

Innovative hybrid concrete framing answers the speed challenge in Perth

Bishops See South Tower is the first of a two stage office block development located in Perth's CBD heritage precinct. Completed in February 2009 by Brookfield Multiplex, this nine storey (above ground) building is providing 18,000 m² of greatly needed office space.

A unique structural solution evolved from two main requirements – speed, due to an urgent need for office space in the Perth CBD; and a desire to minimise site works to cope with labour shortages during the construction period. Combining the speed and prefabrication attributes of precast concrete with the flexibility and economy of insitu concrete in an innovative design solution, Brookfield Multiplex have successfully delivered the project on time and on budget.

A concrete framed solution

Built on a 9.0 m x 8.4 m grid, the building consists of 9 typical floors above a podium level and three basement levels. Up to podium level, the structure is insitu concrete construction. Post-tensioning is used in the podium and basement slabs to limit slab depths.

Project value: \$85 million building structure; \$25 million complete tenancy fit out

9 storeys above ground

Earthworks commencement November 2006

Structure commencement March 2007, project completion February 2009

18,000 m² net lettable area

9.0 m x 8.4 m building grid, 3850 mm floor to floor height



The tower above podium level is an innovative precast concrete solution including columns, perimeter beams and hollowcore floor slabs. Formwork is effectively eliminated. Structural sizes are 600 mm deep x 700 mm perimeter beams, 170 mm deep hollowcore deck units with a 70 mm insitu structural concrete topping.

Internal beams supporting the hollowcore deck units are 600 mm deep x 1200 mm insitu reinforced concrete (RC) beams formed by permanent steel beam side forms. The steel beams provide temporary supports for the precast deck units during construction without the need for propping.

Precast column sizes are 700 mm square internally and 500 mm x 1200 mm externally. Lateral load resistance is provided by a centrally located insitu RC service core.

Bishops See South Tower Building

235 St Georges Terrace, Perth

builder and project manager:

Brookfield Multiplex Group

structural engineer:

Connell Wagner

architect:

Fitzpatrick & Partners

developer:

Hawaiian Group and Brookfield Multiplex Group



top: Internal beam and precast deck units prior to topping

above: Prefabricated form assembly for internal beam

Concrete framing provides superior value

Several structural framing options were considered by the D&C project team and rated against the key criteria of construction speed in Perth's 'over-heated' construction market, cost and risk. Three distinct systems were considered – mixed precast and insitu (hybrid) concrete, insitu concrete and structural steel.

The precast hybrid concrete solution was chosen as the best performing system against cost, speed and risk. Prefabrication of concrete elements off-site alleviated the shortage of labour in Perth, thereby giving it a speed advantage.

While the structural steel solution was also prefabricated, it was viewed as a much higher risk profile due to the volatile and escalating nature of steel prices.

A further benefit of precast was that the hollowcore floors required no propping during construction, permitting fit-out below the construction level at an earlier time and reducing the overall project completion date.

Hybrid concrete framing achieves budget...

Hybrid concrete construction refers to combining precast and insitu concrete technologies optimally to deliver maximum value. The versatility and economy of insitu concrete when combined with PT was adopted in the basement slabs and heavily loaded podium slab. The prefabrication benefits and low labour demand of precast concrete have been fully realised in the more orthodox and repeatable typical floors section of the building.

Using this innovative approach, Brookfield Multiplex reached handover stage on 13 February 2009, on schedule and on budget.

Precast concrete solution delivers speed...

The precast columns, perimeter beams and decking units eliminated the time and labour requirements associated with traditional formwork. Following a small learning curve on the first two floors, the construction process of erecting the columns, then the beams and slabs became a relatively simple operation.

Figure 1 outlines the construction sequencing employed for the precast solution, which achieved a 9 day floor cycle time. In combination with the subsequent fit-out speed enhanced by the elimination of floor construction props, the construction progress ensured the challenging schedule was achieved.

Innovative construction detailing...

A feature of the precast structural solution is the seamless interface achieved between the design detailing and construction sequencing. An example is the internal insitu RC beams. Fully prefabricated permanent steel formwork is designed to be lifted onto the precast columns and support the precast deck units.

EXTERNAL COMPONENT ASSEMBLY

- 1 Precast columns lowered on to existing columns, propped and grouted
- 2 Edge beams placed and fixed to column corbels
- 3 Hollowcore floor planks placed on edge beam
- 4 Insitu topping to floor
- 5 Facade fixed to inserts cast in edge beam

INTERNAL COMPONENT ASSEMBLY

- 1 Precast columns lowered on to cured insitu topping, propped and grouted
- 2 Permanent steel forms, including reinforcement, fixed to column via attached support plate
- 3 Hollowcore floor planks placed
- 4 Insitu topping to floor and insitu beam

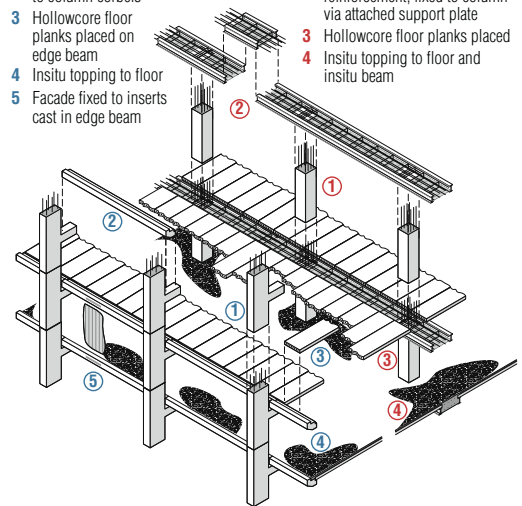


Figure 1: Precast concrete solution for tower

Architecture takes advantage of precast finish...

The superior off-form finish of precast enabled architects Fitzpatrick & Partners to visually express the columns on the North and South elevations. The curtain wall facade, uninterrupted vertically, is recessed between each column bay, giving a striking effect to the building.

Key features of the design-and-construct solution:

- Hybrid concrete construction solution: insitu concrete to podium level, 9 storey precast concrete tower structure.
- Insitu RC concrete slip formed core construction.
- Use of prefabrication to manage Perth's labour shortages.
- Bishops See South tower is the first building in WA to be awarded a 5 star Green Star (Office Design V2 – 'Australian Excellence') rating

March 2009

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