BUILDING MODULE AND METHOD FOR CONSTRUCTING A MULTISTOREY BUILDING

Field of the Invention

The invention relates to building modules and methods for constructing multistorey buildings.

Background of the Invention

In the construction industry modular buildings are becoming more popular as they can be largely constructed offsite and assembled on site into a finished product in shorter timeframes than traditional multi-storey buildings. Modular construction involves building and preparing building modules offsite in a factory setting before transporting and installing the module at an installation location. Despite the time saving benefits of modular construction techniques there is a constant pursuit to improve these methods of construction with the aim of achieving time savings and cost savings in the overall construction of the building.

It is in light of these pursuits for efficiencies in current the construction of modular buildings that the invention was conceived.

Summary of the Invention

The invention provides a method of constructing a multistorey building, the method including:

pre-fabricating a first building module off-site, the first building module having a precast concrete floor and a permanent outer wall fixed at a side edge of the floor so that the outer wall is supported by the concrete floor to extend vertically upward and defines part of a façade of the building; wherein the outer wall is supported by the floor at the side edge of the floor by a connection

extending along the side edge such that the connection bears the load of the outer wall at the side edge without any other load-bearing support, the connection comprising a bracket of the outer wall connected to a fixing joint embedded along the side edge of the floor;

transporting the first building module to a construction site and assembling the first building module by crane adjacent an already installed second building module, whereby the outer wall forms an external safety barrier; and

horizontally joining the first floor with an adjacent floor of the second building module, thereby forming a concrete floor of a building.

An advantage of providing a method that uses concrete to connect adjacently spaced precast floor slabs, such as floor slabs in a building module, is that the step of pouring of concrete to connect the slabs can be decoupled from the construction and assembly of the building, particularly where the building is constructed with modular building units. Furthermore, the amount of formwork used with the present method of using hybrid wet and precast components is reduced compared to traditional multilevel building methods, when that formwork is provided as a separate structure to the precast floor slabs.

In one embodiment the method includes installing a third building module with a third precast concrete floor slab above the first precast concrete floor slab and supporting the third precast concrete floor slab on the upstanding support member. The method may include using a temporary support member or a permanent support member as the upstanding support member. The method may include using an upstanding support member in the form of a wall structure.

The method may include installing the third precast concrete floor slab before the concrete is poured into the channel to form the concrete connection between the first and second precast slabs.

In another embodiment the method includes erecting

The method may also include vertically inserting a pre-fabricated concrete wall panel in between the adjacently spaced precast floor slabs, erecting formwork between the precast floor slabs and pouring concrete into the formwork to tie the vertical wall panel to the floor slabs. Installing precast slabs vertically to form a wall between floor slabs, particularly elevated floor slabs, and then tying the wall slab to the floor slabs by way of the wet joint defined by the in situ poured concrete, provides an efficient means of installing structural support in a building.

The method also preferably includes post tensioning the precast floor slabs by, before pouring concrete into the channel, installing a conduit between bores extending through the first precast floor slab and the second precast floor slab to form a tensioning passage that extends through both the first and second precast floor slabs; pouring concrete into the channel between the first and second precast concrete slabs to connect the first and second precast slabs, thereby forming a slab of a building; and feeding a tensioning cable, such as a tendon, through the tensioning passage and tensioning the tensioning cable.

Post tensioning of the formed connection, or ‘wet joint’ once it has dried, and the floor slabs increases the strength of the resulting concrete floor structure by compressing the concrete slabs. It is possible to tension the full span of a slab made from multiple precast concrete floor slabs. Alternatively, the concrete floor

The first precast concrete slab may have a second precast beam. The second precast beam in the first precast concrete slab may be perpendicular to the first beam in the first precast concrete slab.

The first precast concrete slab may have a reinforcing bar or angle that extends from the first precast concrete slab to anchor the first precast concrete slab to the poured concrete beam.

The first precast concrete slab may form the base of a building module. The first precast concrete slab, or the building module, may be made in a first location and transported to a second location for installation.

The first precast concrete slab may form the base of a building module. The first precast concrete slab, or the building module, may be made in a first location and transported to a second location for installation.

The invention also provides a method of constructing a multistorey building, the method including:

pre-fabricating first and second building modules off-site, the first and second building modules having precast concrete floors and upstanding support members attached to the floors for supporting an upper floor; the first and second building modules each further comprising a permanent outer wall extending upwardly to define part of a façade of the building, wherein the outer wall is fixed at a side of each concrete floor via a connection extending along the side edge and configured to bear the load of the outer wall at the side of the respective concrete floor without any other load-bearing support, the connection comprising a bracket of the outer wall

connected to a fixing joint embedded along the side edge of the floor;

transporting the first and second building modules to a construction site;

installing the first building module adjacently spaced from the second building module

installing a third building module having a third precast concrete floor above the first and/or second building module and supporting the third precast concrete floor slab on temporary support members;

installing a permanent support structure supporting the third building module above the first and second building modules; and

removing the temporary support members.

The method may include feeding a tensioning cable through the tensioning passage and tensioning the tensioning cable to post-tension the concrete floor.

The invention still further provides a building module used for constructing a multi-storey building, comprising a precast concrete floor and a facade wall, wherein the facade wall is attached to and supported by a side of the concrete floor so that the facade wall extends vertically upward from the concrete floor for forming part of the building's facade, wherein the facade wall is supported by the precast concrete floor via a connection extending along the side edge and that is configured to bear the load of the facade wall at its side edge during transportation to the installation location without need for additional load-bearing support, the connection comprising a bracket of the facade wall connected to a fixing joint embedded along the side edge of the floor; and

the facade wall being configured so that when the building

module is adjacently joined at the installation location to another similar building module having a facade wall, the facade walls create an external safety barrier on the multi-storey building.

Brief Description of the Drawings

An embodiment, incorporating all aspects of the invention, will now be described by way of example only with reference to the accompanying drawings in which:

Figure 1 is an isometric view of multi-storey building in which a concrete floor is being constructed in accordance with an embodiment of the present invention;

Figure 2A is a plan view of a concrete floor of a building made in accordance with an embodiment of the present invention;

Figure 2B is a cross-sectional view of the concrete floor in Figure 2A, taken at the line A-A;

Figure 3A is a top isometric view of the concrete floor in Figure 2A;

Figure 3B is a bottom isometric view of the concrete floor in Figure 3A;

Figure 4A is a top isometric view of a precast concrete floor slab having an integrally formed beam;

Claims:

1. A method of constructing a multistorey building, the method including:

pre-fabricating a first building module off-site, the first building module having a precast concrete floor and a permanent outer wall fixed at a side edge of the floor so that the outer wall is supported by the concrete floor to extend vertically upward and defines part of a façade of the building; wherein the outer wall is supported by the floor at the side edge of the floor by a connection extending along the side edge such that the connection bears the load of the outer wall at the side edge without any other load-bearing support, the connection comprising a bracket of the outer wall connected to a fixing joint embedded along the side edge of the floor;

transporting the first building module to a construction site and assembling the first building module by crane adjacent an already installed second building module, whereby the outer wall forms an external safety barrier; and

horizontally joining the first floor with an adjacent floor of the second building module, thereby forming a concrete floor of a building.

2. The method claimed in claim 1, including installing a third building module having a third precast concrete floor above the first precast concrete floor.

3. The method claimed in claim 2, including using a temporary support member or a permanent support member defining an upstanding support member for supporting the third building module above the first building module.

4. The method claimed in claim 3, including installing a permanent support structure between the first and third building modules to vertically support the third building

module above the first building module, and removing the temporary support member.

5. The method claimed in claim 3 or 4, including attaching the temporary support member to the floor of the first building module off-site.

6. The method claimed in any one of the preceding claims, including post tensioning the precast floor slabs by installing a conduit between bores extending through the first precast floor and the second precast slab to form a tensioning passage that extends through both the first and second precast floors;

connecting the first and second precast floors, thereby forming a slab of a building; and

feeding a tensioning cable through the tensioning passage and tensioning the tensioning cable.

8. The method claimed in any one of claims 1 to 5, including:

prefabricating the first and second precast concrete floors with conduits forming a tensioning passage;

installing the first and second building modules so that the tensioning passages in the first and second precast concrete floors are aligned; and

feeding a tension cable through the conduit in the aligned first and second precast concrete floors and post-tensioning the cable.

9. The method claimed in any one of the preceding claims, including precasting the first concrete floor slab to include a steel beam at least partially embedded into the first precast concrete floor slab.

10. The method claimed in any one of the preceding claims, including vertically inserting a pre-fabricated

concrete wall panel in between the adjacently spaced precast floor slabs, erecting formwork between the precast floor slabs and pouring concrete into the formwork to tie the vertical wall panel to the floor slabs.

11. A method of constructing a multistorey building, the method including:

pre-fabricating first and second building modules off-site, the first and second building modules having precast concrete floors and upstanding support members attached to the floors for supporting an upper floor; the first and second building modules each further comprising a permanent outer wall extending upwardly to define part of a façade of the building, wherein the outer wall is fixed at a side of each concrete floor via a connection extending along the side edge and configured to bear the load of the outer wall at the side of the respective concrete floor without any other load-bearing support, the connection comprising a bracket of the outer wall connected to a fixing joint embedded along the side edge of the floor;

transporting the first and second building modules to a construction site;

installing the first building module adjacently spaced from the second building module

installing a third building module having a third precast concrete floor above the first and/or second building module and supporting the third precast concrete floor slab on temporary support members;

installing a permanent support structure supporting the third building module above the first and second building modules; and

removing the temporary support members.

12. A building module used for constructing a multi-storey building, comprising a precast concrete floor and a facade wall, wherein the facade wall is attached to and supported

by a side of the concrete floor so that the facade wall extends vertically upward from the concrete floor for forming part of the building's facade, wherein the facade wall is supported by the precast concrete floor via a connection extending along the side edge and that is configured to bear the load of the facade wall at its side edge during transportation to the installation location without need for additional load-bearing support, the connection comprising a bracket of the façade wall connected to a fixing joint embedded along the side edge of the floor; and

the facade wall being configured so that when the building module is adjacently joined at the installation location to another similar building module having a facade wall, the facade walls create an external safety barrier on the multi-storey building.