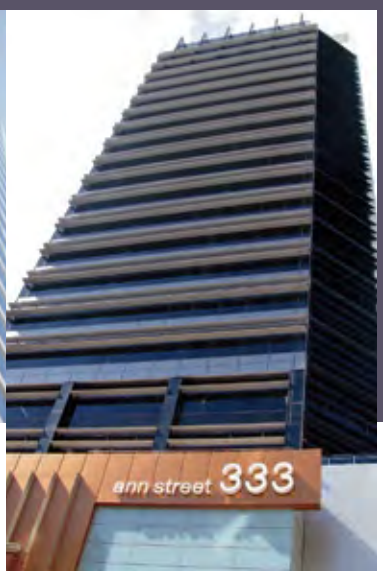
Concrete framing beats budget and programme on a challenging site



In the heart of Brisbane's CBD, a new 25 storey office building at 333 Ann Street brings a contemporary feel to the surrounding heritage precinct. For their first high-rise office project, developer/builder Devine chose the reliability of concrete framed construction on a particularly challenging site.

Facing the busy Ann Street, the site contained a heritage facade, an existing electricity substation structure on the rear boundary and two cable tunnels on both sides. Combined with very limited access during construction, this presented a significant challenge for the design and construct team. A concrete framed structure was a major part of an inspired construction solution that delivered the project under budget and two months ahead of schedule.

A concrete framed solution

Existing concrete pier footings and substation column extensions from a previous building design for the site were fully utilised to support the new tower. The existing heritage facade was completely supported by the final structure.

Total project cost $65 million

25 storeys above ground

16,685 m^2 net lettable area

72 weeks construction period, completed 2 months ahead of schedule

Devine's first office high-rise project

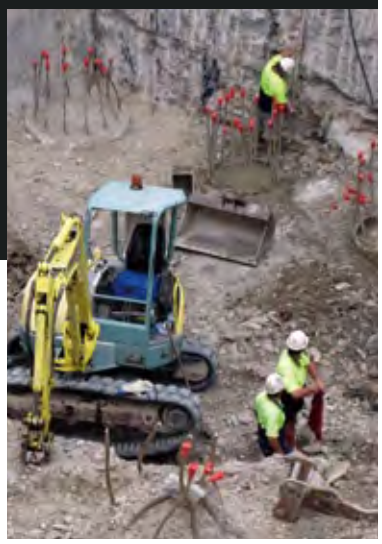
Up to 70 MPa high strength concrete used in lower storey columns

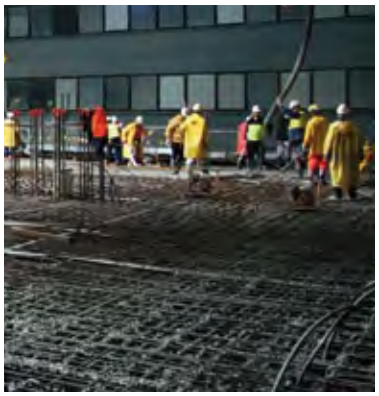
Typical floors consisted of post-tensioned (PT) one-way concrete band beams 550 mm deep x 2400 mm wide, transitioned to 350 mm deep at the ends to provide clearance for services. 170 to 230 mm deep PT slabs spanned in the other direction. Perimeter band beams 350 mm deep x 900 wide completed the floor structure.

A central jump formed concrete core provides 100% of the tower's lateral load resistance. Typically 600 by 600 mm concrete perimeter columns complete the vertical structure. Up to 70 MPa high strength concrete was utilised to contain section sizes.

333 Ann Street, Brisbane

developer:
Devine Limited
builder and project manager:
Devine Construction
structural engineer:
Robert Bird Group
architect:
ML Design





top: Pre-existing footings are uncovered

above: Night pour of a floor slab

Concrete framing provides value

Buildability was the key objective for Devine's structure choice to meet budget and programme on a challenging site. A steel frame option was excluded at the outset as it was considered by Devine to be both high risk and high cost when compared to a concrete framed option. The high price volatility of structural steel coupled with increased floor to floor height required for a steel floor structure were key factors against steel.

A shallow PT concrete band beam floor solution supported by perimeter concrete columns was chosen by the structural engineers as the most economic option that maximised buildability. The PT floor structure minimised floor to floor height and provided open column free floor spaces.

Concrete framing efficiency gains two months time saving

A high level of construction efficiency was enabled by the versatility of concrete framing. Time savings were gained through:

- off site prefabrication of all column reinforcement,
- proprietary modular floor formwork system – 'Titan HV' by Ischebeck,
- early formwork stripping facilitated by high strength concrete, and
- precast concrete utilisation in the facade.

Five-day floor to floor cycles were consistently achieved, with an occasional four-day result. The project was completed under budget and 2 months ahead of schedule which allowed the building to be fully leased by the original completion date.

Concrete framing the low risk option

Concrete framing was viewed as a versatile and proven system by the builder, and a key part of the risk management philosophy to offset the unknown and high risk nature of the challenging conditions. Key risk areas of time, material handling, safety, access and IR were fully understood and managed in the context of proven concrete construction methodologies.

Transfer slabs

The pre-existing footings locations and capacities, and the need to bridge over the cable tunnels and electricity substation required some innovative engineering solutions. At level 1 a 2500 mm deep reinforced concrete slab supports the tower stair core. At level 5 a combination of PT slab and beams, 1800 to 2500 mm deep, transfer tower perimeter column loads to external lower level columns and walls.

The load capacity of the existing substation roof meant that staged concrete pours were required for these deep transfer zones. The initial concrete pours comprised the bottom 500 deep beams that were post tensioned and then capable of supporting loads imposed by the subsequent pours.

Modular floor formwork system

Key features of the design-and-construct solution:

- Heritage facade reserved and incorporated into the final design.
- Existing footings utilised to support the tower.
- Self-climbing jump form core construction.
- Major transfer floors at levels 1 and 5.
- 4-day floor to floor cycle achieved, 5-day typical.
- 3.85 m floor to floor height.
- PT concrete band beam typical floor solution.

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