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(54) **Method for making a floor slab element with drainage installation and the floor slab element**

(57) The object of the invention is a method for making a floor element (1) including a wet room provision area (3) by essentially continuous mold casting. Onto the mold are placed at least floor drain installation fittings,

the floor slab element (1) is then cast, wherein inclination formatting required by the floor drain (5) is carried out in the wet room area (3). Further, the invention comprises a floor slab element (1) including such a wet room provision area.

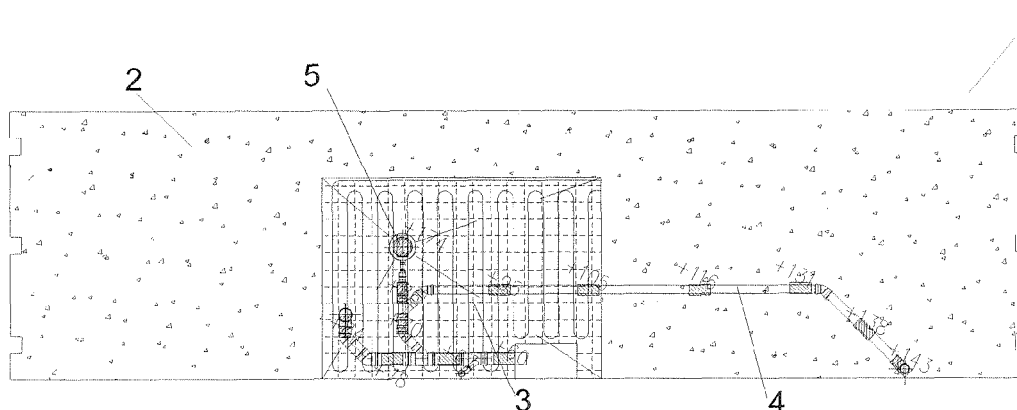


FIG. 1

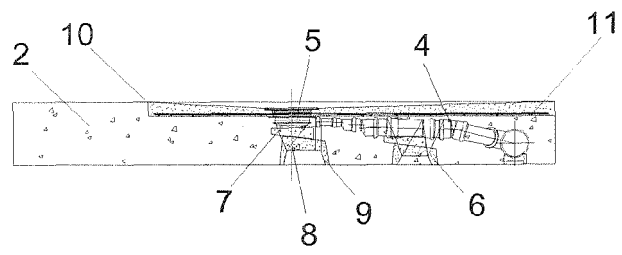


FIG. 3

Description

Field of the invention

[0001] The invention relates to the field of prefabricated concrete building elements. Particularly, the invention relates to a method of making a floor element and to a floor element.

Background of the invention

[0002] In residence buildings, especially in a bathroom area, space is needed in intermediate floor constructions for installation fittings, such as heating, plumbing, ventilation and electrical installation fittings. Conventionally, bathroom intermediate floor constructions have been made either casting in place on top of cast molds, as a composite slab or from load-bearing precast slabs.

[0003] When casting in place, all installation fittings are pre-mounted on top of the casting mold in the course of the reinforcement work, and after that the floor structure is cast, whereupon the installation fittings remain inside the cast concrete. In a composite slab solution, a thin composite slab is mounted undermost on site, acting as a mold for the final cast and later partly as a part of the supporting structure. Additional reinforcement and installation fittings are placed on the composite slab and a floor structure is cast on top of the installation fittings.

[0004] When using prefabricated elements, the installation fittings are placed on site on top of the slab element and the final surface layer of the floor is cast leaving the installation fittings within the cast concrete. In this solution, the floor structure in the bathroom area is made thinner so as to be thinner than the other areas, so that the thickness of the final slab does not grow too much. This can be done at the factory, for example in casting phase, by breaking the hollow structure and compressing the concrete solid in the bathroom area, creating an appropriate sanitary cabin provision.

[0005] The problem in the above-described solutions is the large amount of casting in place on site. Casting in place involves numerous working steps and the concrete setting time is long, slowing down construction. At a frame stage, subcontractors are required on site simultaneously for different phases and scheduling of them is difficult, which often causes waiting and extends the total schedule. Also, raw materials transportation costs and carbon dioxide emissions are greater compared to totally industrially produced slabs. Consequently, there has been a demand to develop intermediate floor designs intended for wet room structures and speed up construction work in on-site conditions.

Disclosure of the invention

[0006] In the solution according to the invention, a floor slab element which is completely factory-prefabricated and includes a wet area provision is used as a floor struc-

ture for wet rooms, which slab element is produced by essentially continuous mold casting. Onto the mold into the relevant areas are placed at least floor drain installation fittings, the floor is cast and pitch formatting required for floor draining is done in the wet room area.

[0007] According to one embodiment, a floor element cast is done at least in the floor drain pitch formatting area as a layered multi-phase cast using concrete having varying viscosity.

[0008] According to another embodiment, a wet room area is limited with a separating mold during at least one cast phase.

[0009] According to a further embodiment, additional slab-specific installation fittings are placed into the mold before the cast.

[0010] According to a further embodiment, at least the areas outside of the wet room provision are cast with self-compacting concrete.

[0011] In addition, the invention provides a floor element which comprises, in the wet room area, at least floor drain plumbing and floor drain pitch formatting and is, at least in the wet room area, made using essentially continuous mold casting.

[0012] Floor elements which are completely prefabricated at the factory significantly accelerate construction work, since time-consuming casting-in-place is no longer needed. Also, construction quality is improved when curvature differences are reduced.

[0013] More specifically, the method according to the invention is characterized by what is stated in the characterizing part of claim 1, the floor element according to the invention is characterized by what is stated in the characterizing part of claim 7.

[0014] The invention will be described in more detail by way of example in the following, with reference to the enclosed drawings, wherein:

Fig. 1 shows a floor element according to the invention seen from above;

Fig. 2 shows a cross section of the floor element according to Fig. 1, and

Fig. 3 shows a cross section of a floor element according to the invention at the site of the floor drain.

[0015] In Figure 1 is shown floor element 1, which consists of slab part 2 and wet room provision area 3. Wet room provision area 3 is a space requiring inclination, e.g. bathroom with floor drain 5. In a process of manufacturing floor element 1 at a factory, reinforcements are firstly placed into the mold, for example prestressed reinforcing strands. Next, the installation fittings required as selected are mounted into the wet room provision area 3, such as heating, water, plumbing, ventilation and electrical installation fittings and heating system plumbing or wires. Plumbing, like sewer pipes 4, must be exactly in the right place and must have the right slope. Also, location and height of floor drains 5 are strictly defined. Sewer pipes 4 and floor drains 5 must be supported so that they

do not move or rise during casting.

[0016] In Figure 2 is shown a cross section of floor element 1, where sewer pipes 4 has been supported in the mold with the aid of adjustable prefabricated concrete supports 6. Adjustable concrete supports 6 are preferably made of recycled waste concrete, in which case they are heavy and large enough to anchor the pipes during casting, and they do not require separate fastening to the mold. Concrete support 6 consists of parts 6, 7 and 8, which are designed in such a way that when they are moved in various directions relative to each other, the overall height of the support changes. Figure 3 shows that top concrete part 7 is so designed that it forms a parallel support surface with pipe 4, resulting in e.g. that drain 5 is positioned at the desired inclination, for example 1:50 or 1:60 - 1:100. The undermost concrete part 8 has studs 9 in the bottom, so that the space between the bottom of concrete support 6 and the mold is filled with concrete during the element cast.

[0017] When all the required installation fittings and reinforcement have been mounted onto the bottom of the mold, the first cast is carried out over the entire area of floor element 1 to a determined height, whereby the installation fittings located on the bottom of the mold become partly or totally embedded in concrete. In a suitable phase of the cast, a stiff sheet-shaped separation mold 10 is installed at the border area between the wet room and the rest of the room space, forming a recess 11 at the wet room area. Sheet-shaped separation mold 10 acts as a temporary mold stopper, preventing the concrete from moving into the recess area 11 as the cast in slab part 2 is raised to its final height. A dam mold method can be used to generate recess area 11. The height of recess area 11 is determined by the space required by pitch casting, plumbing, cabling and floor drain connections and can be 30 - 60 mm, typically 50 mm. Floor drain 5 within recess area 11 is for example 10 - 50 mm above the bottom of recess area 11. In the first cast is preferably used self-compacting concrete, the slump flow of which may be 450 - 800 mm.

[0018] When the concrete has stiffened sufficiently after the first cast, underfloor heating cables or pipes are installed at the desired height position in recess area 11. Also other required installations can be done in recess area 11. Subsequently, a second cast, the so called pitch cast, is carried out in recess area 11, generating sufficient pitch in the wet room area. The pitch cast is usually made using concrete different from that used in the first cast, for example by topping, in which the maximum grain size is below 8 mm, whereby an inclination is effected in the top surface of the recess area. The pitch cast is usually carried out as soon as possible after the first cast phase, so the concrete does not have time to harden and the cast simultaneously acts as a part of the supporting structure of the element, forming a monolithic composite structure with the earlier cast. The timing of the second cast depends on the speed of the concrete receipt and the concrete temperature, and it can be carried out for ex-

ample 10-120 minutes after the first cast.

[0019] According to one example, a floor element is cast in one phase whereby selected installation fittings are placed into the mold before the cast either at a wet room provision area and/or to a slab part. The installation fittings can comprise heating system plumbing or cables. In addition, a separation mold can be installed in the space requiring inclination in the wet room provision area, but the cast can be done also without a separation mold. Next, the slab part and the wet room provision area are cast with the same or different concrete.

[0020] According to a further example, a floor slab element is cast as a two-phase casting. The first and the second cast are done over the entire floor element area, whereby in the second cast a wet room provision area is formed into a space needing inclinations. Before the first cast, selected installation fittings are mounted into the mold either in the wet room provision area and/or to the slab part. Installation fittings may include heating system plumbing or cables. After the first cast, a separation mold is placed in the space requiring inclinations. Heating system plumbing or cables will be installed either to the wet room provision area and/or to the slab part if they have not been added before the first cast. Next, the second cast is done over the slab part and in the wet room provision area, using either the same or different concrete. The wet room provision area can be formed also without a separation mold, in which case the second cast is done on the slab part and in the wet room provision area, and the inclinations in the wet room provision area are formed in context of the cast by adjusting the amount of concrete and simultaneously applying floating until sufficient inclinations are achieved.

[0021] According to a still further example, the slab part is cast to its final height in one phase and the area having a shaped surface in two phases. Before the first cast, selected installation fittings are mounted into the mold. The installation fittings can include a heating system plumbing or cables. In addition, a separation mold is mounted in the space requiring inclinations before the first cast to form a surface-shaping area. The separation mold and the heating system plumbing or cables are supported and fixed so that they do not move during the cast. Next, the slab part is cast to its final height and the first cast is carried out in the wet room provision area. After the first cast, heating system plumbing or cables are installed if needed in the space requiring inclinations and the second, pitch-forming cast is carried out.

[0022] According to a still further example, the cast is done at least in a floor drain inclination area as a layered multi-phase cast with concrete having the same or different viscosity. The cast can be done as multi-phase cast if e.g. different installation fittings require it. Preferably, the cast is done in one or in two phases.

[0023] In all the above mentioned examples, the floor heating can be left out completely whereby heating system plumbing or cables are not installed before the first or the second cast, or if desired they can be mounted

over the whole floor element area or only over the slab part or in the wet room provision area. For example, installation fittings mounted prior to the first cast include heating, water, sewer, ventilation and electrical installation fittings. After the first cast, heating system plumbing or cables are installed only in the wet room provision area. According to the second example, installation fittings including heating, water, sewer, ventilation and electrical ducts as well as heating system plumbing or cables are mounted over the whole slab part prior to the first cast.

[0024] The concrete used in multi-phase casting can be the same throughout or it may vary between phases. Preferably, the concrete used in all casts is self-compacting concrete. The surface-shaped area is formed by floating and it can be formed also without a separation mold. A wet room area can also be coated ready at the factory, for example with moisture-proofing or waterproofing layer, in which case the element does not get wet in the storage or on site and the structure dries faster. Moisture protector / waterproofing agent is sprayed onto the second cast, i.e. the pitch cast at the appropriate phase after casting before unloading the elements from the mold line.

[0025] Using the solution according to the invention the element height is reduced, for example from previously used 370 mm to 270 mm, because a massive slab is used as an element and installation fittings are mounted inside the floor element at the factory. A thinner intermediate floor allows a lower overall storey height or allows for increasing the room height. Because of the massive structure, the width and the length of the element can be increased, leading to faster installation and the number of floor elements decreases even by three elements for each apartment. As a result, less filling and joint grouting is required on site, whereby the consumption of concrete and joint steel bars is reduced and the wet room floor dries faster.

[0026] The solution according to the invention leads to a greater preproduction rate, whereby the working stages on site and construction costs are reduced and time spent in planning is decreased. When plumbing and HVAC are installed inside the element at the factory, no subcontractors are required on site in the frame phase for these stages, and scheduling is easier. Also, construction quality is improved when curvature differences are reduced, leading to decreased use of filler.

[0027] A 270 mm massive slab according to the invention is 140 kg heavier per square meter than the commonly used 370 mm hollow-core slab. As a result of the weight difference, the air and impact sound isolation of the massive slab according to the invention is better than the above-mentioned hollow-core slab.

[0028] The floor element according to the invention can also be used outside of the bathroom, for example in the sauna, kitchen, toilet and other wet areas. None of the solutions disclosed above restrict the use of the invention in other appropriate locations.

Claims

1. A method for making a floor element (1) including a wet room provision area (3) by essentially continuous mold casting, **characterized in that** at least floor drain installation fittings are placed onto the mold, the floor element (1) is cast and inclination formatting required by the floor drain (5) is done in the wet room provision area (3).
2. A method according to claim 1, **characterized in that** the cast is carried out as a layered multi-phase cast at least in the floor drain (5) inclination formatting area.
3. A method according to claim 1 or 2, **characterized in that** the cast is carried out in the wet room provision area (3) as a multi-phase cast using concrete having varying viscosity.
4. A method according to any of the preceding claims, **characterized in that** the wet room provision area (3) is limited with a separating mold (10) at least during one casting phase.
5. A method according to any of the preceding claims, **characterized in that** additional slab-specific installation fittings are placed into the mold before the casting.
6. A method according to any of the preceding claims, **characterized in that** at least the areas outside of the wet room provision area (3) are cast using self-compacting concrete.
7. A floor element (1), which comprises in the wet room area (3) at least floor drain plumbing and floor drain (5) inclination formatting and is, at least in the wet room area (3), made using essentially continuous mold casting.

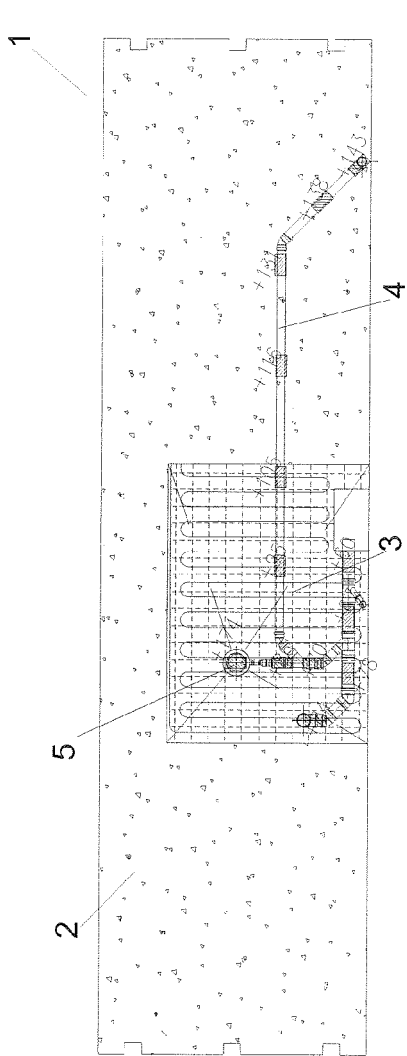


FIG. 1

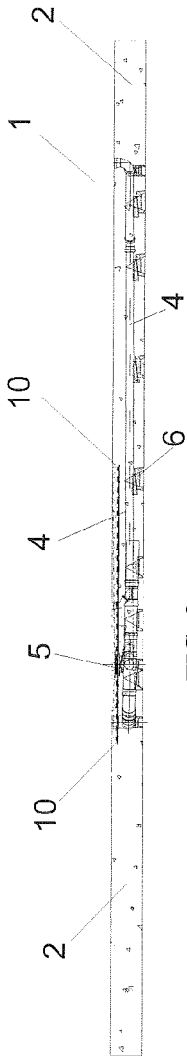


FIG. 2

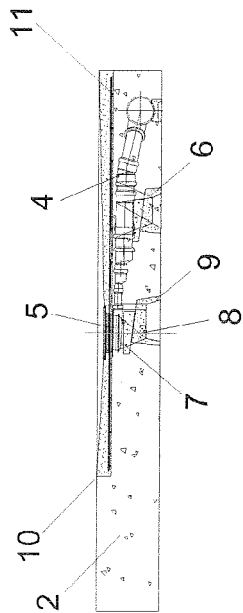


FIG. 3



EUROPEAN SEARCH REPORT

Application Number
EP 10 39 7526

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Y	* page 1, line 1 - line 7 * * page 5, line 25 - page 8, line 28 * * page 10, line 1 - line 29; claim 6; figures 11-4, 13, 14 *	2-6	E04B5/48 E04C2/52 E04G15/06
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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 10 March 2011	Examiner Giannakou, Evangelia
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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