FIG 4) are cast in situ together with the upper floor slab. The lower wall 14, see FIG 5, is then constructed, for example by in-filling with bricks and finishing with plaster.

Next, the upper floor is commenced by preparing suitable formwork and casting the upper floor pillars 16 as seen in FIG 6. Next, referring to FIG 7 suitable formwork is prepared and the roof beam 18 is cast in place together with the roof slab. Finally, referring to FIG 8, the upper wall 22 is constructed with suitable in-filling. The relatively large amount of formwork is removed at convenient stages.

FIGS 9 to 22 refer to the preferred example of the present invention when constructing a simple one room per floor, two storey reinforced concrete building.

Referring first to FIG 9, a wall member 24 is constructed adjacent the building site or it may be constructed remote from the site and transported thereto. The wall member includes upper 26 and lower 28 horizontal frame members and

side vertical frame members 30, 32 located adjacent each end of the horizontal members. The lower horizontal frame member 28 is in the form of a load bearing reinforced concrete support beam adapted to form the load bearing horizontal support beam for the reinforced concrete building. Metal reinforcement 33 is shown extending from the load bearing beam ends for interconnection with the support pillars during casting of the pillars. Being the first floor of the building, the upper beam 26 is relatively non load bearing so that a reinforcement extension is not necessary. The wall member is suitably in-filled and finished with, a hollow concrete panel, and/or bricks, cement, doors, windows or the like.

The building is commenced by completing building supports in the form of footings 34 as seen in FIG 10. Next, as seen in FIG 11, the pre-formed four wall members 24 are temporarily supported in position in accordance with the floor plan.

Reinforced concrete ground floor pillars 36 are then cast in situ as seen in FIG 12. As seen in FIG 15, vertical end faces 38 of the walls are utilised as part of the formwork when casting the pillars 36.

Next, the floor slab is cast, utilising the inner surfaces of the lower wall beams 28 as formwork for the slab.

The sequence is continued during the construction of the upper floor by first temporarily supporting the pre-formed upper wall members 40 in position, as seen in FIG 13. The pre-formed walls include reinforced concrete roof beams 41. The roof beams being load bearing are thus provided with metal reinforcement 43 extending from the beam ends for interconnection with the pillars during casting of the pillars.

As seen in FIG 14, the upper floor pillars 42 are then cast in-situ utilising end faces of the walls as formwork when casting the pillars. Finally, the upper floor and roof slabs are cast utilising the suitable surfaces of the wall members as formwork for the slabs.

FIGS 15 to 18 illustrate in plan view how the surfaces of differently connected pre-formed walls may be used as formwork for casting the pillars.

FIG 15 shows the connection of two walls at a corner of the building, wherein two wall edges 38 are utilised as a part of the pillar formwork.

FIG 16 shows a two wall co-planar connection, wherein two wall edges 46 are utilised as a part of the pillar formwork.

FIG 17 shows the interconnection of three pre-formed walls, wherein three wall edges 48 are utilised as a part of the pillar formwork.

Finally, FIG 18 shows the interconnection of four pre-formed walls, wherein four wall edges 50 are utilised as a part of the pillar formwork.

FIGS 19 to 22 illustrate the construction of one type of wall member having a hollow wall interior.

As seen in FIG 21 a wall member 52 is constructed off-site and includes upper 26 and lower 28 horizontal frame members and side vertical frame members 30, 32 located adjacent each end of the horizontal members. The lower horizontal frame member 28 is in the form of a load bearing reinforced concrete support beam adapted to form at least a part of the load bearing horizontal support beam for the reinforced concrete building.

Referring to FIG 19, the beam 28 and the vertical side members 30, 32 are first cast. The hollow panel 54 is then cast (See FIG 20). To obtain the triangular pattern hollow interior of panel 54 as seen in FIG 22, a series of triangular section rods (not shown) are positioned to extend from the inner face of the lower beam 28 to the height of the side pillars. Following casting of the in-fill area 54 shown in FIG 20 the rods are removed. Finally as seen in FIG 21 the top beam 26 is cast in position.

One advantage of the invention over the prior art is that it is not necessary to cast the building horizontal support beams in situ because they are already pre-formed as part of the pre-formed wall. This can result in relatively large

savings in the total time taken to complete the in-situ construction of the building.

Another advantage is that the pre-formed wall surfaces can form major parts of the formwork necessary to construct the floor slabs and the pillars. This can result in a reduction in the time required to prepare the formwork and a reduction in materials required for the formwork.

Yet another advantage is that the wall member can be in-filled with windows, doors, bricks, cement or the like off site. This also can result in relatively large savings in the total time taken to complete the in-situ construction of the building.

Although the invention has been described with reference to a simple two storey, single room per floor building, of course the invention may be readily adapted to build both single or multiple storey buildings. Similarly, the floor(s) of the building may be provided with various layouts of single or multiple rooms on each floor.

Of course, obvious modifications to the above preferred example will occur to those skilled in the art. It is to be understood that such modifications are intended to fall within the scope of the invention, which is defined by the following claims.

CLAIMS

1. A method of in-situ construction of a reinforced concrete building including, first temporarily supporting pre-formed wall members in desired positions on building support means, and then casting the building vertical support pillars utilising suitable surfaces of the wall members as formwork for the pillars.
2. A method of in-situ construction of a reinforced concrete building as claimed in claim 1 wherein said wall members including a lower horizontal load bearing reinforced concrete support beam adapted to form at least a part of a load bearing horizontal support beam for the concrete building, said beam being provided with reinforcement means extending from the ends of the beams for interconnection with the building pillars during casting of the pillars.
3. A method of in-situ construction of a reinforced concrete building as claimed in claim 1 or claim 2 wherein suitable surfaces of the wall members are utilised as part of the formwork when casting the building floor slab.
4. A method of in-situ construction of a reinforced concrete building as claimed in claim 1 or claim 2 wherein a pillar is located at the intersection of a plurality of wall panels, and wherein suitable surfaces of each wall panel are utilised as formwork when casting the pillar.
- 5 . A method of in-situ construction of a reinforced concrete building including the steps of,
first positioning and temporarily supporting pre-formed concrete frame wall members on building support means,
said wall members including upper and lower horizontal frame members and vertical frame members located adjacent each end of the horizontal members,
said lower horizontal frame member being in the form of a load bearing reinforced concrete support beam adapted to form at least a part of a load bearing horizontal support beam for the reinforced concrete building and provided with reinforcement means extending from the ends of the beam

ready for interconnection with building support pillars during casting of the pillars,
casting the building support pillars utilising suitable surfaces of the wall members as part of the formwork for the pillar, and
casting the floor slab, utilising suitable surfaces of the wall members as part of the formwork for the floor slab.

6. A method of in-situ construction of a reinforced concrete building according to claim 1 or claim 5 to form a multi-storey building including the additional steps of,
positioning and temporarily supporting upper pre-formed wall members on the lower wall members,
casting the building upper support pillars utilising suitable surfaces of the upper wall members as part of the formwork for at least one pillar, and
casting the upper floor and roof slabs, utilising suitable surfaces of the wall members as part of the formwork for the slabs.
7. A concrete wall member for use in the in situ construction of a reinforced concrete building having load bearing horizontal support beams, said wall member including upper and lower horizontal frame members and vertical frame members located adjacent each end of the horizontal members, said lower horizontal frame member being in the form of a load bearing reinforced concrete support beam adapted to form at least a part of the load bearing horizontal support beam for the reinforced concrete building and provided with reinforcement means extending from the ends of the beam ready for interconnection with building support pillars during casting of the pillars.
8. A wall member according to claim 7 suitably in-filled and finished with a hollow concrete panel, and/or bricks, doors, windows or the like.
9. A wall member according to claim 7 or 8 for use in the method of claim 1 or claim 5.