

Concrete framing overcomes Adelaide's strict building height regulations

A sleek and stylish new office building with over 15,000 m² of net lettable area is the new corporate home for Santos in Adelaide. A centrally located core adjacent a full height atrium and stair ensemble connects the 13 levels of office space, with a café and lobby located on ground floor.

Built by John Hindmarsh (South Australia) Pty Ltd under a design and construct contract, the choice of structural frame was driven by the requirement for 15 m clear spans as well as Adelaide City's strict building height restrictions. With the building height set, minimising the floor to floor height became critical in achieving the required number of levels to meet the chief tenant's space requirements.

Over 15,000 m² net lettable area

Construction value \$60 million

14 storeys above ground

Column grid layout: 15 m x 6.6 m and 7.2 m x 6.6 m

9.0 m x 13.5 m column grid

50 and 40 MPa concrete used in columns



A concrete framed solution

Floor plates consisted of one-way spanning precast concrete Hollowcore planks supported by insitu reinforced concrete band beams in the other direction. Prestressed 320 mm deep Hollowcore plank units with a 75 mm insitu structural topping achieved 15 m spans. The band beams were 420 mm deep and spanned 6.6 m, giving a total floor depth of 420 mm. The innovative connection detail between band beams and Hollowcore planks shown over page kept beams and precast plank units in the same plane, minimising the critical floor to floor height.

600 mm square insitu reinforced concrete columns were typically used for the vertical structure, with some 700 mm square columns used internally up to the fourth floor. A central service core completed the structure. The building's lateral load resistance for earthquake and wind loads is provided dually by the service core and moment resisting perimeter frame of columns and beams.



Santos Office Headquarters

Flinders Street, Adelaide, SA

developer:

Flinders Link Pty Ltd

builder:

John Hindmarsh (South Australia) Pty Ltd

structural engineer:

Wallbridge and Gilbert

architect:

Hassell Group



top: The structural frame comprises an optimised mix of insitu and precast concrete elements

above: The shallow structural floor plates minimise the critical floor to floor height

Concrete framing provides superior value

Options for the floor plate considered in the design phase were a one-way spanning post-tensioned insitu concrete slab supported by reinforced concrete band beams, and a two-way spanning post-tensioned insitu concrete flat slab. A structural steel option was estimated to be uneconomical to achieve the necessary floor to floor height and therefore eliminated at the early planning stage.

The design and construct team determined that an all concrete structural frame using a mix of precast and insitu was the lowest cost solution to achieve the key project criteria of a 3525 mm floor to floor height and large clear floors without column intrusions.

Floor cycle time beats prediction

The original predicted floor cycle in the construction schedule was 14 days. From level 2 onwards the actual floor cycles achieved were either 10 or 11 days which greatly assisted Hindmarsh Builders overcome late design changes and still achieve the ambitious tenant move-in date of March 2007. The construction programme also required that floors were completed to hand-over as soon as they were constructed, reinforcing the importance of speed.

Concrete framing a low-risk solution

An unanticipated design change occurred late in the planning period at the anchor tenant's request. The change consisted of a full height atrium to the centre of the building with access stairs and bridges between floors. The flexibility and capacity for increased speed of the chosen precast and insitu concrete framing system allowed this change to be incorporated and still meet the target hand-over dates. Flexibility in design and construction coupled with speed proved to be two major risk reduction attributes of concrete construction for this project in meeting schedule and budget.

Engineering challenges

Given the very long spans involved, floor vibration performance was analysed for each floor plate option considered. The precast

Hollowcore plank solution was carefully modelled and has proven to be a very stiff floor system giving excellent vibration performance.

Lateral deflections of the building structure under earthquake loads were calculated and the bracing system modified to limit sway for the chosen curtain wall facade. A close working relationship between structural engineers Wallbridge and Gilbert and the facade contractor facilitated an economical compromise between building sway and facade cost.

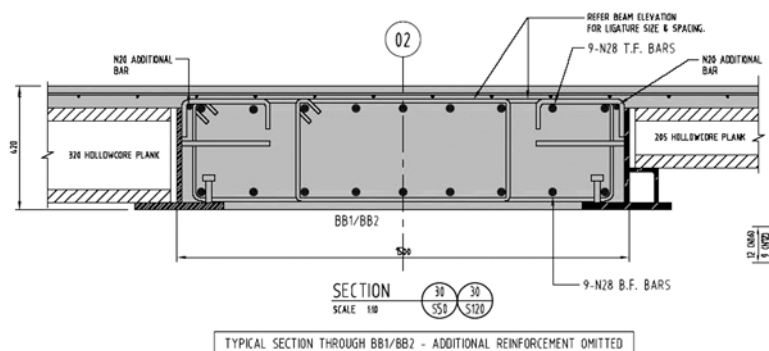
Innovative concrete construction

The entire lift core and adjacent toilet and stairwell walls were constructed using a self-climbing jump form which achieved a 6 day turn around time per floor. Insitu concrete was delivered to levels 4 up to the level 14 plant room with a satellite boom pump. High strength concrete was used to achieve early stripping times and self climbing screens formed the safety barrier around the perimeter.

Key features of the design-and-construct solution:

- Mixed precast and insitu concrete construction components optimised to achieve 3525 mm floor to floor height.
- Self climbing jump form core construction.
- Self climbing perimeter screens.

Innovative precast flooring connection details designed by the structural engineers minimised the floor depth



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