Joints & Connections

Between Building Components

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As the overall stability of a precast or semi-precast structure depends largely on its connections, it is important to consider the effectiveness of these connections in transferring the forces between individual building elements and to the stabilising cores and foundation. Special provisions of structural ties should be provided and detailed for structural integrity.

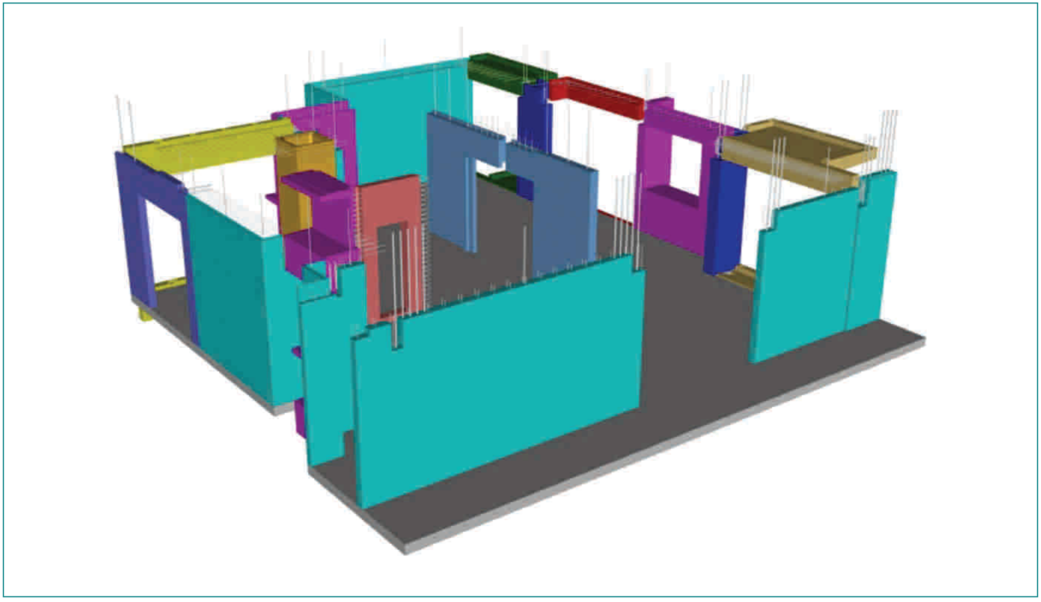


Fig. 2.1 – An assemblage of precast elements that need to be connected at joints to form building framework

The detailing of connections should satisfy the requirements with respect to the manufacture, transport and erection of the precast units. It should be designed for simple assembly and details compatible with the overall requirements for the building so as to achieve a shorter construction time.

Locally, cast in-situ joints including grouted pipe sleeves are more commonly used in private residential projects. In general, connection details for floor slab with precast façade/ wall system are relatively simple as compared with precast frame and skeleton system. Essentially, one need to consider the connections between the floor slab, façade and wall element, between the individual floor elements and wall elements.

This section will highlight some of the common features in such connections used in private residential projects as a guide. They should not be considered as "standard", as proper connections and details fulfilling all relevant performance requirements would need to be designed based on project specific basis.

2.1 CONNECTIONS AT VERTICAL JOINTS BETWEEN PRECAST FAÇADES/ WALL PANELS

The connections at the vertical joints between precast façades/ wall panels are often achieved by means of cast in-situ joints. The connecting links can be provided by using means of distributed loops anchored directly within the panels. For load bearing façade or wall elements, the vertical continuity bars should be provided and designed so as to transmit shear forces for overall stability.

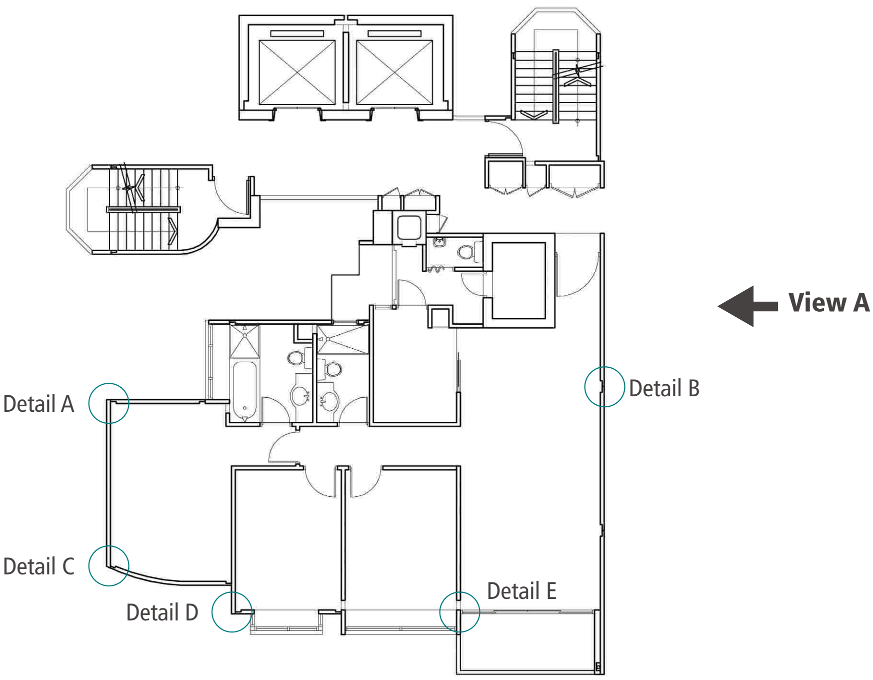


Fig. 2.2 – Example of a typical unit using precast façades/ wall panels

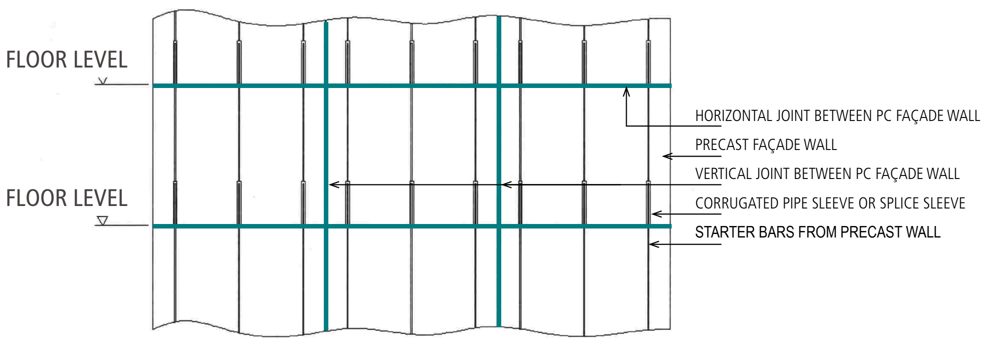


Fig. 2.3 – View A showing horizontal and vertical wall joints and splicing layout

2.1.1 Connection Details between Load-Bearing Façades

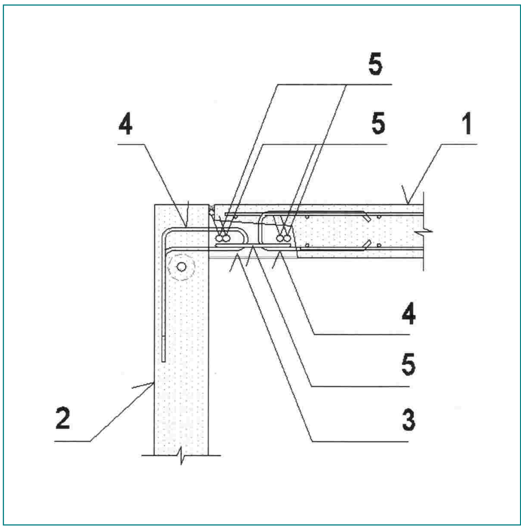


Fig. 2.4 – Detail A

1. PC wall
2. PC façade wall
3. In-situ concrete joint
4. Rebars from PC wall
5. Vertical continuity bars

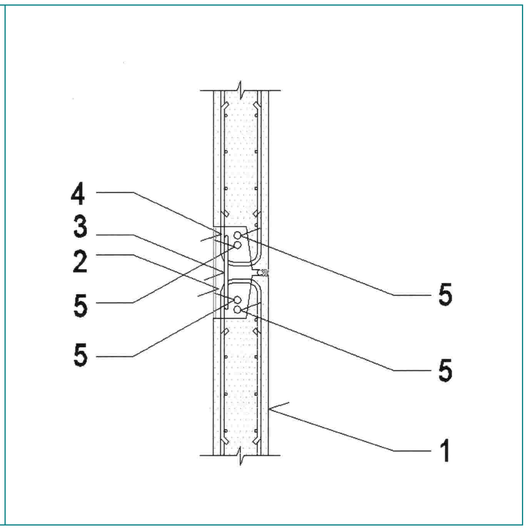


Fig. 2.5 – Detail B

1. PC wall
2. In-situ concrete joint
3. Rebar placed on site
4. Rebars from PC wall
5. Vertical continuity bars

2.1.2 Connection Details between Window Unit with Supporting Wall

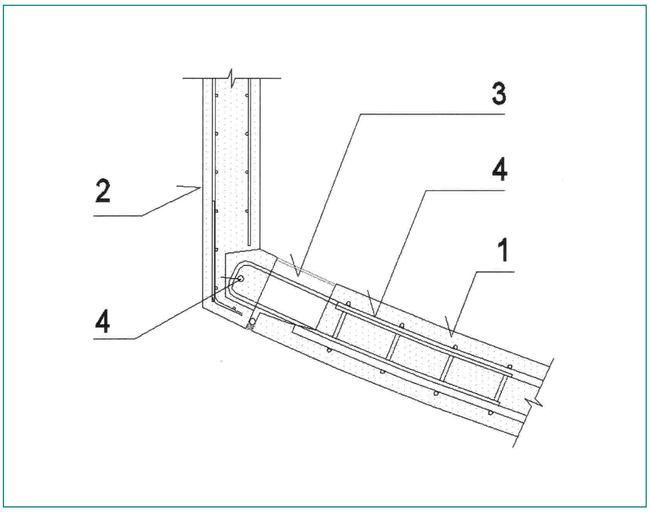


Fig. 2.6 – Detail C

1. PC window wall with beam
2. PC wall
3. In-situ concrete joint
4. Rebars from PC wall

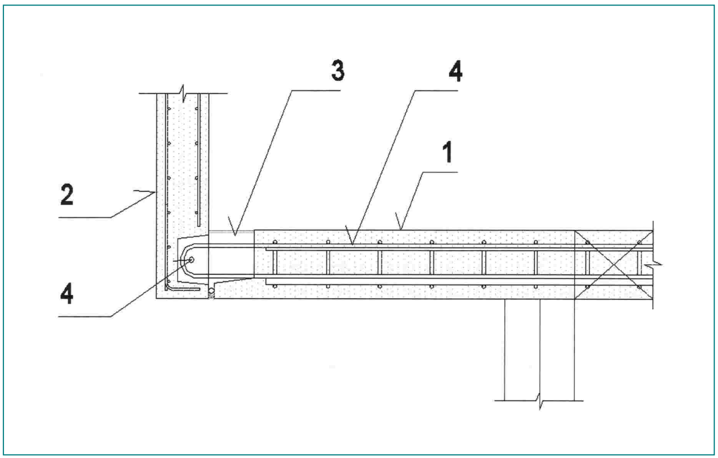


Fig. 2.7 – Detail D

1. PC beam for bay window
2. PC wall
3. In-situ concrete joint
4. Rebars from PC wall

2.1.3 Connection Details between Internal Load-Bearing Wall Elements

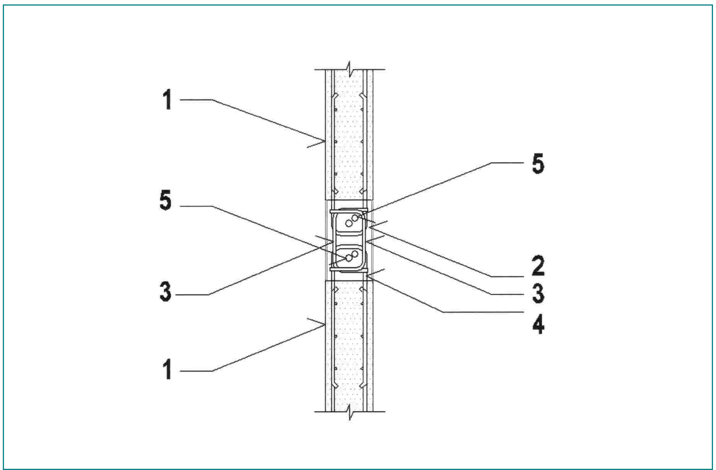


Fig. 2.8 – Detail E

1. PC wall
2. In-situ concrete joint
3. Rebars placed on site
4. Rebars from PC wall
5. Vertical continuity bars

2.2 CONNECTIONS BETWEEN PRECAST FAÇADES/ WALL PANELS AND FLOOR SLAB

The connections at the horizontal joints between precast façades/ wall panels are often connected by means of dowel connection, particularly for load bearing wall. Core holes within the wall panel are formed using proprietary splice sleeve or corrugated pipe sleeves. These holes together with the vertical continuity bars are filled with grout after wall installation. As for the connection between the precast façade/ wall with floor slab, the use of starter bars for bridging and continuity is commonly adopted as illustrated in the following figures.

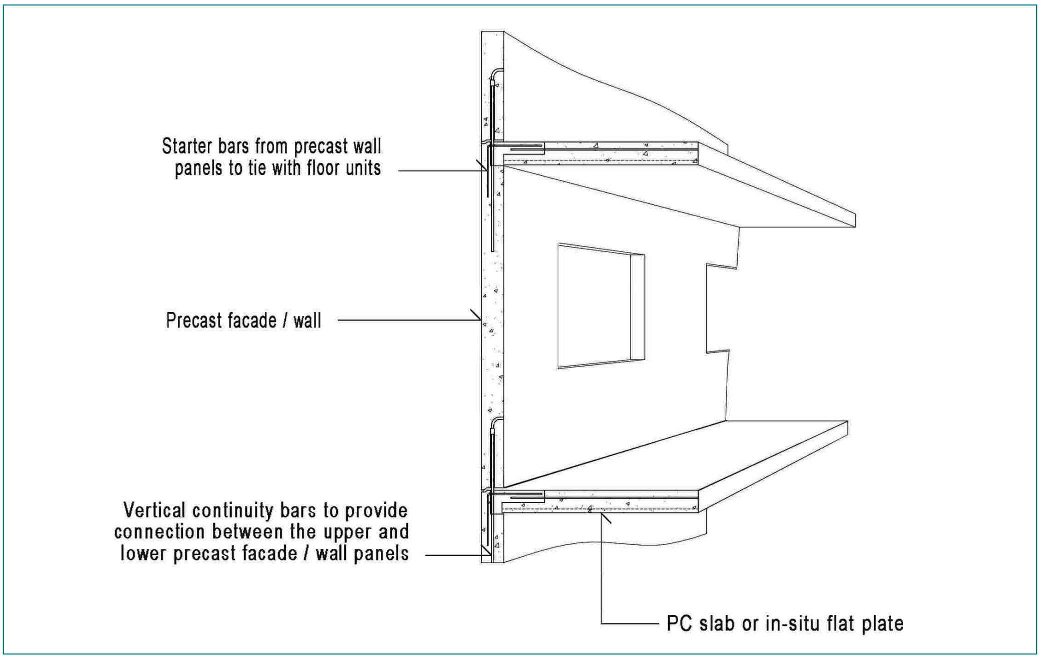


Fig. 2.9 – Design principle for connection between precast façade wall with floor slab

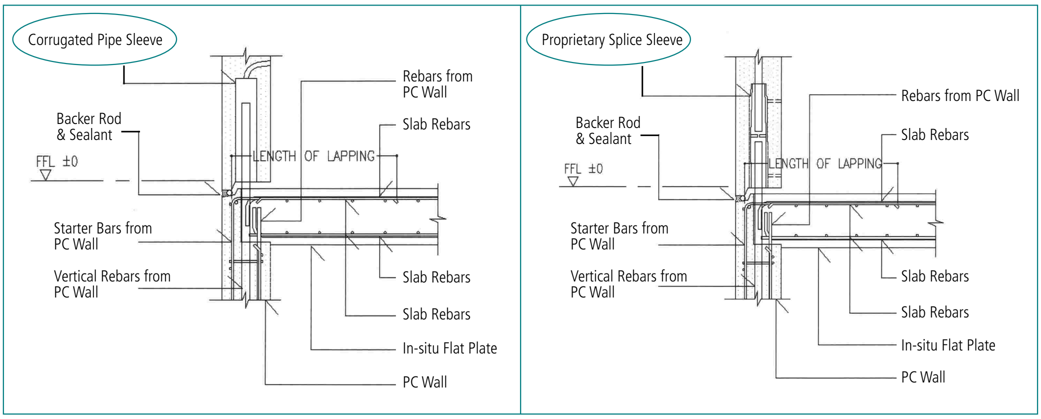
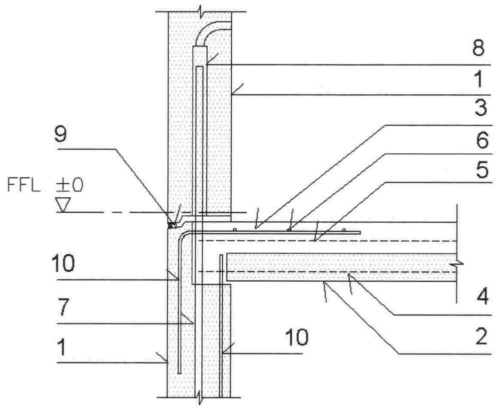


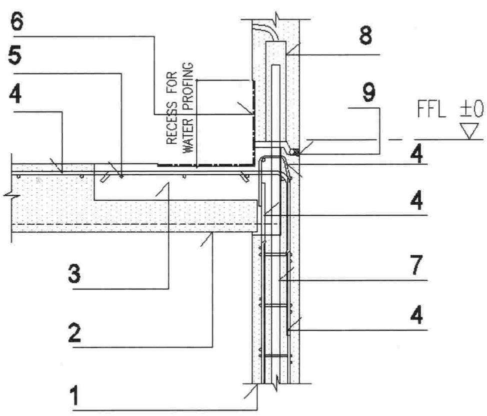
Fig. 2.10 – Different splicing details for connection between the upper and lower precast wall units

2.2.1 Wall to Floor Connections at Edge or Central Core



1. PC wall
2. PC half slab
3. In-situ concrete topping
4. Rebars from PC slab
5. Slab rebars to be placed on site
6. Rebars from PC wall
7. Vertical continuity bars
8. Corrugated Pipe Sleeve
9. Backer rod & sealant
10. Starter bars from PC wall

Fig. 2.11 – Connection between precast wall with precast half slab



1. PC wall
2. PC full slab
3. In-situ concrete joint
4. Rebars from PC wall
5. Rebars to be placed on site
6. Waterproofing system
7. Vertical continuity bars
8. Corrugated pipe sleeve
9. Backer rod and sealant

Fig. 2.12 – Connection between precast wall and precast full slab with waterproofing details

2.2.2 Intermediate Load-Bearing Walls to Floor Connections

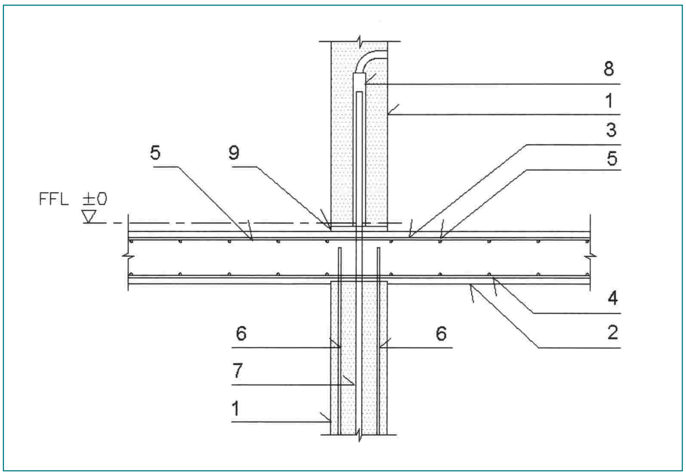


Fig. 2.13 – Internal PC wall to flat plate

1. PC wall
2. In-situ flat plate
3. Rebars to be placed on site
4. Rebars from In-situ flat plate
5. Rebars from In-situ flat plate
6. Rebars from PC wall
7. Vertical continuity bars from PC wall
8. Corrugated pipe sleeve
9. Grouting joint

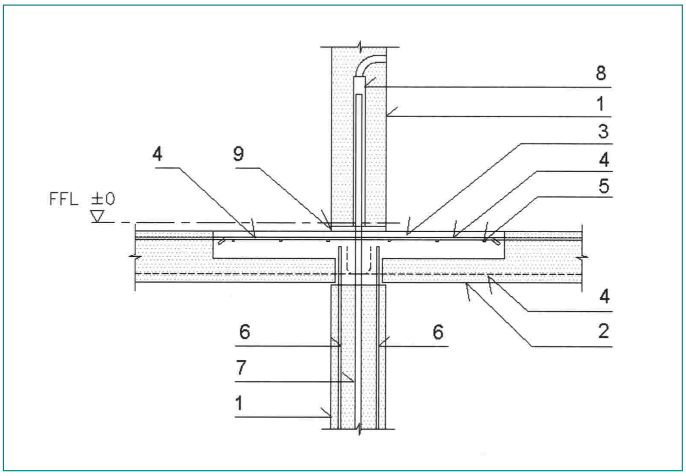


Fig. 2.14 – Internal PC wall to PC full slab

1. PC wall
2. PC full slab
3. In-situ concrete joint
4. Rebars from PC slab
5. Rebars to be placed on site
6. Rebars from PC wall
7. Vertical continuity bars from PC wall
8. Corrugated pipe sleeve
9. Grouting joint

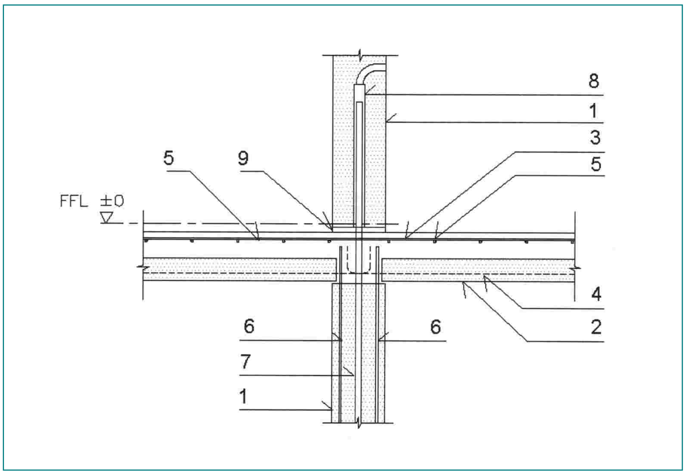
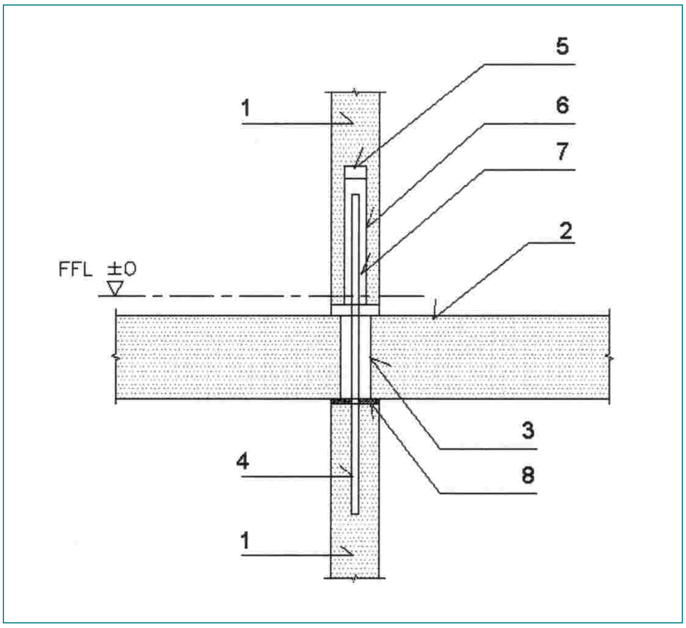


Fig. 2.15 – Internal PC wall to PC half slab

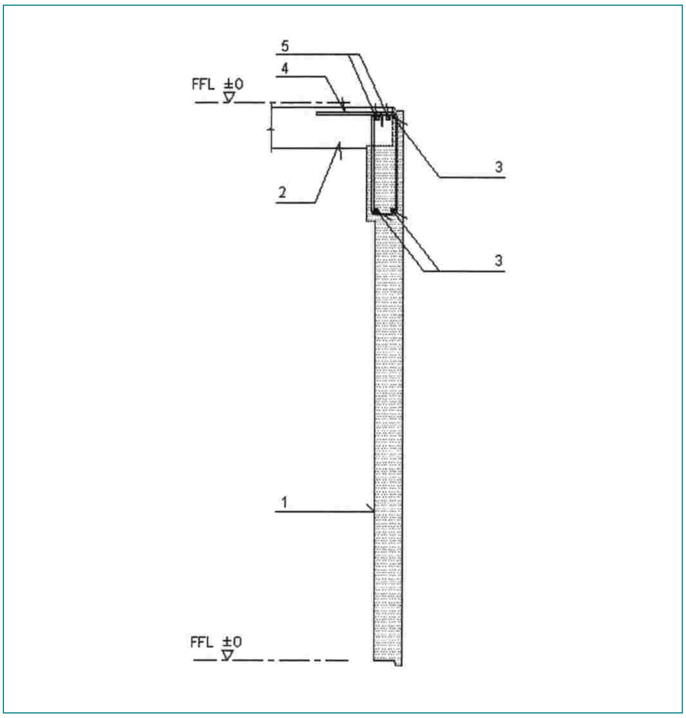
1. PC wall
2. PC half slab
3. In-situ concrete topping
4. Rebars from PC slab
5. Rebars to be placed on site
6. Rebars from PC wall
7. Vertical continuity bars from PC wall
8. Corrugated pipe sleeve
9. Grouting joint

2.2.3 Non Load-Bearing Wall to Floor Connections



1. PC partition wall
2. PC full slab
3. Corrugated pipe sleeve
4. Dowel bars from PC partition wall
5. Polyfoam
6. PVC pipe
7. Non-shrink grout
8. Compressive foam

Fig. 2.16 – Internal partition PC wall to PC full slab



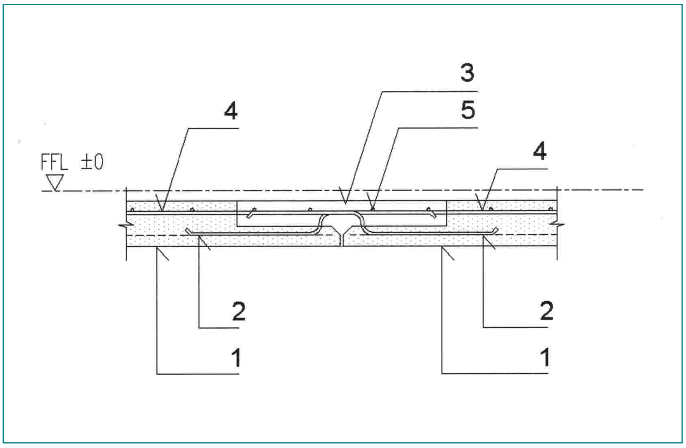
1. PC wall
2. In situ flat plate
3. Rebars from PC wall
4. Starter bars from PC wall
5. Rebars to be placed on site

Fig. 2.17 – Downhang wall details

2.3 CONNECTIONS BETWEEN PRECAST FLOOR ELEMENTS AND SUPPORTING STRUCTURES

The floors are required to resist horizontal forces in addition to vertical loads. To prevent movement between slabs, individual precast elements must be connected to form an integrated floor. This can be achieved using cast in-situ reinforced structural topping as in the case of composite precast half slab with topping system. For precast full slab, the use of grouted and concreted joints in combination with connecting tie bars will serve to achieve structural integrity and diaphragm action. The floor panels, in turn are supported by either beams, cast in-situ pour strips or bearing walls.

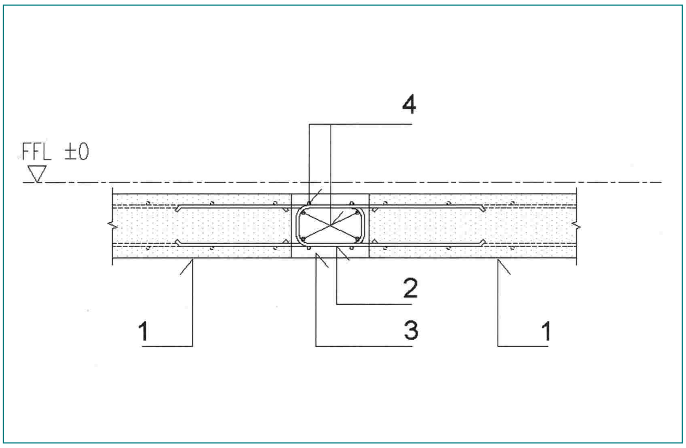
2.3.1 Connections between Precast Slab Panels and with Other Supporting Structures



1. PC full Slab
2. Bottom rebars from PC slab
3. In-situ joint
4. Top rebars from PC slab
5. Rebars placed on site

NOTE : Recess at joint can be incorporated for better panel alignment and finishes. Appropriate fibre mesh can be placed to pre-empt cracks before proceeding to skim coat

Fig. 2.18 – Connection between precast full slab panels



1. PC full slab
2 Rebars from PC slab
3. In-situ pour strip
4. Rebars placed on site

Fig. 2.19 – Connection between precast full slab panels using cast in-situ pour strip

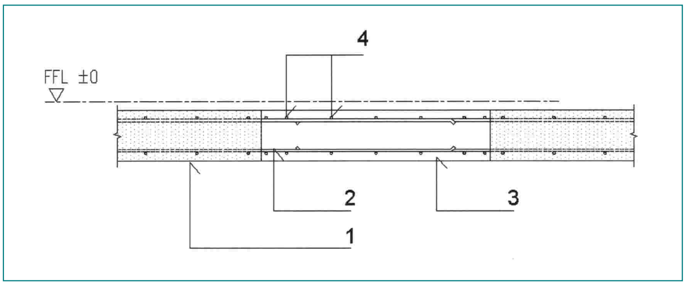


Fig. 2.20 – Use of stiffened cast in-situ pour strip to connect precast full slabs

1. PC full slab
2. Rebars from PC slab
3. In-situ pour strip
4. Rebars placed on site

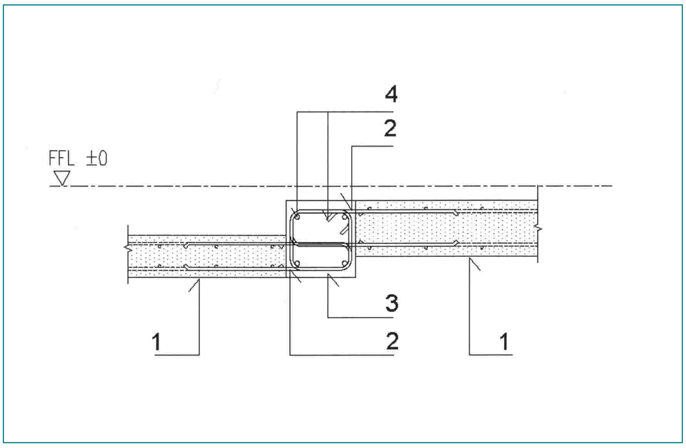


Fig. 2.21 – Use of cast in-situ pour strip to cater for floor level difference

1. PC full slab
2. Rebars from PC slab
3. In-situ pour strip
4. Rebars placed on site

Note: Dimensions of pour strip depends on design requirements

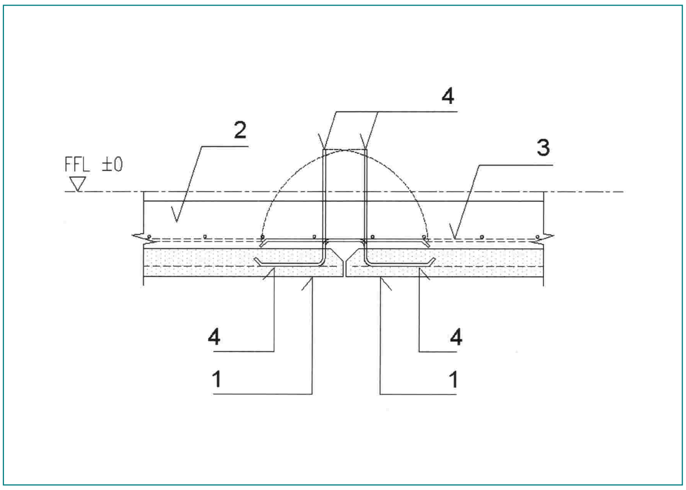
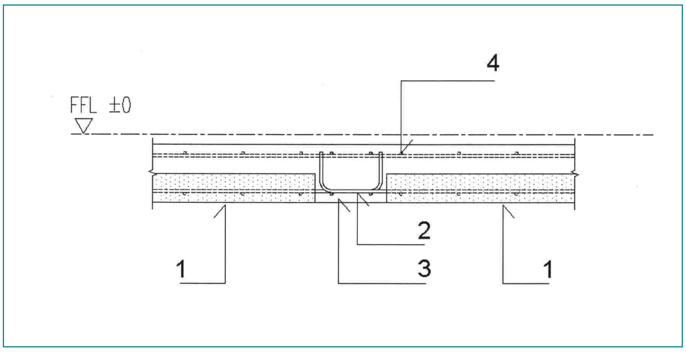


Fig. 2.22 – Connection between precast half slab in the secondary direction

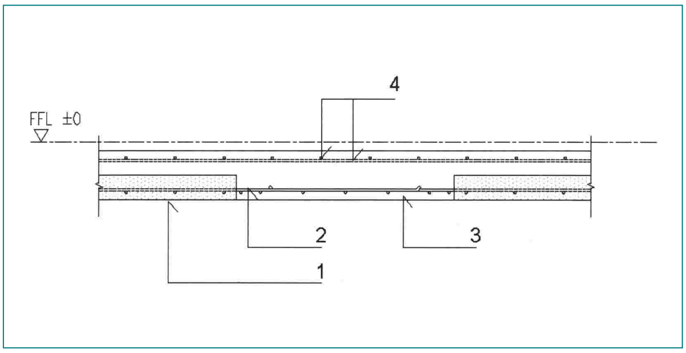
1. PC half slab
2. In-situ structural topping
3. Rebars placed on site
4. Rebars from PC slab

See note in Fig 2.18



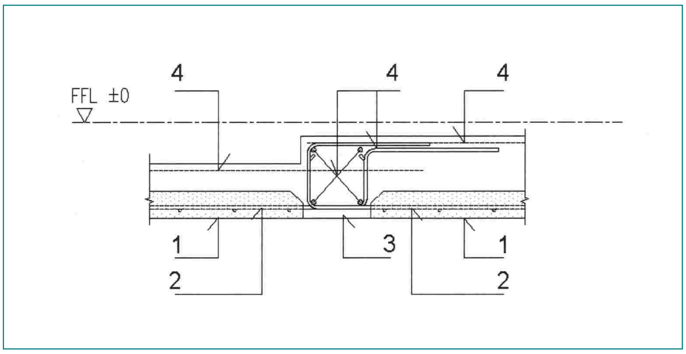
1. PC half slab
2. Rebars from PC slab
3. In-situ pour strip
4. Rebars to be placed on site

Fig. 2.23 – Connection between PC half slab in the secondary direction using cast in-situ pour strip



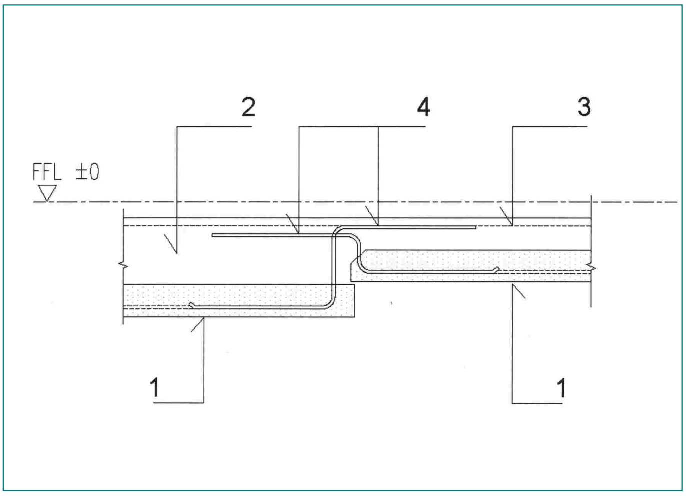
1. PC half slab
2. Rebars from PC slab
3. In-situ pour strip
4. Rebars to be placed on site

Fig. 2.24 – Use of stiffened cast in-situ pour strip to connect PC half slab panels in the secondary direction



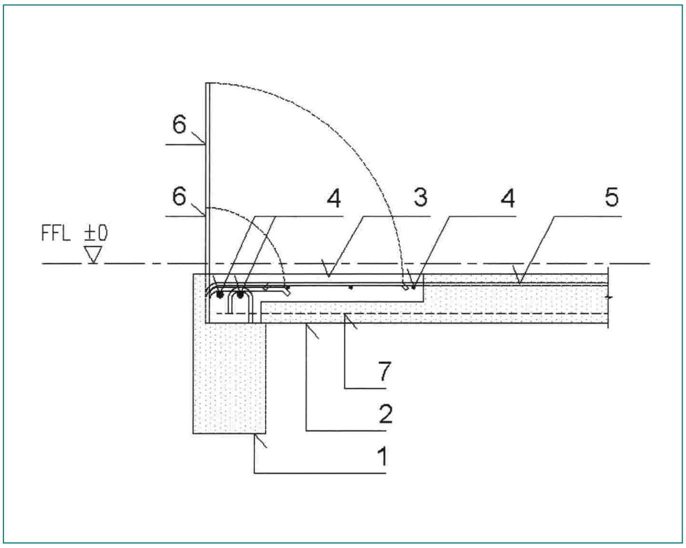
1. PC half slab
2. Rebars from PC slab
3. In-situ pour strip
4. Rebars to be placed on site

Fig. 2.25 – Use of cast in-situ pour strip to cater for floor level difference



1. PC half slab
2. In-situ structural topping
3. Rebars to be placed on site
4. Rebars from PC slab

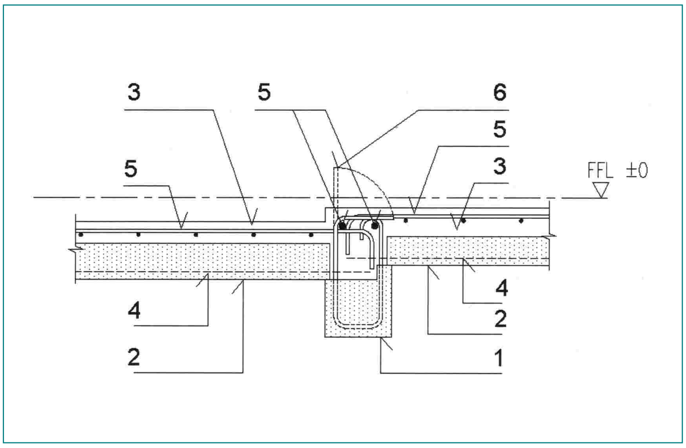
Fig. 2.26 – Details to cater to the change in slab thickness



1. PC beam
2. PC full slab
3. In situ concrete infill
4. Rebars placed on site
5. Rebars from PC slab
6. Rebars from PC beam
7. Bottom layer wire mesh from PC slab

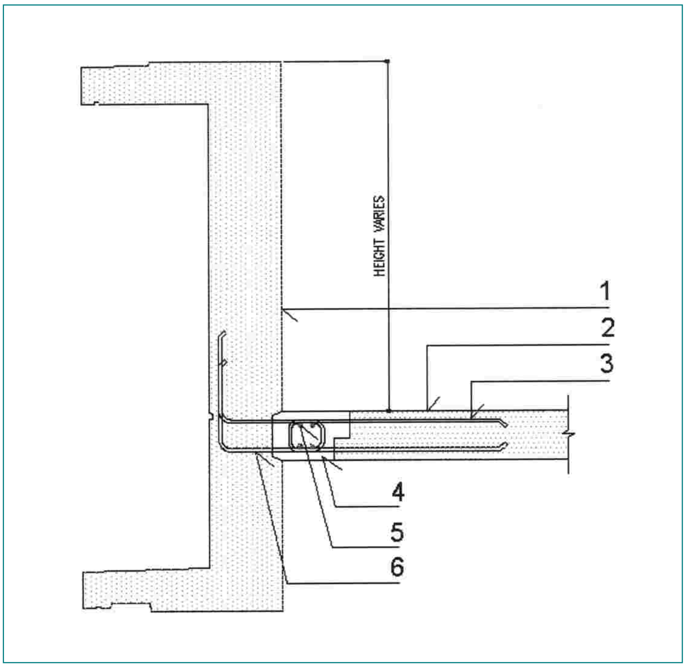
Note: PC slab could "sit" directly on the PC beam during installation. The anchorage bars from the precast beam are to be bent and tied in place before casting the joint.

Fig. 2.27 – External PC beam supporting PC full slab



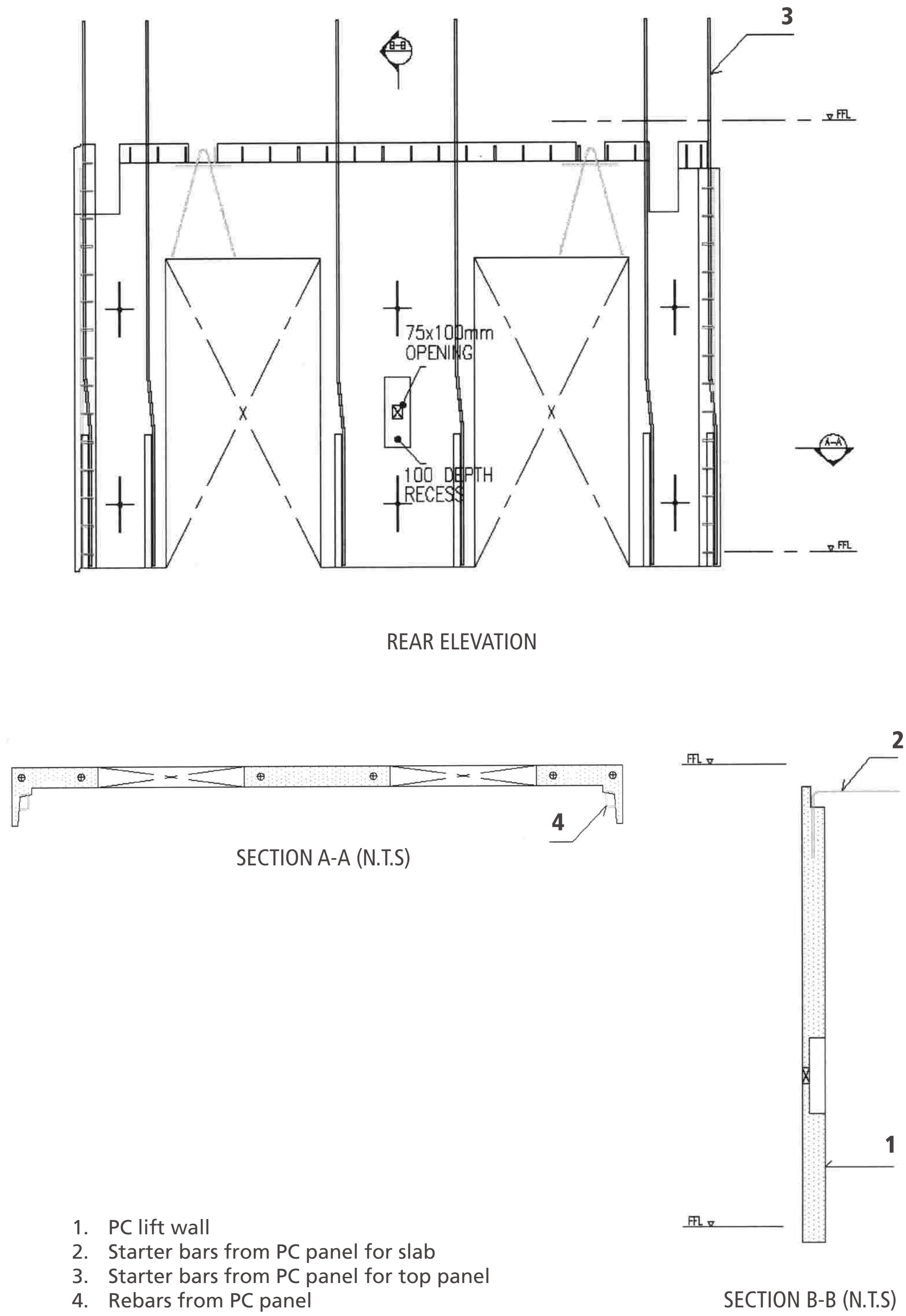
1. PC beam
2. PC half slab
3. In-situ concrete infill
4. Bottom layer wire mesh from PC slab
5. Beam & slab rebars to be placed on site
6. Rebars from PC beam

Fig. 2.28 – Internal PC beam supporting PC half slab



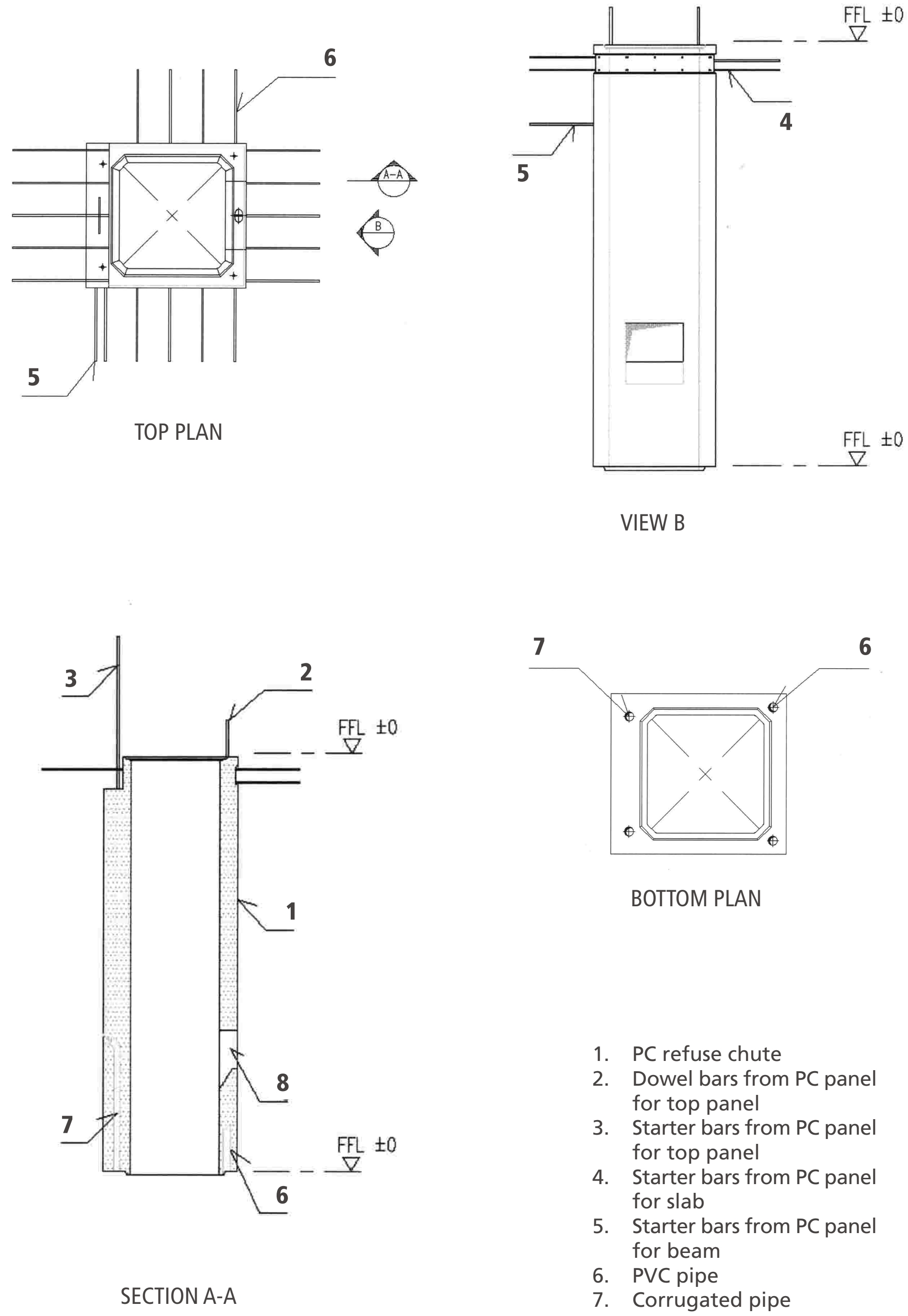
1. PC beam
2. PC full slab
3. Rebars from PC slab
4. In-situ concrete infill
5. Rebars to be placed on site
6. Rebars from PC beam

Fig. 2.29 – Bay window beam supporting PC full slab



1. PC lift wall
2. Starter bars from PC panel for slab
3. Starter bars from PC panel for top panel
4. Rebars from PC panel

Fig. 2.30 – Example of PC lift wall details and connection with floor elements



1. PC refuse chute
2. Dowel bars from PC panel for top panel
3. Starter bars from PC panel for top panel
4. Starter bars from PC panel for slab
5. Starter bars from PC panel for beam
6. PVC pipe
7. Corrugated pipe

Fig. 2.31 – **Example of PC refuse chute details and connection with floor elements**