

Bovis Lend Lease delivers exceptional value with concrete framing

Exceptional value is the most appropriate epithet for the 40-storey Deutsche Bank Building at 126 Phillip Street, Sydney. It provides 43,000 m² net office space over 31 levels. By using an innovative concrete frame solution, Bovis Lend Lease (BLL) was able to overcome the challenges of a narrow site and produce a viable financial project for the developer.

Background

In early 2001, BLL commenced discussions with the developer on how to turn an office tower concept prepared by London-based architect Foster Partners into a financially viable project. With the earlier schematics based on a central service core and composite concrete and steel frame, the resulting net floor space returns didn't equate to an adequate return on investment for the project to proceed.

240 m high tower

43,000 m² net office space over 31 levels

21 m x 64 m open tenancy spaces per floor

Post tensioned 21 m span concrete band beams

Project completed in 4 years

Building structure completed in 26 months

Cost \$235 million

25 to 100 MPa concrete used in superstructure



The solution

The BLL design and construct team, in close cooperation with the architect, set about redesigning the building to meet the client's target performance, financial and aesthetic criteria. The solution involved shifting the core to the western building exterior which allowed totally open floor spaces with freedom in tenancy space configuration, but introduced a challenge for the structural engineer. BLL turned to its long experience in innovative use of concrete construction to produce a building design that was both commercially attractive and structurally sound.



Deutsche Bank Building

126 Phillip Street, Sydney
builder:

Bovis Lend Lease
architect:

Foster and Partners, London;
with Hassell, Sydney
structural engineer:

Lend Lease Design

developer:

Investa Property Group



Why a concrete structural frame solution delivered value:

Cost savings achieved

With the core on the perimeter, the question became how to cost effectively achieve an uninterrupted 64- by 21-m floor plate. The innovative concrete solution incorporated post-tensioned floor beams cross spanning 21 m with an integral reinforced 125-mm slab spanning one way in the longitudinal direction.

The 800-mm-deep and 900-mm-wide post-tensioned band beams produced an extraordinary deflection control of 1:700. The beams were reduced in depth to 400 mm at their ends for a length of 2 m, which provided low cost underfloor horizontal service duct access, and a low cost stressing operation.

The alternative structural steel solution investigated by the design team would have required excessively deep steel beams, pushing up the floor to floor height and increasing the building cost substantially. Additionally, for the required span of 21 m, steel beams would have had unacceptable deflection and vibration characteristics.

Four-day floor cycles achieved

Construction speed was increased by innovative table formwork tailor made for the floor plate, slab/column connection detail and off-site fabrication of reinforcement for columns and beams. Self-climbing perimeter screens with attached column formwork and edge board provided both speed and a safe environment for workers on the decks. The natural flexibility of concrete allowed last minute changes to be made throughout the construction period, with minimal lead time required between final drawings and construction.

All of these factors combined to produce a very low cycle time of four days for a typical floor.

Lowest risk

The time-tested reliability of building in concrete in Australia allowed BLL to confidently predict cost and schedule performance, and to take on the role as project manager responsible for the design and construction of the entire development.

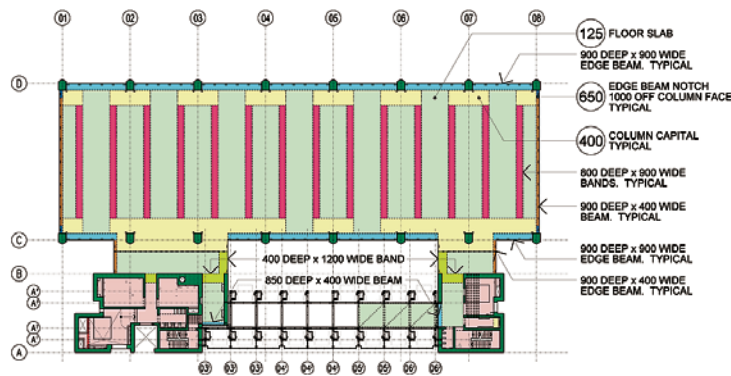
Innovation

BLL employed high performance concrete (HPC) to add further value to the frame design and construction. HPC allowed long-term differential shortening between the columns and remote core walls to be minimised, and permitted smaller footprint columns using concrete strengths up to 100 MPa.

Innovative structural design facilitated off-site fabrication of many reinforcement assemblies including: column cages, footing cages, edge beam cages with facade support brackets, floor beam cages and post-tensioning cables, core wall penetration boxes and tailored fabric slab reinforcement. In combination with purpose designed re-usable typical floor table forms, these innovations helped to achieve an incredibly low 4 day cycle speed as well as significant cost savings.

Key features of the design and construct solution:

- Remote core location, a first for Australian high rise construction.
- Clear uninterrupted flat plate floor area, 64 by 21 metres, giving commercial tenants unlimited flexibility in terms of fit out and future business requirements.
- Use of long spanning post tensioned band beams for the most economical structural floor plate system capable of delivering stringent serviceability criteria.
- Leading edge construction technology by BLL employing project specific table forms with folding wings so that they could fit into the formwork hoist without having to be dismantled.



Arrangement of typical floor structural components