Raptis Group manages risk with concrete framing

Minimising risk is a key factor in Raptis Group's successful tower developments like The Phoenician at Broadbeach and the Towers of Chevron Renaissance at Surfers Paradise. The Group's latest project, Southport Central, is set to revitalise the Gold Coast's CBD. Set over a 1.8-ha site, three towers incorporate 730 apartments on the upper levels, 400 boutique office suites on the lower levels, and 76 retail spaces around a landscaped pedestrian thoroughfare.

Key construction risk areas were identified as weather, site safety, workforce and those associated with building materials/components. Each of these issues could affect the scheduled completion date. While speed of construction is important also, Raptis requires that its achievement does not compromise either safety or quality. The time-tested reliability and flexibility of concrete framed construction forms a central part of Raptis' risk management.

3 x 40-storey mixed use towers

35,000 m^2 office space; retail areas;

700 luxury apartments

Status (Nov 2006): Tower 1 complete, Tower 2 underway

Tower 1 completed in 20 months

Project budget $ 700 million

80 MPa concrete used in vertical elements

The solution

A mixed insitu and precast concrete structural frame solution best satisfied all essential design and construction criteria for the development while minimising the building risks. Lateral-load resistance is provided to the towers by 200-mm insitu concrete offset shear walls and outrigger walls that extend from the core to the building perimeter, thus utilising the full depth of the building for lateral-load resistance. Other vertical elements were taken off the critical path by being designed as precast concrete fabricated off site. Conventionally reinforced flat-plate floors, 200-mm on residential levels and 300-mm on commercial levels, were used to minimise the depth of the floor zones and to simplify formwork. The jump-formed core advanced four levels above the floors.

Southport Central

Scarborough Street, Southport Qld

builder/developer:
Raptis Group

structural engineer:
Connell Wagner (formerly Connell Mott MacDonald)

architect:
Archidiom Design Group

Level 6 post-tensioned transfer floor

Concrete framing provides value

Steel framing was not considered a viable option since too few Gold Coast Contractors are 'geared up' for it, creating an unacceptable risk of delays and cost overruns. The typically greater floor-zone depth in steel-framed buildings would have led to a higher building with proportionately higher facade costs. Furthermore, in the aggressive Gold Coast environment, whole-of-life maintenance liability for the building owner is minimised with a concrete-framed building.

Three different forms of concrete framing – insitu, precast and post tensioning – were reviewed at planning stage by both the builder and structural engineer to develop an optimal construction solution for the project in terms of cost, speed and risk mitigation.

Lowest cost solution

The innovative use of concrete outrigger shear walls played a significant part in providing an economical structure to build and a financially profitable building. The amount of reinforcement was minimised and the element sizes reduced, thus increasing the net lettable area.

High-strength concrete, typically 80-MPa, was used to minimise wall thicknesses and column sizes. High-early-strength concrete was used throughout to minimise the period required for back-propping. Since the building was to be occupied in three stages, the early fit-out that this facilitated had a significant impact on the project's financial viability.

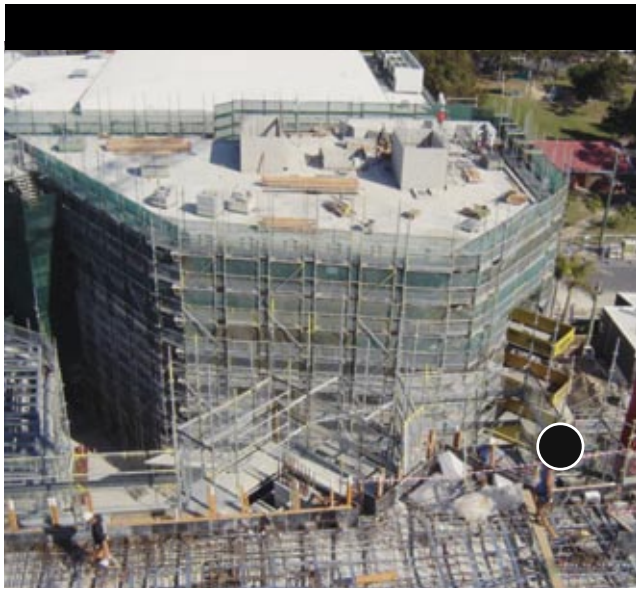
Precast saves time and lowers risk

An early construction decision was to make all compression-load-only columns (about 60% of all columns) precast, which helped achieve 4-day floor cycles by removing the forming of columns from the critical time path. A unique connection detailing system enabled seamless precast erection.

Post-tensioned solution for transfer slab

The main challenge was the transfer slab needed at the change from commercial to residential use above level 5. To reduce construction loads on the levels below, the 1300-mm-thick post-tensioned slab was placed in two layers. This minimised the extent of back-propping on the floors below, thereby not inhibiting the fit-out of the commercial areas. Once the second layer had been placed, and had gained sufficient strength, the conventional reinforcement provided in the transfer slab enabled it to support the first ten residential floors. Only as further floors were added was it necessary to stress the slab's post-tensioning tendons. This progressive-stressing approach ensured that the slab was not at any stage overstressed.

Tower 1 under construction



Key features of the design-and-construct solution:

- The use of outrigger shear walls.
- Construction optimised by using precast columns.
- The use of high-strength concrete to minimise element sizes.
- Fire engineered solution allows reduced wall and column thicknesses.
- Self-climbing perimeter screens extended two floors down for added safety.
- 4-day floor cycles on typical floors.
- Accelerated fit-out.

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