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PATENT SPECIFICATION

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(54) IMPROVEMENTS IN BUILDING CONSTRUCTION

(71) We, FOREST CITY DILLON, INC., a corporation organised and existing under the laws of the State of Ohio, United States of America, of 1730 Akron-Peninsular Road, Akron, State of Ohio, United States of America, do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The invention relates to the field of building construction, either dwelling or commercial and either single or multi-storey.

It further relates to the incorporation of precast building components into a field erection that is accompanied by field positioning of reinforcing means, followed by embedding the same within and on top of the precast components that have been erected.

This invention is concerned with extending the basic concepts set forth in British patent specification 1,336,748. This patent disclosed an arrangement wherein precast bearing walls having through voids therein are united with half-thickness floor slabs through the medium of angular reinforcing rods and site-poured concrete.

According to one aspect of the invention there is provided a multi-storey building comprising pre-cast components including vertical load-bearing walls supporting the ends of floor slabs, each wall component having internal vertical voids extending from top to bottom, and each floor slab being of partial thickness relative to the completed floor; the building being erected with said ends of the floor slabs leaving the voids of the wall components exposed so that the voids of a lower wall communicate with the voids of the wall next above, shear dowels being arranged in the voids to join said wall components to one another, tension steel being laid on the ends of the

floor slabs across the gap, and concrete being poured into the voids and over the floor slabs, on site, to embed the shear dowels and tension steel, and to bring the floor to full thickness.

According to a second aspect of the invention there is provided a method of erecting a multi-storey building using pre-cast components including vertical load-bearing wall components having internal vertical voids extending from top to bottom, and floor slabs of partial thickness relative to the completed floor, comprising the steps of:

assembling the wall components and floor slabs of one storey so that the ends of the floor slabs rest on the walls leaving the voids exposed;

inserting shear dowels in the voids to protrude upwardly therefrom;

laying tension steel over the ends of the floor slabs across the gap;

assembling the wall components of the next storey so that the voids thereof communicate with the voids of the wall components directly below and the shear dowels connect the components; and

pouring concrete into the voids and over the floor slabs to embed the shear dowels and tension steel, and to bring the floor to full thickness.

Preferably, utility or service modules are provided, modified by forming the same with horizontally projecting reinforcing means, to be tied in to the floor slabs shown in the abovementioned specification to thus preclude any lateral shifting between the module and the floor slab.

Further, in this regard, by establishing a careful relationship in thickness between the two, the service module slab, upon being properly positioned, can serve as a natural "form" for the site-poured concrete.

Additionally, it has been found that if elevator modules are provided with vertical

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voids in the walls thereof, the same can be structurally integrated with the remaining components of the overall building, and thus the elevator shafts that result will be structurally united with the building instead of being supported independently thereof as is the normal building procedure.

It has been found that if the voids in the walls are poured separately from the time the floor is poured, this will permit improved placement of the reinforcing means so that additional forces against tension, shear, and seismic forces, as well as forces against lateral shifting, can all be positioned prior to the time the floor is poured in the field.

It has also been found that by utilizing a system of this type, it is possible to use other precast elements such as precast corridor walls and precast balcony slabs, with all of these essential components being tied together in the final pouring of the floor as the building progresses upwardly floor by floor.

It has also been discovered that erecting a building in the manner that will hereinafter be described produces an additional advantage in that a high degree of safety for the workmen can be maintained since at all times during construction they are provided with a solid surface upon which to stand. The use of scaffolding of the conventional type can be avoided throughout construction.

In The Drawings:

Figure 1 is an isometric view partially broken away and illustrating a partially built building embodying the invention;

Figure 1A is a perspective view similar to Figure 1 but taken from a different angle and showing the structure just below the floor level of the floor that is immediately thereabove;

Figure 2 is a similar isometric view partially exploded;

Figures 3, 4, and 5 are further perspective views, with Figure 3 illustrating the condition of the component parts after positioning, while Figure 4 illustrates the positioning of the sheer dowels, tensioning steel, and reinforcing steel; Figure 5 shows the completed product broken away and in section;

Figure 6 is a similar perspective view partially broken away in section and showing the manner in which the corridor beams, heart module, floor truss slabs, and balcony slabs are positioned with regard to a typical bearing wall;

Figures 7 and 7A comprise a plan view using match lines A—B to show a typical floor of a building;

Figure 8 is a sectional view taken on the lines 8—8 of Figure 7;

Figures 9, 9A, and 9B are floor plans of a typical one bedroom unit (9), a typical one bedroom end unit (9A), and a typical efficiency unit (9B);

Figures 10 and 10A comprise a plan view using match lines A—B to show a foundation plan of the building;

Figures 11 and 12 are sectional views taken on the lines 11—11 and 12—12 of Figure 10;

Figures 13 and 13A comprise a plan view using match lines A—B to show a structural floor plan illustrating the position of the corridor truss slabs and corridor beams;

Figures 14 and 14A comprise a plan view using match lines A—B to show a structural floor plan showing the position of the roof components of the building illustrated in Figure 6;

Figures 15, 16 and 17 are sectional views taken on the lines 15—15, 16—16, and 17—17 of Figure 13A;

Figures 18, 19, 20, and 21 are sectional views taken on the lines 18—18, 19—19, 20—20, and 21—21 of Figure 13;

Figures 22, 23, and 24 are sectional views taken on the lines 22—22, 23—23, and 24—24, respectively, of Figure 14;

Figure 25 is a sectional view taken on the line 25—25 of Figure 13;

Figures 26, 27, and 28 are sectional views taken on the lines 26—26, 27—27, and 28—28 of Figure 13A;

Figures 29, 30, 31, and 32 are sectional views taken on the lines 29—29, 30—30, 31—31, and 32—32 of Figure 13;

Figure 33 is a plan view of the stabilizer used to initially secure the bearing wall with respect to the service module;

Figure 34 is a side elevation view thereof;

Figure 35 is a perspective view of the brace used to temporarily secure the bearing wall with respect to the floor upon which the same is received;

Figure 36 is a plan view on line 36—36 of Figure 35;

Figure 37 is a partial plan view of a modified form of the corridor wall construction;

Figure 38 is a section taken on the lines 38—38 of Figure 37;

Figure 39 is a plan view of a typical elevator module;

Figures 40, 41, 42, and 43 are sectional views taken on the lines 40—40, 41—41, 42—42, and 43—43, respectively, of Figure 39;

Figure 44 is an elevational view of a typical end wall member identified in correlated drawings as EW-1;

Figure 44A is a partial end view of the wall member of Figure 44;

Figures 45 and 46 are top and bottom views thereof;

Figure 47 is an elevational view of a

bearing wall identified in co-related drawings as BW-1;

Figures 48 and 49 are top and bottom views thereof;

5 Figure 50 is a plan view of the heart module slab referred to in co-related drawings as HME-1L;

Figure 51 is a side view thereof;

10 Figure 52 is a plan view of the floor truss slab hereinafter referred to in co-related drawings as FTS-1;

Figure 53 is an elevational view thereof;

15 Figure 54 is a plan view of a corridor truss span hereinafter referred to in co-related drawings as CTS-1;

Figure 55 is an elevational view thereof;

Figure 56 is a plan view of the balcony slab hereinafter referred to in co-related drawings as BS-1;

20 Figure 57 is an elevational view thereof;

Figures 58 and 59 are plan and elevational views of a precast stair landing referred to in co-related drawings as SL-1;

25 Figure 60 is a typical end detailed for such precast stair landing; and

Figure 61 is a section taken on the lines 61-61 of Figure 13A and showing the stairs installed.

General Description of The System

30 A general understanding of the system can be had by reference to the above-identified British Patent Specification No. 1,336,748, in which a general description of the system is set forth, and essentially it is shown there how there is a combined use of precast concrete and site-poured concrete to achieve a monolithic structure that has reinforcing means embedded within the site-poured concrete following erection and placement of the precast components at the building site.

45 For clarity in this general description portion of the specification, the principal components of the system will be referred to by their initials. Thus the bearing walls shown in Figures 1 and 1A, for example, are identified by the letters BW. Similarly, the floor truss slabs will be identified by the letters FTS, while the "heart" or service module and elevator module will be indicated by the letters HM and EM, respectively. Similar additional abbreviations will be utilized for the remaining components, with site-poured concrete being identified as SPC for example (see Figures 3 and 5).

60 Because of structural limitations, it is often necessary to vary the size of the basic components involved. Thus on certain of the drawings, such as Figures 13 and 13A and Figures 14 and 14A, it will be observed that there may appear such diverse designations as FTS-1, FTS-2. This merely in-

dicates a different configuration and dimension of the floor truss slab in plan view. 65

In addition to being identified by the initials involved, each major component is separately described, and in such instances the specific description will be undertaken with the conventional numerals in all instances. 70

Specific Description Of The System

A. Foundations

75 Although it is apparent that any one of several conventional foundations could be employed, the embodiment of the invention shown in the accompanying drawings envisions the use of the so-called "caisson" type of foundation which is best illustrated in Figures 10, 10A, and 15 through 31 of the drawings. 80

Referring to Figure 10, a typical series of caissons 100, 101, 102, 103, 104, and 105 are positioned in a line so as to support a grade beam 106, for example, with similar grade beams 107, 107a, and others that are not numbered being utilized for the purpose of providing a foundation surface that is elevated above grade level shown in Figures 15 through 23. 85

Referring to Figure 15, the grade beam 108 shown therein includes the usual reinforcing means 110 that extends downwardly within the confines of the caisson 111 in this instance as shown in broken lines. 90

Referring next to Figure 16, a concrete footer 112 positioned on the grade beam 113 serves as a perimeter wall for field-poured concrete 114. Similarly, and as shown in Figure 17, this same grade beam could support the opposed ends of a service module HM positioned in the notched portion thereof as clearly indicated at Figure 17. 105

By the use of this arrangement, the first floor of the building will comprise, prior to pouring, service modules, elevator module, and footers that are supported on grade beams. In this regard it is to be noted that the ends of adjacent service modules, for example, are slightly spaced apart from each other (see Figure 20) so that a reinforcing shear dowel 116 can project upwardly. By this arrangement when the first bearing wall 117 is positioned, there will be a void within which the concrete being received in the upper portion thereof during pouring of the second floor can be received, and thus uniting bearing wall 117 with respect to the service modules as shown in Figure 20. 115

A similar arrangement exists with respect to the field-poured concrete 114 that is shown in Figure 19 of the drawings. It is to be understood with reference to Figure 19 that the field-poured concrete 114 could, of 120 125

course, partially be replaced by precast slabs much in the manner of the remaining floors.

B. Description Of Precast Components

1. Bearing Walls (BW)

The bearing walls (BW) are best shown in Figures 47, 48, and 49 of the drawings.

As will be noted, each bearing wall is of slablike configuration so as to include opposed faces 120, 120a, opposed ends 121a, 121b, as well as a top surface 122, and a bottom surface 123. A plurality of vertical voids 124, 124 extend from the top surface 122 to the bottom surface 123, and it will be noted that wire mesh 125 and 126 is positioned on opposed sides of the voids for structural strength purposes.

Lifting loops 127a are provided in the top surface 122 for permitting lifting of these units at the building site by crane.

Preferably a pair of additional reinforcing rods 128, 128 are provided, with one of these rods being positioned on each side of the vertical voids in close proximity to the bottom surface 123.

2. "Heart" (Service) Modules (HM)

The service module referred to herein is, in general, a pre-assembled, self-contained unit having plumbing, electrical, and bearing components positioned thereon for connection to the supply lines of the building. The module includes a floor slab, side walls, and the utility connections, with the floor slab having a dimension such that it effectively spans the distance between the main loading bearing walls of the building and becomes integral therewith upon construction.

Also, the physical layout of the service module (HM) is shown in Figures 9, 9A, and 9B.

The plan view of the service module slab (HMS) illustrated in Figure 50 shows a generally rectangular block-like member having a plurality of reinforcing rods 130, 130 that extend transversely thereof, with one end 130a thereof projecting beyond the opposed edges 131, 131 of the service slab module so that the same may be moved to the chain-dotted line position following positioning on the bearing walls in the field.

It will also be noted that a pair of through voids 132 and 133 are provided between the top surface 134 and the bottom surface 135 thereof, with these voids providing a built-in utility chase within the confines of the module. Wire strand lifting loops 136, 136 project from the opposed longitudinal end walls 137 and 138, and it will be noted that these lifting loops 136 are spaced closer to the top surface 134 than they are to the bottom surface 135, with the same also being true with regard to the projecting

ends 130a of the reinforcing rods 130, 130. This arrangement is to permit them to be bent out over an adjacent slab or building component that was of half thickness size compared to the thickness of the service module slab which is normally eight inches and is referred to as a "full thickness" slab. Each of the voids 132, 133 has additional reinforcing rods 139, 139 around the perimeter thereof and in embedded condition for structural strength.

3. Floor Truss Slabs (FTS)

While the service module slabs just described in connection with Figures 50 and 51 have been designated as "full thickness", the floor truss slab shown in Figures 52 and 53 is "half thickness" so that when it is placed in transverse abutment with a service module slab, the members 130b thereof can be folded out and lie above the top surface 140 of the adjacent floor truss slab, as best shown in Figure 1, for example.

The floor truss slabs are rectangular in plan and include a top surface 140, a bottom surface 141, opposed side surfaces 142 and 143, and end surfaces 144 and 145.

Reinforcing means 146, 146 are internally embedded throughout the length of the floor truss slab for structural strength, and also the top surface 140 is preferably raked so as to be rough as indicated in the area designated by the numeral 140a.

Four wire strand lifting loops are also embedded within the slab as indicated by the numerals 147 and the projecting portions 147a thereof are provided adjacent each corner of the slab so that a uniform lift may be made.

4. Balcony Slabs (BS)

The construction of the balcony slab (BS) shown in Figures 1 and 1A is described in detail in Figures 56 and 57 of the drawings.

It will be first noted that the balcony slabs are "full thickness" so that when they are positioned next to the just described floor truss slabs, as shown in Figures 1 and 6, for example, the top surface 151 thereof will be elevated above the top surface of the adjacent floor truss slab, which will be "half thickness" as already described. It will further be noted that this surface 151, as shown in Figure 57, slopes slightly from rear edge 152 toward the front end 152b for drainage purposes, and it will further be noted that the opposed ends are provided with notches or offsets 152a and 153a so that the forward portions will jut beyond the point of support by the bearing wall that is positioned beneath the balcony slab in supporting relationship therewith.

A series of inserts 155, 155 are cast into the upper surface 151 of the slab for the

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purpose of installing the balcony (B) in known fashion, and furthermore lifting inserts 156, 156 are provided for field insertion of lifting rings.

Each balcony also includes a series of reinforcing rods 157, 157 that project beyond the wall 152 so that they may be moved to the dotted-line position shown at 156 following positioning in the field, with these extended reinforcing rods then being embedded within the site-poured concrete (SPC) that is poured on top of the adjacent floor truss slab. Additional reinforcing rods 158, 158 are also shown provided in embedded condition beneath the surface 151 as clearly shown in Figures 56 and 57 of the drawings. A notch 159a is provided in the lower surface 159 for preventing water from dripping onto the balcony below.

Each lateral edge has a curb 152c provided thereon for supporting the next bearing wall in the most efficient manner and for preventing the ingress of rain into the dwelling unit.

5. Corridor Truss Slab (CTS) and Corridor Beam (CB)

The construction of the corridor portion of the dwelling unit is best shown in Figures 6, 13A, 26, 27, and 28, and first referencing to Figure 6, it will be noted that when the bearing walls have been positioned, there is a space between the same that defines the corridor area of the building as noted in Figure 6. This space is spanned by a pair of angle members 160, 160 that are known as "corridor beams", with the opposed edges of the corridor beams resting on the opposed ends of the bearing walls as shown in Figure 6.

The corridor truss slab (CTS) is then positioned on the legs of the corridor beams 160, 160 to define the corridor area of the building. Normally and as shown in Figure 6, the corridor truss slabs will be the first horizontal units positioned following erection of the bearing walls, with this being preferred because it enables the building to be accurately located, and in view of the fact that the modules are sequentially positioned outwardly from the corridor so as to cause the building to grow in width in a progressive fashion, with the heart module first being positioned, followed by positioning of the two floor truss slabs and finally positioning of the balcony slab.

It will be noted that the corridor truss slabs are "half thickness" compared to the heart module slabs, with it being noted that the reinforcing members projecting from the heart modules can then be embedded within the field-poured concrete at the time the floor of the building in question is being finished off (see Figures 27 and 28).

A typical corridor truss slab is shown in

Figures 54 and 55 and is identified as CTS-3, with the location of this being identified in the structural plan of Figure 13.

As will be noted, the unit is generally rectangular in plan except that it includes a cutout portion 161 for accommodation of the elevator module and a second cutout portion 161a that is intended to accommodate the utility chase UC shown in Figure 13 of the drawings. In addition to the usual wire mesh 163 that is employed in construction of this type, there are transversely extending reinforcing bars 164, 164 provided at various positions both at the end and intermediate length thereof as shown in Figures 54 and 55, with diagonal bracings 165, 165 being provided adjacent the inside corridors for reinforcing purposes.

Again, and as in the case of the floor truss slab, the top surface 166 is raked rough as indicated at the numeral 167, and also as in the case of the floor truss spans (FTS), a plurality of wire strand lifting loops 168, 168 are provided adjacent the four corners, with it being noted that the same may be readily folded down and covered when the corridor truss span is covered with concrete during field erection.

6. End Walls (EW)

The construction of the end walls (EW) is shown in detail in Figures 44, 45, and 46 of the drawings, and further disclosure of the construction of the end wall unit in the completed stage of the building is set forth in Figures 15, 16, and 17 of the drawings.

Referring to Figures 44, 44A, 45, and 46 since the end walls are bearing walls also, it is manifest that the same will have a construction similar to the construction of the bearing walls that have been previously described. Accordingly, and referring to the elevational view shown in Figure 44, the front surface 172 is provided with an offset front portion 173 that forms a ledge 173a upon which either a heart module slab, a floor truss slab, or a balcony slab may be rested as shown in Figures 15, 16, and 17, with this arrangement permitting access to the vertical voids 174, 174 that are provided in the end wall from top to bottom as clearly shown in Figure 45 and 46.

Wire strand lifting loops 175, 175 are also provided and project from the top surface 173a as shown in Figures 44 and 45.

Each end wall also includes an extreme top surface 176, a bottom surface 177, and opposed ends 178 and 178a as clearly shown in Figure 44, with conventional reinforcing bars 179 also being provided and with reinforcing mesh 179a being provided on opposed sides of the voids as shown in Figures 45 and 46.

Angular reinforcing steel (ARS) may be

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used to stabilize the end walls or, if desired, cast-in place hook bars may be employed to provide stability, with the former method being illustrated in Figure 16 of the drawings. A hook bar arrangement is shown in Figure 17 of the drawings where hook 80c is cast into place around the shear dowel shown therein. Use of similar reinforcing hook rods are shown in Figure 21 where another hook rod 80d is shown cast in place so as to stabilize the heart module with respect to the end wall.

The frontal surface 172 may be provided with a texture or decorative surface if so desired for aesthetic purposes.

7. Elevator Module (EM)

The detailed construction of the elevator module is set forth in Figures 39 through 43 of the drawings, and its association with the remaining components of the building is set forth in Figures 13, 13A, 14, 14A, 22, 23, and 24 of the drawings.

The elevator module referred to herein includes a combined, precast elevator shaft and utility chase area one storey high and adapted to be stacked on top of each other to form the completely finished elevator shaft and utility chase. The module includes built-in features such as a door opening with a pre-finished door jamb, and head sections, and partially embedded steel plates serving to minimize assembly time required on site. The module also includes most of the hardware necessary for installing the elevator per se.

Referring to the plan view of the elevator module shown in Figure 39, it will be noted that the module shown is a two-elevator unit having a front surface 180, a rear surface 181, and opposed side surfaces 182 and 183, with door openings 184, 184a being provided in the front wall 180 for ingress and egress purposes and with the usual elevator doors 185, 185a opening and closing with respect to the door openings at the proper time to permit the entry and discharge of passengers from the elevator units which are shown outlined in chain-dotted lines in Figure 39 and as indicated by the letter E.

As in the case of the bearing walls (BW) and end walls (EW), the elevator module (EM) preferably includes a series of vertical voids 180a within the site-poured concrete (SPC) may be received.

Referring now to Figures 40 and 41, it will be noted that each end wall 182 and 183 has leveling pockets 186, 186 provided therein on the base 187 thereof, with these leveling pockets cooperating with shims (not shown) that will be placed on the embedded brackets 188, 188 that are embedded in the top wall 189 of the elevator module.

Referring again to Figure 40, it will be noted that both the front and rear walls are provided with embedded plate members 190, with these plates serving as a point of support for attachment of the I-beam members 191 that are employed for the purpose of supporting elevator guide rail brackets 192, that in turn support the vertical elevator guide rails 193.

As noted in Figure 39, the interior faces of the end walls 182 and 183 support the remaining guide rails 194 that will be used to guide each of the two elevators shown, with Figure 41 illustrating how the guide rail supports 195 are secured with respect to the interior of the wall for supporting the guide rails 194 with the same guide rails and preferably also supporting the conduit member 196 within which the electrical components may be housed. A limit switch 197 is normally provided at ground floor level only for preventing the descent of the elevator beyond this point.

Referring to Figure 43, it will be noted that the inside surface of the rear wall 181 also supports a counterweight guide rail and brackets that are indicated generally by the numeral 198, with the usual counter-weight 199 (see Figure 39) being encased therein and moving upward and downward in conventional fashion.

Referring to Figure 42 for a further description of the elevator door mechanisms, it will be noted first that a pair of spring door closing mechanisms 200 are provided for each door, with motor interlocks 201, 201 preventing opening of the doors until such time as the motor roller release assembly 202 has been properly positioned to indicate that the door can be safely opened.

The usual guide rails 203, 203 are provided in each instance to permit the door to freely move into and out of closed position upon operation of the usual control 204.

Notches 205, 205 extend transversely of each end wall 182 and 183 for the purpose of coacting with the heart modules that are shown disposed adjacent thereto in Figure 14.

In this regard the position of the elevator modules in stacked or assembled condition is shown best in Figures 11 and 12 of the drawings where this feature is clearly illustrated, with the heart module received within the notch 205 so as to be supported on the top edge 189 of the elevator module immediately beneath the one shown in Figure 11.

With regard to the assembly of the elevator module after positioning, the wall voids 180a are filled and the shear dowels (SD) positioned therein (see Figures 11 and 12) in a manner similar to erection of the

bearing and end walls, with the floor being subsequently poured as shown in Figure 23 and with reinforced rod 80b being provided.

8. Stair Landings (SL)

The present stair landings (SL) shown in Figures 1 and 1A of the drawings are shown in detail in Figures 58, 59, and 60 of the drawings, while Figure 61 of the drawings shows the manner in which the stair landing is structurally united with the remaining components of the building during construction.

Referring to Figure 61, it will be noted that the stair system employed is what is generally referred to as a "scissors" system, which means that there are two flights of stairs between each floor level with an intermediate landing being provided.

Each precast stair landing includes a stair portion 210, an upper landing portion 211, and a lower landing portion 212, with the usual reinforcing mesh 213 being embedded therein adjacent the top and bottom surfaces of the stair landing unit. Additionally, lifting rings 214 are provided at each end. It will be further noted that pockets 215 are provided in each end, with a stud anchor 216 being received in each pocket to provide additional support when the unit is placed in position during erection.

Regarding erection and positioning of the unit, reference is made to Figure 61 of the drawings wherein the unit has been shown positioned, with one end being supported on a corridor truss span (CTS) and the other end being shown supported on one side of an end wall (EW). By this arrangement when the field-poured concrete, indicated in Figure 61 by the numeral 217, is poured both on top of the corridor truss slabs (CTS) and end wall (EW), concrete will be made level with the landing surfaces as shown in Figure 61, following which conventional railings 218 can be installed.

While the description has been given in accordance with a so-called scissor type set of stairs, reference is made to Figure 2 of the drawings wherein a conventional single flight of stairs is shown being positioned in the stair opening.

9. Roof Corridor Truss Spans (RCTS)

Roof Truss Slabs (RTS)

Roof Balcony Slabs (RBS), and

Roof Service Module Slabs (RHMS)

The roof framing plan is shown in Figures 14 and 14A of the drawings. Since the roof of the building in question is essentially no different than any remaining portion of the building, a detailed description of the individual roof elements will not be undertaken.

Suffice it to say that the roof members, in

general, correspond to their counterparts on the other floors of the building.

Thus a roof corridor truss slab is in reality no different than a normal corridor truss span of the type previously described in detail. It again is "half thickness" as are the roof truss slabs that have been identified as RTS.

Similarly, the roof balcony slabs are, as in the case of the normal balcony slabs, "full thickness". When all parts are positioned as shown in Figure 1, they will form the border to which the concrete will be poured. The only other "full thickness" slab on the roof is the roof service module slabs (RHMS) that are positioned on opposite sides of the elevator module as shown in Figure 14.

In this regard a detailed construction of the roof members can be noted in Figures 15 through 23 of the drawings where decking D and roofing R are utilized to enclose the building.

C. Non-Precast Components

1. Reinforcing Steel

Although the majority of the precast components abovedescribed have reinforcing means provided therein at the time of delivery to the building site, several different types of reinforcing means are field-positioned and subsequently embedded within the structure during the field pouring of concrete.

In this regard reference is first made to Figure 4 of the drawings wherein the general arrangement of positioning the reinforcing means is most clearly illustrated.

In each instance of use, shear dowels (SD) are positioned within the vertical voids 124 of the bearing wall (BS) (Figures 18, 19, 20, and 21) in the manner shown in Figures 4 and 5, as well as in the vertical voids 174 of the end wall (Figures 15, 16, and 17) and the vertical voids 180a of the elevator module (Figures 22 and 23).

In this regard, the shear dowel is positioned in the void after the same has been partially filled with concrete in the field, and the shear dowel is generally approximately four foot in length so that two feet will be inserted within the bearing wall, end wall, or elevator module wall that has been filled with field-poured concrete, while two feet will project above the same much in the manner shown in Figure 5 of the drawings wherein the field-poured concrete has been poured to the floor level.

When the next bearing wall is positioned on top of the floor surface for erection of a subsequent floor, the part of the shear dowels that are projecting in Figure 5 will ultimately be covered and embedded within concrete poured within the voids of the subsequently positioned bearing wall.

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Also utilized in each instance is reinforcing mesh (RM) which is laid over the exposed surfaces of the positioned floor truss spans (FTS) as shown in Figure 5. Said mesh would also be employed over the top of the corridor truss spans (CTS) which are not shown in either Figures 4 or 5. This mesh is ultimately embedded beneath the surface of the floor that is poured in the field.

Additionally as shown in Figures 4 and 5, field-positioned tension steel (FTS) is employed by being positioned over the mesh so as to interconnect adjacent floor truss slabs as shown in Figure 4 of the drawings. Tension steel is generally of bar stock and serves to provide a tension force between adjacent living units.

Referring next to Figure 21 as a typical example, it will be noted that there is also provided an angular reinforcing steel (ARS) that is used in the roof section of the building, with this member ultimately being embedded within the concrete poured on the roof portion of the building, with one leg being inserted in the voids of the bearing wall, end wall, or elevator module as the case may be.

Referring next to Figures 13A and 16, it will be noted that provision is made in all end bays to avoid what is known as "progressive collapse" which means that a failure of one floor results in the subsequent failure of additional lower floors. Thus and referring to Figure 13A, if an explosion force should result in failure of the end wall indicated, the additional steel, indicated by the letters PCS, which is the abbreviation for progressive collapsed steel, would serve to still support the wall in cantilever fashion off of the bearing wall, and it will be noted from Figure 16 that the progressive collapsed steel (PCS) is angled in position within the voids of the bearing wall so as to provide this additional force to prevent "progressive collapse".

Additional support against progressive collapse is achieved through the use of structural studs 310 shown in Figure 1A of the drawings.

It has already been noted with regard to the service module slabs (Figures 50 and 51) and the balcony slabs (Figures 56 and 57) that the same have reinforcing rods that are intended to be bent in the field so as to overlie the floor truss slabs and corridor truss slabs to permit the same to be covered with the concrete that is poured in the field to further strengthen the tie between them.

As shown in Figure 6, it is sometimes desired to eliminate these projections and use an "all thread" type of reinforcing rod that is merely threaded into inserts provided in the heart module or balcony slab, with these merely being threaded rods

that would be embedded within the concrete much in the manner of the reinforcing means shown in Figures 50, 51, 56, and 57.

"All thread" rods are illustrated schematically by the numeral 300, 300 in Figure 6 of the drawings.

In certain areas having a high incidence of earthquakes and ground tremors, provision is made for the use of seismic steel in addition to the conventional shear dowels (SD) previously described. Seismic steel is long length bar stock (e.g., 10 feet) that is again inserted within the voids of the bearing wall much in the manner that the shear dowels are inserted. However, the seismic steel is joined end-to-end throughout the height of the building as by welding, threading or like means to provide a continuous, unbroken rod.

In instances where seismic steel is used, it will normally be used in ten foot lengths, with the bearing wall being slipped down over the projecting portion thereof, and with the same again being embedded within concrete much in the manner that the shear dowels are embedded.

Also, in certain areas of the building, such as the community areas on the first floor which span several bays, it will be necessary to use something other than a bearing wall.

In such instances as shown in Figures 29 through 32, metal spans, either in the form of I-beams or angles, are supported at their opposed ends and, in turn, support the floor truss spans, with dowels of the type shown therein being used to mix with the site-poured concrete.

2. Penthouse (P)

The penthouse unit (P) is shown best in Figure 8 of the drawings where it will be noted that the same is a steel framed building positioned on top of the uppermost elevator module (EM) so that the equipment required to operate the elevators can be housed therein. The construction thereof employs conventional framing elements.

3. Typical Floor Plans

A typical floor plan is shown in Figures 7 and 7A of the drawings, with match lines A, B being provided on these drawings to show the point of match between the two sheets of drawings.

As will be seen from Figures 7 and 7A, each floor includes stair landings SL-1 and SL-2, as well as an elevator module as shown in Figure 7. In the plan shown in Figure 7, each floor is essentially made up of one-bedroom units, with the end one-bedroom units being designated as E-1BR, the conventional one-bedroom units being

designated as 1BR, and the efficiency units being designated as E. A laundry (L) shown in Figure 7 is located on one or more floors of the building, while one or more utility chases (UC) are provided on each floor for reception of conventional conduits, trash disposal, etc.

Referring now to Figure 9 wherein a typical one-bedroom unit is illustrated, it will be noted that the same includes a bath area 225, a kitchen area 226, a corridor entry 227, storage 228, living room 229, and bedroom 230. It will be further noted that the perimeter portion of the building is enclosed in this instance by a curtain wall 231 that is non-load bearing in nature and includes sliding doors 232, 233, as well as a unit 234 that can be used for heating and air conditioning purposes. A balcony 235 having a railing 236 completes the arrangement shown in Figure 9.

Referring to Figure 9A, there is illustrated a typical one-bedroom end unit that includes a corridor entry door 240, kitchen 241, bath 242, storage area 243, living area 244, and bedroom area 245, with a partition 246 separating the living room and bedroom areas, while curtain wall 247 and balcony 248 complete the living arrangements.

The efficiency unit shown in Figure 9B includes a corridor entry door 250, a kitchen area 251, bath area 252, and a combined living/sleeping area 253, with curtain wall 254 separating the living area 253 from the balcony 255.

D. Erection Techniques

During the erection of the high-rise buildings, certain techniques are preferably employed to achieve the most satisfactory results.

1. Shoring

Because the corridor truss slabs and floor truss slabs are "half thickness" in size, it is necessary to shore or prop up these units until such time as the topping has been poured on the same and hardened into place. Shoring merely involves the providing of transverse support beneath the slab and adjusting it to the proper level so that the same will not sag as would otherwise be the case. No drawing is believed required to explain this well-known technique.

2. Stabilizing

Because of the relatively large size of the bearing walls, it is preferable to brace stabilize the same until they are finally filled with the reinforcing means and field-poured concrete. To this end, certain means for stabilizing and bracing are shown in Figures 1, and 33 through 35 of the

drawings. The stabilizer 260, illustrated in Figures 33 and 34 of the drawings, includes a thin plate member that is offset as at 261 and provided with a first hole 262 as well as additional holes 263, 263 that are provided in the opposite end thereof, with the holes 263, 263 being adapted to permit attachment to the roof of a heart module as shown in Figure 1, while the holes 262 can be secured to an appropriate pin provided on the bearing wall for this purpose.

Figures 35 and 36 show a bracing arrangement that has been employed for the purpose of bracing the bearing wall until such time as the same can be stabilized with respect to the heart module and other components. The bracing means shown in Figure 35 include an angle iron 270 having a hole provided at one end therein for insertion around a pin 271 that is provided on the outer edge of the balcony slab (BS) shown in Figure 35. A C-clamp 272 has an arm 273 pivotally secured thereto, with the arm 273 being connected to a turnbuckle 274 whose opposed end is secured to the plate 270 as shown in Figure 35 of the drawings. By this arrangement the bearing wall (BW) can be accurately braced with respect to the balcony slabs until the same can be permanently stabilized as by the field pouring of the concrete therein.

3. Seismic Modification

Figures 37 and 38 show a modification utilized in high-rise seismic zones. In this arrangement the corridor walls 280 are made of similar construction to the bearing walls shown, so that when the voids 281, 281, 302, 302 thereof are poured with concrete as shown in Figure 38, the same will not only support the corridor truss slabs, but will also be united structurally with the bearing walls.

E. Erection Procedure

Although much of the erection procedure and technique has been set forth in the foregoing detailed description of component parts, a sequential step-by-step recitation of the erection steps will now be discussed in detail.

1. Site Preparation and Completion of Foundations

It is, of course, necessary to first have the foundation properly prepared. Included in this operation will be site preparation to the extent necessary to accommodate sewers, water, and other utilities along with proper grading.

During this preparation and referring to Figure 10, the first physical objects installed are the caissons, such as the caissons 100 to 105 shown in Figures 10 and 10A of the drawings, with such caissons first being

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driven to the appropriate depth and then filled with concrete and reinforcing rods in the fashion shown in Figures 15 to 23.

As shown in these figures and also in Figures 10 and 10A, grade beams, such as grade beams 107a, 107, are supported on the caissons for the purpose of supporting heart module units between parallel adjacent grade beams, with a typical heart module being positioned initially as shown in Figure 10 in chain-dotted lines spanning the space between the parallel grade beams 106 and 107.

The final step in preparing the foundation is the pouring of the frost walls 109, 109a, 109b, 109c (Figure 10), and 109d and 109e (Figure 10A), and any remaining frost walls for the non-load bearing walls of the building.

When this operation has been completed, the enclosed portion of the building is provided with the appropriate gravel which is then compacted to obtain the density needed to provide sub-surface to the concrete that will subsequently be poured.

2. The First Floor

Erection of the first floor of the building is then commenced by first positioning the heart modules in spanning relationship to the grade beams, much in the manner as illustrated in Figure 10 of the drawings.

It will also be noted from Figures 11 and 12 that the elevator module pit (EMP) has been located on the caissons that support the same, and at this time the first floor elevator module (EM) can be positioned thereon as shown in Figures 11 and 12.

It will also be assumed that during the preparation of the foundation the reinforcing rods, such as the rod 275 shown in Figure 21, have been positioned, and at this time it is merely necessary to pour the site-poured concrete (SPC) floor to the level of the ground floor elevation as defined by the top of the positioned heart module slab (HMS).

When the concrete floor surface of the first floor of the building has set to the requisite degree of hardness, the bearing walls (BW) for the first floor may be positioned over the upwardly projecting rods 275, 275 using the bracing means shown in Figures 35 and 36 to position these members in place and, further, stabilizing the same to the roof of the heart modules (HM) much in the manner shown in Figure 1 by use of the stabilizer 260 shown in Figures 1, 33, and 34.

As soon as the bearing walls for the first floor have been positioned as just described, the second floor elevator will be placed, and following this the corridor beams 160, 160 will be positioned on the inboard ends of the spaced-apart bearing

walls (BW) as shown in Figure 6, for example, and then secured in place.

Following this, the corridor truss slabs (CTS) will be positioned in spanning relationship between adjacent corridor beams 160, 160 so that a temporary centre portion of the building now exists, with it being noted that as earlier mentioned, the building will grow outwardly from side-to-side hereinafter.

Again referring to Figure 6, the heart modules (HM) are positioned on opposed sides of the corridor truss span (CTS), with normal procedure being to position all heart modules (HM) first along the corridor, followed by positioning of the floor truss slabs (FTS) and the balcony slabs (BS) in that order until the building has grown outwardly to its full width.

As mentioned earlier, the all-thread bolts 300 shown in Figure 6 will be positioned or, alternatively, the reinforcing rods 130, 130 shown in Figures 50 and 56 will be bent outwardly so as to be disposed in a position above the surface of the corridor and floor truss slabs (CTS, FTS) but beneath the final finish floor level, which is represented by the top surface of the heart module slab (HMS) and the top surface of the balcony slab (BS).

During the period that the ceiling of the first floor is being completed, the second floor elevator module (EM) has been installed on top of the first floor elevator module, and also during this same period when the various slabs (HMS, CTS, FTS, BS) are being positioned to form the floor of the second floor of the building, the precast stair landings SL-1 and SL-2 can be installed in the manner previously described in connection with Figures 58 through 61, with this condition being schematically illustrated in part in Figure 1 of the drawings.

All slabs to receive structural topping are shored at mid-point of their span. Shoring heights are adjusted so the bottom of the slabs match that of the adjacent heart module slabs (HMS) and balcony slabs (BS).

When all of the components have been positioned as just described, the dwelling will have an appearance substantially similar to that shown in Figures 1, 13, and 13A, and at this time the next step will be to pour the vertical voids of the bearing walls (BW), the end walls (EW), and the elevator module (EM) for the first floor.

One point that should be observed with respect to the positioning of the just described walls is that the same are normally shimmed so as to be spaced approximately 1/2 of an inch off of the floor surface upon which the same are supported. This permits the gravitationally descending

concrete within the voids of the bearing and end walls to force out the air and thus avoid any voids, with it being possible to observe the emitting concrete on the floor level below that on which the pour is being made. Normally these shims are of asbestos material and also serve the dual purpose of permitting very fine leveling adjustment.

Preferably the concrete is poured in the voids of these vertical walls to about a point two or three inches beneath the top surface thereof. At this time and after appropriate hardening has taken place within the voids, the shear dowels (SD) are inserted to a depth of about two feet within the concrete that has just been poured within the voids of the bearing wall (BW), end wall (EW), and elevator module (EM) (see Figures 16 to 23).

Also at this time the tension steel (TS) is placed over the voids in a horizontal mode, and also the reinforcing mesh (RM) is positioned over the floor truss slabs (FTS), corridor truss slabs (CTS) and also over the top of the vertical voids that have just been poured with concrete.

At this time site-poured concrete (SPC) can be poured over the floor truss slab (FTS) and corridor truss slabs (CTS) and the vertical voids filled, floated, and otherwise raised to the level of the balcony slabs (BS) and service module slabs (HMS) so as to produce a finished floor.

When the second floor portion of the second floor of the unit has been completed to the extent just described, the sequence of events would then be repeated by first positioning the bearing walls (BW) thereon, followed by installation of third floor corridor beams 160 and the corridor truss slabs (CTS) which are positioned on the beams. Following this, installation of the third floor service module (HM), elevator module (EM), floor truss slabs (FTS), and balcony slab (BS) may be done, with this process being repeated until the building has been completed.

During work upwardly on the building, at each floor the precast stairs SL-1 and SL-2 and elevator modules (EM) are progressively inserted as the building progresses so that when the building is topped out, the stairs and elevator portion of the building are substantially completed, having been fitted with hardware as the work progressed.

Accordingly, it is merely necessary to lift the entire elevator cab unit by crane into the elevator shaft, and following appropriate blocking and shoring of the same within the shaft, the elevator penthouse can be placed over the elevator shaft, and the equipment therein attached to the elevator for operation substantially

coincident with the topping out of the building. 65

Also to be noted is the fact that as the building progresses from floor to floor, the plumbing and electrical and other work can be done concurrently therewith, with the plumbing wall of the heart module being readily accessible. 70

Also it will be noted that as each floor progresses, workmen can commence work to complete the floor, with this work including such items as positioning of the curtain walls, installing partitions, hanging doors, putting on balcony railings, connecting plumbing, electrical, and heating outlets, and generally readying the units for occupancy. 80

Modification

The modified form of the invention shown in Figures 37 and 38 of the drawings essentially follows the same technique of erection that has just been described, with the single exception that corridor bearing walls 280, having voids 281, 281, are employed and are also filled at the same time as the remaining voids of the bearing walls, the end walls, and elevator module in the manner just described. 85

As shown in Figure 37, the use of these units will require service module slabs having central voids 302, 302 instead of the side voids shown in Figure 50 of the drawings. 90

WHAT WE CLAIM IS:—

1. A multi-storey building comprising pre-cast components including vertical load-bearing walls supporting the ends of floor slabs, each wall component having internal vertical voids extending from top to bottom, and each floor slab being of partial thickness relative to the completed floor; the building being erected with said ends of the floor slabs leaving the voids of the wall components exposed so that the voids of a lower wall communicate with the voids of the wall next above, shear dowels being arranged in the voids to join said wall components to one another, tension steel being laid on the ends of the floor slabs across the gap, and concrete being poured into the voids and over the floor slabs, on site, to embed the shear dowels and tension steel, and to bring the floor to full thickness. 100

2. The building of Claim 1 wherein said slabs are balcony slabs, corridor truss slabs, floor truss slabs, or service module slabs. 105

3. The building of Claim 1 or 2 wherein said load bearing wall components are bearing walls, end walls, or elevator module walls. 110

4. The building of any preceding claim including floor slabs of full thickness and the partial thickness slabs are half 115



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concrete within the voids of the bearing and end walls to force out the air and thus avoid any voids, with it being possible to observe the emitting concrete on the floor level below that on which the pour is being made. Normally these shims are of asbestos material and also serve the dual purpose of permitting very fine leveling adjustment.

Preferably the concrete is poured in the voids of these vertical walls to about a point two or three inches beneath the top surface thereof. At this time and after appropriate hardening has taken place within the voids, the shear dowels (SD) are inserted to a depth of about two feet within the concrete that has just been poured within the voids of the bearing wall (BW), end wall (EW), and elevator module (EM) (see, Figures 16 to 23).

Also at this time the tension steel (TS) is placed over the voids in a horizontal mode, and also the reinforcing mesh (RM) is positioned over the floor truss slabs (FTS), corridor truss slabs (CTS) and also over the top of the vertical voids that have just been poured with concrete.

At this time site-poured concrete (SPC) can be poured over the floor truss slab (FTS) and corridor truss slabs (CTS) and the vertical voids filled, floated, and otherwise raised to the level of the balcony slabs (BS) and service module slabs (HMS) so as to produce a finished floor.

When the second floor portion of the second floor of the unit has been completed to the extent just described, the sequence of events would then be repeated by first positioning the bearing walls (BW) thereon, followed by installation of third floor corridor beams 160 and the corridor truss slabs (CTS) which are positioned on the beams. Following this, installation of the third floor service module (HM), elevator module (EM), floor truss slabs (FTS), and balcony slab (BS) may be done, with this process being repeated until the building has been completed.

During work upwardly on the building, at each floor the precast stairs SL-1 and SL-2 and elevator modules (EM) are progressively inserted as the building progresses so that when the building is topped out, the stairs and elevator portion of the building are substantially completed, having been fitted with hardware as the work progressed.

Accordingly, it is merely necessary to lift the entire elevator cab unit by crane into the elevator shaft, and following appropriate blocking and shoring of the same within the shaft, the elevator penthouse can be placed over the elevator shaft, and the equipment therein attached to the elevator for operation substantially

coincident with the topping out of the building.

Also to be noted is the fact that as the building progresses from floor to floor, the plumbing and electrical and other work can be done concurrently therewith, with the plumbing wall of the heart module being readily accessible.

Also it will be noted that as each floor progresses, workmen can commence work to complete the floor, with this work including such items as positioning of the curtain walls, installing partitions, hanging doors, putting on balcony railings, connecting plumbing, electrical, and heating outlets, and generally readying the units for occupancy.

Modification

The modified form of the invention shown in Figures 37 and 38 of the drawings essentially follows the same technique of erection that has just been described, with the single exception that corridor bearing walls 280, having voids 281, 281, are employed and are also filled at the same time as the remaining voids of the bearing walls, the end walls, and elevator module in the manner just described.

As shown in Figure 37, the use of these units will require service module slabs having central voids 302, 302 instead of the side voids shown in Figure 50 of the drawings.

WHAT WE CLAIM IS:—

1. A multi-storey building comprising pre-cast components including vertical load-bearing walls supporting the ends of floor slabs, each wall component having internal vertical voids extending from top to bottom, and each floor slab being of partial thickness relative to the completed floor; the building being erected with said ends of the floor slabs leaving the voids of the wall components exposed so that the voids of a lower wall communicate with the voids of the wall next above, shear dowels being arranged in the voids to join said wall components to one another, tension steel being laid on the ends of the floor slabs across the gap, and concrete being poured into the voids and over the floor slabs, on site, to embed the shear dowels and tension steel, and to bring the floor to full thickness.

2. The building of Claim 1 wherein said slabs are balcony slabs, corridor truss slabs, floor truss slabs, or service module slabs.

3. The building of Claim 1 or 2 wherein said load bearing wall components are bearing walls, end walls, or elevator module walls.

4. The building of any preceding claim including floor slabs of full thickness and the partial thickness slabs are half

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thickness; said full thickness slabs having projecting reinforcing means that overlie the surface of adjacent half thickness slabs; said site-poured concrete covering said reinforcing means.

5. The building of claims 2 and 4, wherein said service module slabs and said balcony slabs are full thickness; and said floor truss slabs and said corridor truss slabs are half thickness.

6. The building of any preceding claim, including at least one precast stair unit interconnecting successive floors.

7. The building of any preceding claim including at least one elevator module at each floor, the module having a plurality of vertical through voids in the walls thereof; elevator module being vertically aligned with one on adjacent storey.

8. The building of any preceding claim, wherein the wall components are arranged in parallel pairs with floor slabs spanning them, to form a building bay.

9. The building of any preceding claim wherein steel embedded in the floor slabs extends from their ends to be bent at right angles and extend into a void in a wall component.

10. A multi storey building as claimed in claim 1, and using at least some of the extra components herein described, with reference to the accompanying drawings.

11. A method of erecting a multi-storey building using pre-cast components including vertical load-bearing wall components having internal vertical voids extending from top to bottom and floor slabs of partial thickness, relative to the completed floor, comprising the steps of:
assembling the wall components and floor slabs of one storey so that the ends of the floor slabs rest on the wall leaving the voids exposed;

inserting shear dowels in the voids to protrude upwardly therefrom;

laying tension steel over the ends of the floor slabs across the gap;

assembling the wall components of the next storey so that the voids thereof communicate with the voids of the wall components directly below and the shear dowels connect the components; and

pouring concrete into the voids and over the floor slabs to embed the shear dowels and tension steel, and to bring the floor to full thickness.

12. The method of claim 11, wherein the step of pouring the concrete is performed in separate stages including:

at least partially filling the voids of the erected lower wall components, before the laying of the tension steel; bringing the floor slabs to full thickness after laying the tension steel while completing the filling of the voids of the lower walls if necessary;

and at least partially filling the voids of the walls of the next storey.

13. The method of Claim 11 or 12 including the step of setting a precast elevator module on said bearing walls in non-covering relationship to said vertical cores thereof; said elevator modules being stacked one above the other on successive floors.

14. The method of any of claims 11 to 13 including the step of setting of precast service module on said bearing walls.

15. The method of claim 14 wherein said service module includes a slab having a thickness greater than said floor slabs with projecting reinforcing members; and bending said reinforcing members to overlie adjacent partial thickness floor slabs.

16. A partially "precast" and partially "cast in place" multi-storey building comprising a foundation; a series of precast, vertically positioned bearing walls arranged in parallel relationship with each other to form building bays; with each bearing wall having a series of vertical voids located centrally thereof and extending from top to bottom of said walls; the voids of one wall being aligned with those of the wall next above or below, a series of elongated, precast floor truss slabs each spanning the space in each building bay and each being supported at their longitudinal ends by the outer edge portion of said bearing walls, whereby said voids of said walls are accessible following positioning of said floor slabs on said bearing walls; a series of precast service modules each spanning the space in each building bay whereby the same can be supported thereon, and having a floor thickness approximately twice the thickness of said floor slabs, supported on the edge portions of said bearing walls in spaced-apart relationship with each other, whereby said voids of said bearing walls are accessible, and being arranged equi-distant from the centre line of a corridor portion of said building; corridor beams transversely spanning the space between said service modules and corridor sections supported at their opposed ends on said corridor beams and having a thickness approximating the thickness of said floor slabs; stair portions vertically interconnection successive corridors of adjacent floors; a series of non load-bearing walls spanning the space between parallel load-bearing walls in right angle relationship therewith for dwelling unit closure purposes, with said non load-bearing walls defining opposed perimeter portions of said building; opposed precast vertically arranged load-bearing end walls arranged in parallel relationship with said first mentioned load-bearing walls and



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5 defining opposed perimeter portions of said building; a roof covering the uppermost series of dwelling units and enclosing said building to the elements; first site-positioned reinforcing means positioned in vertically aligned relationship within the voids of vertically adjacent load bearing walls following site pouring of concrete; 10 second site positioned means horizontally disposed on top of horizontally adjacent floor slabs and corridor slabs and bearing embedded within said site-poured concrete beneath the floor surface thereof on each floor; third site-positioned reinforcing 15 means projecting from the floor portion of each said service modules and extending over the surface of said corridor topping slabs, said floor topping slabs and said bearing walls whereby the same will be 20 embedded beneath the floor surface of each said floor following site pouring of said concrete; balcony slabs corresponding in approximate thickness to the thickness of the slab portion of said service module, with 25 said balcony slabs being supported on their opposed ends by said bearing walls in side-by-side parallel relationship with said floor topping slabs; fourth field-positioned reinforcing means projecting laterally from 30 one edge of said balcony slab in overlying relationship with the adjacent floor topping

slab whereby the same is embedded within said field-positioned concrete; site-poured concrete at each floor level of said building poured over said field-positioned floor 35 topping slabs and said corridor slabs to the floor surface level of said service module and said balcony slabs whereby a floor surface is created, said voids of said bearing walls being gravitationally filled, and said 40 first, second, third, and fourth mentioned reinforcing means being embedded beneath the floor surface of said site-poured concrete; said site-poured concrete structurally integrating said load-bearing 45 walls, said floor topping slabs, said service modules, said corridor slabs, and said balcony slabs into a monolithic floor surface for each floor of the building.

17. A method of erecting a multi-storey 50 building substantially as herein described with reference to the accompanying drawings.

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