

DESCRIPTION

ROOM UNIT, BUILDING, AND BUILDING CONSTRUCTION METHOD

Technical Field

[0001] The present disclosure relates to a room unit, a building, and a building construction method.

Background Art

[0002] Japanese Patent Application Laid-Open (JP-A) No. H05-339996 describes a method of transporting a plurality of box-shaped units for a house manufactured in a factory to a site and combining the box-shaped units to construct a high-rise house.

SUMMARY OF INVENTION

Technical Problem

[0003] The box-shaped unit in the high-rise house construction method of JP-A No. H05-339996 is provided with interior finishing on the walls and ceiling. In addition, in the site, a high-rise house is constructed by injecting concrete by using the walls and ceiling of the box-shaped unit as a formwork. As a result, a construction period is shortened.

[0004] The mass of the wall of the box-shaped unit is smaller than the mass of the wall in the high-rise house by the mass of the concrete injected at the site. As a result, as compared with a structure in which concrete is not poured at the site but is poured in a factory, the box-shaped unit has a smaller weight, which facilitates transportation of the box-shaped unit to the site and lifting of the box-shaped unit at the site.

[0005] However, since the box-shaped unit includes the ceiling, the wall of the box-shaped unit needs to support the load of the ceiling during a period from manufacturing in the factory to transportation to the site. For this reason, the walls of the box-shaped unit must have a strength enough to prevent damage caused by the load of the ceiling. Therefore, the effect of reducing the weight of the box-shaped unit is limited.

[0006] In view of the above circumstance, the present disclosure constructs a building by using a lightweight room unit.

Solution to Problem

[0007] A room unit of a first aspect is a room unit that is assembled at a site to form a building including a plurality of the room units, the room unit including: a floor slab; and a permanent formwork provided integrally with the floor slab and serving as a formwork for at least one of a column or a wall.

[0008] The room unit of the first aspect includes the floor slab and the permanent formwork serving as the formwork for at least one of the column or the wall. The permanent formwork is a concrete formwork that forms the column or wall, and thus is lighter than a body of the column or wall formed of concrete.

[0009] Therefore, the room unit is easier to transport from a factory to a construction site and to lift even at the construction site as compared with a room unit including the body of the column or wall formed of concrete.

[0010] Further, the permanent formwork is formed integrally with the floor slab, but is not formed integrally with a ceiling member. Therefore, the permanent formwork does not need to support the load of the ceiling member. Therefore, for example, the room unit is lighter than a room unit in which a ceiling member and a wall supporting the ceiling member are integrally formed. That is, the building can be constructed by using the lightweight room unit.

[0011] According to a second aspect, in the room unit of the first aspect, the floor slab is formed using first concrete and includes a recess formed at a peripheral edge and having a thickness smaller than other portions, a plurality of floor units are formed by the floor slab and the permanent formwork, and second concrete that is poured into the recesses of the plurality of floor units arranged side by side and connects the plurality of floor units is provided.

[0012] In the room unit of the second aspect, the floor unit is formed by the floor slab and the permanent formwork. The number of floor units is plural, and in each of the floor units, the floor slab includes the recess formed at the peripheral edge. The floor units are arranged side by side, and the second concrete is poured into the recess to connect the floor units.

[0013] In this manner, the room unit formed by the floor slab and the permanent formwork is formed by the plurality of floor units and connected by on-site concrete. As a result, the room unit can be divided and transported from the factory to the construction site.

[0014] A building of a third aspect is a building including the room unit of the first or second aspect, the building including: a wall or a column formed by pouring concrete between permanent formworks of room units that are adjacent to each other; and a ceiling member arranged on an upper side of the room unit.

[0015] The building of the third aspect is constructed by combining a plurality of room units. The floor slab is formed in the room unit. Therefore, it is not necessary to construct the floor of the building in the site. In addition, the wall or column in the building is formed by pouring concrete between permanent formworks forming the room unit. Therefore, the number of formworks to be constructed in the site can be reduced, and a construction period can be shortened.

[0016] According to a fourth aspect, in the building according to the third aspect, the room

units are layered in the vertical direction, and a ceiling member in a room unit of a lower floor is formed by a floor slab of the layered room unit of an upper floor.

[0017] In the building of the fourth aspect, a ceiling member in a room unit of the lower floor is formed by a floor slab in the room unit of an upper floor. Therefore, the ceiling member does not have to be formed in each room unit arranged in the lower floor. As a result, the configuration of the room unit can be simplified.

[0018] According to a fifth aspect, in the building of the second or third aspect, the permanent formwork is formed by layering a wet material.

[0019] In the building of the fifth aspect, the permanent formwork in the room unit is formed by layering the wet material. The configuration of layering the wet material can be formed using, for example, a 3D printer. This makes it possible to save labor for constructing the room unit.

[0020] A building construction method of a sixth aspect is a building construction method including: laterally arranging room units each including a floor slab and a permanent formwork that is provided integrally with the floor slab and serves as a formwork for at least one of a column or a wall, pouring concrete between the permanent formworks in room units that are adjacent to each other to construct a lower floor; and arranging a room unit forming an upper floor above the lower floor to form a ceiling member of a room unit of the lower floor with a floor slab in the room unit of the upper floor.

[0021] In the building construction method of the sixth aspect, the building is constructed by combining a plurality of room units. The floor slab is formed in the room unit. Therefore, it is not necessary to construct the floor of the building in the site.

[0022] In addition, the wall or column in the building is formed by pouring concrete between the permanent formworks forming the room unit. Therefore, the number of formworks to be constructed in the site can be reduced, and a construction period can be shortened.

[0023] Further, the ceiling member in the room unit of the lower floor is formed by the floor slab in the room unit of the upper floor. Therefore, the ceiling member does not have to be formed in each room unit arranged in the lower floor. As a result, the configuration of the room unit can be simplified.

[0024] According to a seventh aspect, the building construction method of the seventh aspect further includes: forming a plurality of floor slabs each including a recess formed at a peripheral edge by pouring concrete on a part of an upper side of a precast concrete plate; forming a plurality of floor units by fixing the permanent formwork to each of the floor slabs; arranging the plurality of floor units side by side; and forming the room unit by pouring concrete into each recess and connecting the plurality of floor units.

[0025] In the building construction method of the seventh aspect, the floor unit is formed by the floor slab and the permanent formwork. The number of floor units is plural, and in each of the floor units, the floor slab includes the recess formed at the peripheral edge. The floor units are arranged side by side, and concrete is poured into each recess to connect the floor units.

[0026] In this manner, the room unit formed by the floor slab and the permanent formwork is formed by the plurality of floor units and connected by concrete. As a result, the room unit can be divided and transported from the factory to the construction site.

Advantageous Effects of Invention

[0027] According to the present disclosure, it is possible to construct a building by using a lightweight room unit.

BRIEF DESCRIPTION OF DRAWINGS

[0028] Fig. 1A is a plan view showing a room unit according to an embodiment of the present disclosure.

Fig. 1B is a cross-sectional view taken along line B-B in Fig. 1A.

Fig. 2 is a perspective view showing a state in which a permanent formwork according to the embodiment of the disclosure is formed.

Fig. 3 is a plan view partially showing a building according to the embodiment of the disclosure.

Fig. 4 is a partially enlarged plan view of the building according to the embodiment of the disclosure.

Fig. 5A is an elevation view showing a state in which an upper room unit is placed above a lower room unit.

Fig. 5B is an elevation view showing a state in which a wall reinforcing bar is arranged.

Fig. 5C is an elevation view showing a state in which the room units are arranged after reinforcement arrangement.

Fig. 5D is an elevation view showing a state in which concrete is poured between the permanent formworks.

Fig. 6A is an elevation view showing a state in which the top floor of the building is constructed.

Fig. 6B is an elevation view showing a state in which the lowest floor is constructed.

Fig. 7A is a perspective view of that permanent formwork that is formed by a column formwork and a wall formwork.

Fig. 7B is a perspective view of the permanent formwork that is formed by the column formwork and a beam formwork.

Fig. 8A is a plan view showing a development example of the room unit according to the embodiment of the disclosure.

Fig. 8B is a cross-sectional view taken along line B-B in Fig. 8A.

Fig. 9A is a plan view showing a plurality of floor units included in the room unit according to the development example.

Fig. 9B is a cross-sectional view taken along line B-B in Fig. 9A.

Fig. 10A is a plan view showing a plate forming the floor unit.

Fig. 10B is a cross-sectional view taken along line B-B in Fig. 10A.

Fig. 11A is a plan view showing a state in which a poured portion is formed on the plate forming the floor unit.

Fig. 11B is a cross-sectional view taken along line B-B in Fig. 11A.

Fig. 12A is a plan view showing a state in which the permanent formwork is fixed onto the poured portion forming the floor unit.

Fig. 12B is a cross-sectional view taken along line B-B in Fig. 12A.

DESCRIPTION OF EMBODIMENTS

[0029] Hereinafter, a room unit, a building, and a building construction method according to an embodiment of the present disclosure will be described with reference to the drawings. Components denoted by the same reference numerals in the drawings mean the same components. However, unless otherwise specified in the specification, the number of components is not limited to one, and a plurality of components may be present.

[0030] In addition, a description of duplicate components and reference numerals in the drawings may be omitted. Note that the disclosure is not limited to the following embodiments, and can be implemented with modifications such as omission of a configuration or replacement with a different configuration within the scope of the object of the disclosure, if appropriate.

[0031] In each drawing, directions indicated by arrows X and Y are directions along a horizontal plane and are orthogonal to each other. A direction indicated by an arrow Z is a direction along a vertical direction (in other words, a top-bottom direction). In the drawings, the respective directions indicated by the arrows X, Y, and Z coincide with each other.

[0032] <Room Unit>

Figs. 1A and 1B illustrate a room unit 20 according to an embodiment of the disclosure. The room unit 20 is, for example, a structural body forming a dwelling of a housing complex, and is manufactured in a factory or the like. As will be described later, a plurality of room units 20 are assembled at a construction site to form a building 10 (see Fig. 3). Note that, in the present embodiment, the room unit 20 is a module unit that forms one dwelling.

[0033] (Floor Slab)

The room unit 20 includes a floor slab 22 and a permanent formwork 24. The floor slab 22 is a slab made of concrete, and is formed in such a way that end portions of a reinforcing bar 22A which is a slab reinforcement protrude from both end surfaces in a lateral direction (X direction) (in other words, both end surfaces in a longitudinal direction).

[0034] The reinforcing bars 22A protruding from the respective end surfaces of the floor slabs 22 are arranged to be shifted in position in the longitudinal direction (Y direction) of the floor slab 22. That is, the reinforcing bars 22A protruding from both end surfaces of the floor slab 22 in the X direction are arranged at positions not overlapping each other when viewed from the direction along the X direction.

[0035] In the case of assembling adjacent room units 20, the floor slabs 22 in the respective room units 20 are arranged in such a way that the end surfaces in the lateral direction face each other, but since the positions of the reinforcing bars 22A are shifted in the longitudinal direction of the floor slabs 22, interference between the reinforcing bars 22A is suppressed (see Fig. 4).

[0036] Although not shown in Fig. 1A, the floor slab 22 can be formed in such a way that portions forming a common hallway 32 and a balcony 34 as indicated by broken line hatching in Fig. 3 are formed integrally with a portion forming the dwelling.

[0037] Further, both or one of the common hallway 32 and the balcony 34 may be formed separately from the floor slab 22 and may be retrofitted to the room unit 20 at the construction site.

[0038] (Permanent formwork)

As shown in Figs. 1A and 1B, a permanent formwork 24 is fixed to an upper surface of the floor slab 22. The permanent formwork 24 includes a column formwork 24A for forming a column 12 of the building 10 shown in Figs. 3 and 4, and a wall formwork 24B for forming a wall 14 of the building 10.

[0039] As shown in Fig. 1A, the column formworks 24A are arranged at four corners (four corners of a portion to be an indoor space in the embodiment) of the floor slab 22, and the wall formwork 24B is arranged between the column formworks 24A along the outer periphery of the floor slab 22. In addition, the wall formwork 24B is arranged on the outer periphery serving as a door boundary in a case where the plurality of room units 20 are assembled, that is, on an end portion in the X direction (the outer periphery along the Y direction). Furthermore, the wall formwork 24B is arranged on a surface as an entrance side of the room unit 20, that is, one end portion in the Y direction (the outer periphery along the X direction).

[0040] The column formwork 24A alone does not serve as a formwork for the column 12 (see Fig. 3). As will be described later, the column formwork 24A serves as the formwork for the

column 12 by forming a space surrounded by the column formwork 24A and a column formwork 24C in an adjacent room unit 20.

[0041] Similarly, the wall formwork 24B alone does not serve as a formwork for the wall 14 (see Fig. 3). As will be described later, the wall formwork 24B serves as the formwork for the column 12 by forming a space surrounded by the wall formwork 24B or a wall formwork 24D in an adjacent room unit 20.

[0042] As shown in Fig. 2, the permanent formwork 24 is formed by layering wet materials M. A nozzle 100 of a shaping device (for example, a 3D printer) moves in the lateral direction while ejecting the paste-like wet material M to form the permanent formwork 24. As a result, a long layer of the wet material M is formed. The permanent formwork 24 is formed by forming these layers in the vertical direction.

[0043] In addition, in the permanent formwork 24, a portion forming the column formwork 24A and a portion forming the wall formwork 24B are integrally formed by continuously ejecting the wet material M to these portions. As described above, it is possible to save labor for constructing the room unit 20 by forming the permanent formwork 24 using a 3D printer or the like.

[0044] A curable material that is cured over time is used as the wet material M. Specifically, mortar (for example, normal strength mortar or fiber-reinforced mortar), gypsum, a molten resin, or the like is used as the wet material M. Examples of the molten resin include geopolymer. The geopolymer is a generic term for solidified bodies generated by a condensation polymerization reaction between alumina silica powder and an alkali solution.

[0045] (Other Components in Room Unit)

As shown in Fig. 1A, the room unit 20 includes a wall body 26 and a door/window 28 in addition to the floor slab 22 and the permanent formwork 24. The wall body 26 is a wall that partitions the inside (that is, an indoor space) and the outside (that is, an outdoor space) of the room unit 20. The door/window 28 is an openable and closable front door or glass window.

[0046] Furthermore, a partition wall, an inner door/window, a bathroom, a kitchen, a toilet, or the like (not shown) can be arranged inside the room unit 20, if necessary. Furthermore, the surfaces of the floor slab 22, the permanent formwork 24, the partition wall, and the like can be covered with a finishing material, if appropriate.

[0047] The respective components “other than” the floor slab 22 and the permanent formwork 24 in the room unit 20 may be attached at the factory, or may be attached at the construction site after the room unit 20 is carried into the construction site.

[0048] <Building>

Fig. 3 shows a part of the building 10 formed by assembling the room units 20. The

building 10 is a multi-layer building which is made of reinforced concrete and in which the plurality of room units 20 shown in Fig. 3 are arranged in the X direction and the vertical direction (Z direction).

[0049] As shown in Fig. 4, the building 10 is formed by pouring concrete between the permanent formworks 24 in the room units 20 adjacent to each other.

[0050] Specifically, the column 12 of the building 10 is formed of concrete poured between the column formworks 24A of the room units 20 adjacent to each other, and the column formworks 24A and 24C. In the case of pouring the concrete forming the column 12, the column formwork 24C is arranged on a side not covered by the column formwork 24A.

[0051] Similarly, the wall 14 of the building 10 is formed using concrete poured between the wall formworks 24B of the room units 20 adjacent to each other and the wall formwork 24B (or concrete and the wall formworks 24B and 24D). In the case of pouring the concrete forming the wall 14, the wall formwork 24D is arranged on a side surface not covered by the wall formwork 24B.

[0052] The wall 14 of the building 10 is a wall beam, and has a strength enough to omit a beam. The aspect of "having a strength enough to omit a beam" includes an aspect in which the thickness of the wall 14 is larger than that of a structure including a beam. Alternatively, it is possible to adopt an aspect in which the concrete forming the wall 14 is concrete having a strength higher than that of a wall including a beam.

[0053] Therefore, the beam is omitted in the building 10. Various aspects can be adopted as a structural form of the building 10, and details thereof will be described later.

[0054] The reinforcing bars are arranged in the concrete forming the column 12 and the wall 14. Specifically, a main column reinforcement 42 and a hoop reinforcement 44 are embedded in the column 12. Further, the reinforcing bar 22A protruding from the end surface of the floor slab 22 described above and a wall reinforcement 46 are embedded in the wall 14.

[0055] <Building Construction Method>

First, a method of constructing a reference floor of the building 10 will be described. The "reference floor" is a floor having a planar configuration that is repeated most frequently over a plurality of layers, and is a middle floor other than the lowest floor and the top floor in the building 10.

[0056] The room unit 20 is placed above a lower floor as shown in Fig. 5A in order to construct the reference floor of the building 10. Specifically, a room unit 20U forming the upper floor is placed above a room unit 20D forming the lower floor.

[0057] At this time, the room unit 20U is arranged in such a way that the X-direction position and the Y-direction position of the permanent formworks 24 of the upper and lower floors

coincide with each other. The reinforcing bar 22A protruding from the floor slab 22 in the room unit 20U is arranged above concrete C1 forming the wall 14 of the lower floor.

[0058] Next, the wall reinforcements 46 of the upper floor are arranged as shown in Fig. 5B. Among the wall reinforcements 46, the wall reinforcements 46 of the upper floor along the vertical direction are joined to the wall reinforcements 46 of the lower floor along the vertical direction by using a mechanical joint 46A. The wall reinforcements 46 may be pressure-welded to each other. The upper end of the wall reinforcement 46 in the vertical direction protrudes from the upper end surface of the permanent formwork 24.

[0059] Similarly, the main column reinforcement 42 and the hoop reinforcement 44 shown in Fig. 4 are arranged. The upper end of the main column reinforcement 42 protrudes from the upper end surface of the permanent formwork 24.

[0060] Next, as shown in Fig. 5C, the room unit 20U is arranged next to a previously arranged room unit 20U. At this time, the room unit 20U is arranged in such a way that the X-direction position and the Y-direction position of the permanent formworks 24 of the upper and lower floors coincide with each other.

[0061] Then, the column formwork 24C and the wall formwork 24D shown in Fig. 4 are arranged, and concrete is poured between the permanent formworks 24 in the room units 20U adjacent to each other. Specifically, the concrete C1 is poured between the wall formworks 24B adjacent to each other and between the wall formworks 24B and 24D. Concrete C2 is poured between the column formworks 24A and 24C. The concrete C1 and the concrete C2 are integrally poured.

[0062] As a result, the room unit 20U of the upper floor is constructed above the lower floor as shown in Fig. 5D.

[0063] The wall 14 is formed by two wall formworks 24B and the concrete C1, but a structural bearing force is secured by the concrete C1. The thickness of the concrete C1 is larger than the sum of the thicknesses of the two wall formworks 24B, and the mass of the concrete C1 per unit area when the wall 14 is viewed from the front is larger than the sum of the masses of the two wall formworks 24B.

[0064] The floor slab 22 of the room unit 20U is joined to the wall 14 of the upper floor via the reinforcing bar 22A (see Fig. 5B) by pouring the concrete C1. In addition, the wall 14 of the upper floor is joined to the wall of the lower floor via the wall reinforcement 46.

[0065] Although no ceiling member is formed in each of the room units 20, the ceiling member of the room unit 20D is formed with the floor slab 22 of the room unit 20U of the upper floor.

[0066] In a case where a floor is further constructed above the floor constructed by the room

unit 20U, the reference floor is constructed by repeating a procedure described with reference to Figs. 5A to 5D.

[0067] Then, the top floor of the building 10 is also constructed by repeating the procedure described with reference to Figs. 5A to 5D. However, a ceiling member 50 different from the floor slab 22 is provided in the room unit 20 forming the top floor as shown in Fig. 6A.

[0068] Various methods can be adopted as a method of fixing the ceiling member 50 to the room unit 20. A precast concrete plate material, a corrugated steel plate, or the like may be used as the ceiling member 50. In addition, the ceiling member may be constructed by on-site concrete. From the viewpoint of the comfort of the room unit 20, the ceiling member 50 is preferably subjected to a water stop treatment and a heat insulation treatment.

[0069] The lowest floor of the building 10 is also constructed by repeating the procedure described with reference to Figs. 5A to 5D. However, the room unit 20 forming the lowest floor is fixed to a foundation 60 as shown in Fig. 6B.

[0070] The foundation 60 is a supporting body of the building 10 constructed on the ground surface and made of reinforced concrete, and has, for example, a rising portion 62 on which the room unit 20 is placed. A basic reinforcement 64 protrudes from the upper surface of the rising portion 62. The above-described wall reinforcement 46 is joined to the basic reinforcement 64.

[0071] The building 10 has been described as a multi-story building in the above description. However, the building 10 can also be a two-story building or a single-story building. In this case, the configuration described with reference to Figs. 5A and 5B is applied to the building 10.

[0072] <Actions and Effects>

As shown in Figs. 1A and 1B, the room unit 20 according to the embodiment of the disclosure includes the floor slab 22, and the permanent formworks 24 serving as the formworks for the column 12 and the wall 14 (see Fig. 3). The "permanent formwork" is a concrete formwork that forms a column or wall, and thus is lighter than the body of the column or wall formed of concrete.

[0073] Therefore, the room unit 20 is easier to transport from the factory to the construction site and to lift even at the construction site as compared with a room unit including the body of the column or wall formed of concrete.

[0074] Further, the permanent formwork 24 is formed integrally with the floor slab 22, but is not formed integrally with the ceiling member. Therefore, the permanent formwork 24 does not need to support the load of the ceiling member at the time of transportation from the factory to the construction site or the like. Therefore, for example, the room unit is lighter than a room unit in which a ceiling member and a wall supporting the ceiling member are integrally formed.

That is, according to the disclosure, the building 10 can be constructed by using the lightweight room unit 20.

[0075] Furthermore, the building 10 according to the embodiment of the disclosure is constructed by combining a plurality of room units 20. The floor slab 22 is formed in the room unit 20. Therefore, it is not necessary to construct the floor of the building 10 in the site.

[0076] In addition, the wall 14 and the column 12 in the building are formed by pouring concrete (the concrete C1 and the concrete C2) between the permanent formworks 24 forming the room unit 20. Therefore, the number of formworks to be constructed in the site can be reduced, and a construction period can be shortened.

[0077] In addition, in the building 10 according to the embodiment of the disclosure, a ceiling member in the room unit 20D of the lower floor is formed with the floor slab 22 in the room unit 20U of the upper floor as shown in Fig. 5D. Therefore, the ceiling member does not have to be formed in each room unit 20D arranged in the lower floor. As a result, the configuration of the room unit 20 can be simplified.

[0078] (Modified Example)

In the above embodiment, the permanent formwork 24 is formed using the column formwork 24A and the wall formwork 24B as shown in Fig. 7A, but the embodiment of the disclosure is not limited thereto.

[0079] For example, the wall formwork 24B may be omitted, and the column formwork 24A and a beam formwork 24E for forming a beam in the building 10 may be provided as in a permanent formwork 70 shown in Fig. 7B. In a case where the beam formwork 24E is formed by a 3D printer, a support and a plate material are arranged at a portion forming a beam bottom, and the support and the plate material are held until the wet material is cured.

[0080] By using such a permanent formwork 70, the building 10 can be constructed as a column and beam structure (in other words, a Rahmen structure). The permanent formwork may include all of the column formwork 24A, the wall formwork 24B, and the beam formwork 24E. Also in this case, the building 10 can be constructed as the column and beam structure (in other words, the Rahmen structure).

[0081] Further, the permanent formwork may be formed of only a wall formwork without the column formwork 24A and the beam formwork 24E. A building having a wall structure can be constructed by constructing the permanent formwork in this manner. As described above, the structural form of the building in which the room units 20 are combined is not particularly limited.

[0082] In the embodiment, the permanent formwork 24 is formed by a 3D printer using the wet material M, but the embodiment of the disclosure is not limited thereto. For example, the

permanent formwork may be formed by manually layering the wet material M instead of using a 3D printer.

[0083] Further, at the time of forming the permanent formwork 24, an uneven member or the like that bites into an interface between the respective layers may be arranged between the respective layers formed of the wet material M. As a result, it is possible to suppress the occurrence of deviation at the interface of the wet material M.

[0084] The permanent formwork 24 may be formed of a dry material instead of a wet material. Various kinds of veneers such as a lightweight cellular concrete (ALC) panel and a concrete panel can be used as the dry material.

[0085] <Development Example of Room Unit>

Figs. 8A and 8B illustrate a room unit 80 which is a development example of the room unit 20. The room unit 80 includes a plurality of floor units 80A, 80B, 80C, and 80D, concrete 86, and a joint formwork 88.

[0086] (Floor Unit)

The room unit 80 is formed by assembling the floor units 80A, 80B, 80C, and 80D shown in Figs. 9A and 9B. As shown in the drawings, each of the floor units 80A, 80B, 80C, and 80D includes a floor slab 82 and a permanent formwork 84.

[0087] Further, the floor slab 82 includes a precast concrete plate 82A and a poured portion 82B formed on the plate 82A. "First concrete" in the disclosure refers to a configuration including both the plate 82A and the poured portion 82B.

[0088] The outlines of the floor units 80A, 80B, 80C, and 80D shown in Fig. 9A indicate the outline of the plate 82A. As shown in the outlines of the floor units 80A and 80C, the plate 82A is formed by cutting out a peripheral edge portion, if necessary. As shown in the floor units 80B and 80D, a plurality of plates 82A are arranged, if necessary.

[0089] The poured portion 82B is concrete poured on the plate 82A except for a part of the peripheral edge portion of the plate 82A. The "part of the peripheral edge portion of the plate 82A" is a joint portion between the floor units 80A, 80B, 80C, and 80D. In addition, the "part of the peripheral portion of the plate 82A" is a peripheral edge portion to which the permanent formwork 84 is not fixed in each of the floor units 80A, 80B, 80C, and 80D.

[0090] In each of the floor slabs 82 forming the floor units 80A, 80B, 80C, and 80D, a portion where the poured portion 82B is not formed is a recess 82V having a smaller thickness than other portions.

[0091] Further, a reinforcing bar 22A, which is a slab reinforcement, is arranged inside the poured portion 82B. The reinforcing bar 22A is arranged in such a way that an end portion of the reinforcing bar 22A protrudes from an end surface of the poured portion 82B.

[0092] The permanent formwork 84 is fixed to each of the floor units 80A, 80B, 80C, and 80D. The permanent formwork 84 is fixed to the poured portion 82B. A portion to which the permanent formwork 84 is fixed in the poured portion 82B is a portion to be an outer peripheral portion of the room unit 80 shown in Fig. 8A.

[0093] In the room unit 80, the concrete 86 is poured into the recess 82V as shown in Fig. 8A in a state where the floor units 80A, 80B, 80C, and 80D shown in Fig. 9A are arranged. The concrete 86 is a connecting member that connects a plurality of floor units (the floor units 80A, 80B, 80C, and 80D). The concrete 86 is an example of second concrete in the disclosure.

[0094] Further, the joint formwork 88 is bridged between the permanent formworks 84 in the floor units 80A, 80B, 80C, and 80D arranged adjacent to each other. The joint formwork 88 is temporarily fixed to the permanent formwork 84.

[0095] Although not shown in Fig. 8A, similarly to the floor slab 22, the floor slab 82 can be formed in such a way that portions forming the common hallway 32 and the balcony 34 as indicated by the broken line hatching in Fig. 3 are formed integrally with a portion forming a dwelling. Further, both or one of the common hallway 32 and the balcony 34 may be formed separately from the floor slab 82 and may be retrofitted to the room unit 20 at the construction site.

[0096] (Other Components in Room Unit)

As shown in Fig. 8A, the room unit 80 includes a wall body 26 and a door/window 28 similarly to the room unit 20. Furthermore, a partition wall, an inner door/window, a bathroom, a kitchen, a toilet, or the like (not shown) can be arranged inside the room unit 80, if necessary. Furthermore, the surfaces of the floor slab 82, the permanent formwork 84, the partition wall, and the like can be covered with a finishing material, if appropriate.

[0097] <Room Unit Construction Method>

(Construction of Floor Slab)

First, the precast concrete plates 82A are laid as shown in Figs. 10A and 10B in order to construct the room unit 80. At this time, the plates 82A forming the floor units 80A, 80B, 80C, and 80D may be arranged while being spaced apart from each other as shown in Fig. 9A.

[0098] Next, the reinforcing bars 22A as slab reinforcements are arranged as shown in Figs. 11A and 11B, and concrete is then poured on the plate 82A to form the poured portion 82B. The poured portion 82B is poured to portions other than a portion serving as a joint between the respective floor units 80A, 80B, 80C, and 80D (that is, portions on boundary lines E1, E2, and E3).

[0099] As a result, the recess 82V having a smaller thickness than the other portions is formed in each of the floor units 80A, 80B, 80C, and 80D. Further, a plurality of floor slabs 82 forming

the respective floor units 80A, 80B, 80C, and 80D are constructed.

[0100] The boundary line E1 is a boundary line between the floor unit 80A and the floor units 80B and 80D. The boundary line E2 is a boundary line between the floor unit 80C and the floor units 80B and 80D. The boundary line E3 is a boundary line between the floor unit 80B and the floor unit 80D.

[0101] In pouring the concrete forming the poured portion 82B, it is preferable to roughen an upper surface of the plate 82A from the viewpoint of securing an adhesion of the concrete. Alternatively, a cotter may be formed on the upper surface of the plate 82A. Alternatively, a plate in which a reinforcing bar is exposed from an upper surface may be used as the plate 82A.

[0102] (Construction of Floor Unit)

Next, the permanent formwork 84 is fixed to each of the floor slabs 82 included in the floor units 80A, 80B, 80C, and 80D as shown in Figs. 12A and 12B. The permanent formwork 84 is a portion excluding the recess 82V and is formed above the poured portion 82B. A method of forming the permanent formwork 84 is similar to that of the permanent formwork 24, and thus, a description thereof will be omitted. Through the above process, the floor units 80A, 80B, 80C, and 80D in which the permanent formwork 84 is fixed to the floor slab 82 are constructed.

[0103] The above processes are performed in the factory. A part of the above process may be performed in the factory, and the other part may be performed in a work yard of the construction site.

[0104] The floor units 80A, 80B, 80C, and 80D can be divided at the boundary lines E1, E2 and E3. Therefore, each of the floor units 80A, 80B, 80C, and 80D can be transported from the factory to the construction site where the room unit 80 is constructed in a divided state, that is, in a state of being subdivided from the room unit 80.

[0105] (Construction of Room Unit)

Next, the floor units 80A, 80B, 80C, and 80D are arranged side by side, and the concrete 86 is poured into the recess 82V at the construction site or the work yard as shown in Figs. 8A and 8B. As a result, the floor units 80A, 80B, 80C, and 80D are connected to each other. At the time of pouring the concrete 86, it is preferable to arrange a slab reinforcement forming a lap joint with the reinforcing bar 22A.

[0106] Next, the joint formwork 88 is bridged over the permanent formworks 84 in the floor units 80A, 80B, 80C, and 80D arranged adjacent to each other. As a result, the room unit 80 is constructed. The wall body 26, the door/window 28, other partition walls, the inner door/window, the bathroom, the kitchen, the toilet, and the like may be arranged before the concrete 86 is poured, or may be arranged after the concrete 86 is poured. That is, the wall

body 26, the door/window 28, other partition walls, the inner door/window, the bathroom, the kitchen, the toilet, and the like may be arranged at the factory or at the construction site.

[0107] The room units 80 constructed as described above can be assembled to form the building 10 similarly to the room unit 20.

[0108] <Supplementary Note>

The following configuration will be additionally described as a development example of the room unit 80.

[0109] A room unit including: a plurality of floor units each including a floor slab formed using first concrete and including a recess formed at a peripheral edge and having a thickness smaller than that of other portions, and at least one of a wall member or a column member fixed to the floor slab; and second concrete poured into the recesses of the plurality of floor units arranged side by side and connecting the plurality of floor units.

[0110] That is, the development example of the room unit 80 can include: the plurality of floor units 80A, 80B, 80C, and 80D each including the floor slab 82 formed using the first concrete (the plate 82A and the poured portion 82B) and including the recess 82V formed at the peripheral edge and having a thickness smaller than that of other portions, and at least one of the wall member or the column member fixed to the floor slab 82; and the second concrete (concrete 86) poured into the recesses 82V of the plurality of floor units 80A, 80B, 80C, and 80D arranged side by side and connecting the plurality of floor units 80A, 80B, 80C, and 80D.

[0111] Here, the "wall member or the column member fixed to the floor slab 82" is a wall member or a column member as a structural member of the building 10. The wall member or column member can be applied in place of the permanent formwork 84. In a case where the building 10 is constructed by using the room unit 80 including such a wall member or column member, concrete pouring work at the construction site can be reduced.

[0112] The disclosure of Japanese Patent Application No. 2021-084935 filed on May 19, 2021 is incorporated herein by reference in its entirety. All documents, patent applications, and technical standards mentioned herein are incorporated herein by reference to the same extent as if each individual document, patent application, and technical standard were specifically and individually stated.

CLAIMS

1. A room unit that is assembled at a site to form a building including a plurality of the room units, the room unit comprising:

a floor slab; and

a permanent formwork provided integrally with the floor slab and serving as a formwork for at least one of a column or a wall.

2. The room unit according to claim 1, wherein:

the floor slab is formed using first concrete and includes a recess formed at a peripheral edge and having a thickness smaller than other portions,

a plurality of floor units are formed by the floor slab and the permanent formwork, and second concrete that is poured into the recesses of the plurality of floor units arranged side by side and connects the plurality of floor units is provided.

3. A building including the room unit according to claim 1 or 2, the building comprising:

a wall or a column formed by pouring concrete between permanent formworks of room units that are adjacent to each other; and

a ceiling member arranged on an upper side of the room unit.

4. The building according to claim 3, wherein:

the room units are layered in a vertical direction, and

a ceiling member in a room unit of a lower floor is formed with a floor slab of a layered room unit of an upper floor.

5. The building according to claim 3 or 4, wherein the permanent formwork is formed by layering a wet material.

6. A building construction method comprising:

laterally arranging room units each including a floor slab and a permanent formwork that is provided integrally with the floor slab and serves as a formwork for at least one of a column or a wall,

pouring concrete between permanent formworks in room units that are adjacent to each other to construct a lower floor; and

arranging a room unit forming an upper floor above the lower floor to form a ceiling member of a room unit of the lower floor with a floor slab in the room unit of the upper floor.

7. The building construction method according to claim 6, further comprising:

forming a plurality of floor slabs each including a recess formed at a peripheral edge by pouring concrete on a part of an upper side of a precast concrete plate;

forming a plurality of floor units by fixing the permanent formwork to each of the floor slabs;

arranging the plurality of floor units side by side; and

forming the room unit by pouring concrete into each recess and connecting the plurality of floor units.