209 Kings Way

THE VERSATILITY OF STEEL MET THE CHALLENGE

BUILDING CONTRACTOR
Multiplex

FABRICATOR
Alfasi Steel Constructions

ARCHITECTS
METIER3

STRUCTURAL ENGINEER
Bonacci Group

STEEL DETAILER
Universal Steel

FIRE ENGINEER
Norman Disney and Young

As the building had a structural steel frame, it was possible to accommodate the client's changes and still meet the final project deadline

The versatility and adaptability of structural steel was critical to the success of the construction of an 11-storey recently completed commercial building.

The elegance of Melbourne's wide streets has been enhanced by a new 11-storey steel building at 209 Kings Way, South Melbourne, with a total floor area of 45,000 square metres, incorporating a showroom for BMW vehicles at ground level and offices for the ANZ bank.

The completed building has a basement car parking level, a commercial showroom and offices at ground level, five levels of suspended car-parking, and five office levels constructed around a central atrium.

VERSATILITY OF STEEL MET THE CHALLENGE

The construction industry is used to coping with changes to initial plans, but the addition of 15 percent to the floor area of a partially completed building is at the extreme end of last minute changes! However, as the building had a structural steel frame, it was possible to accommodate these changes and still meet the final project deadline, despite the six week period awaiting town-planning approval of the changes.

The structural steelwork on the building had reached level 4 when the client requested the addition of approximately 6000 square metres of floor area. The additions required a further bay at the front of the building and the conversion of the car park at level 5 into office space. This conversion required increasing the floor-to-floor height at this level from 2.2 metres to 3.6 metres.

The steel columns for the levels above level 4 had already been fabricated when the additions were introduced. The construction team extended the columns at level 5 to allow construction to continue above this level. This extension was necessary because of the different floor-to-floor levels required for office accommodation.

Detailing and fabrication of the steelwork for the new bay was carried out while erection went ahead on the remainder of the building. An additional erection crew enabled erection of the new bay to catch up with the remainder of the building by level 8, so there was no disruption to the flow of work for the following trades.

Alfasi Steel Constructions, the structural steel contractors, and Multiplex Constructions, the builders on this project, would not have foreseen that, by selecting Alfasi's non-conforming tender for a steel-framed option over the original post-tensioned concrete design, they would be able to incorporate these last-minute changes without loss of time on the project.

While a steel-framed option was cost-competitive, it was the potential time saving offered by the structural steelwork alternative that convinced the builders to accept this tender, particularly in view of the client's requirement for the earliest possible occupation of the building.

REDUCED CONSTRUCTION TIME FRAME

Alfasi introduced steps on this project to ensure the shortest possible construction schedule to meet the client's requirements. These were:

- standardisation of the secondary beams so they could be used at any secondary beam location, facilitating just-in-time erection
- the construction was "jump-started", in that construction of the ground floor level was deferred with erection jumping immediately to level one. This enabled the more time-consuming construction of the ground floor level, which had to accommodate ramps, set-downs and mezzanine floor supports, to be carried out at a later stage while construction of the upper levels proceeded
- a composite core construction was pioneered for this building. Steel sheeting was used as permanent steel formwork around the core. This was constructed using shot-creted structural decking over steel framing

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to achieve the required fire rating. This ensured that construction of the service core did not control the progress of erection, as three storeys of structural steelwork could be erected ahead of shot-creting the service core

- three storey high columns were used on the project, with splices located one metre above floor level for ease of connection and faster erection
- temporary spigots were fastened to perimeter beams that enabled safety railing to be fixed in place while the beams were still on the ground prior to their erection
- unpropped structural decking was used for the one-way suspended floor slabs, which acted as permanent formwork and bottom reinforcement and enabled the following trades unfettered access to the areas below the suspended slab

Close liaison was established between Multiplex, Alfasi Steel Constructions, and the consulting structural engineers, the Bonacci Group from the beginning. Only 16 RFI's (Requests for Information) were issued compared to hundreds that might normally be expected on a project of this size, thanks to that cooperation.

The latest fire engineering techniques, based on research sponsored by OneSteel, were applied in the design of this building resulting in considerable savings for the client.

Significant emphasis was placed on co-ordination between the work carried out by Alfasi and the façade contractor, Termasteelisa.

The three-dimensional model of the building created by the steel shop detailers, Universal Steel Detailers (now known as Planet) was used to co-ordinate the installation of services with the structure.

Avri Alfasi, Managing Director of Alfasi Steel Constructions said that "the success of this project for Multiplex and Alfasi was due to our early involvement with the design, leading to a collaborative approach, which enabled the two companies to work together to minimise both the cost of the project and time of construction".

The elimination of all internal propping, resulted in a cleaner than expected site

- purpose-made mobile scaffolds were developed for steel erection access, located directly on the steel decking.

Using these techniques, a floor cycle of eight days for 4500 square metres was achieved, resulting in an effective construction period of only eight months.

TIME AND COST SAVING INITIATIVES

In their role as the structural contractor, the scope of works for Alfasi Steel Constructions included design development, significant involvement in design finalisation, the fabrication and erection of 2600 tonnes of structural steel and around 52,000 square metres of structural decking, in addition to over-seeing fixing the shear studs and placing the reinforcement supplied by OneSteel Reinforcing.

Removal of the core from the construction critical path through the use of a steel-framed service core, reduced the number of trades on the critical path to two, structural steel and decking, both of which were under Alfasi's control, giving them full responsibility for the program.

Stud installation and reinforcing placement followed one or two floors below the uppermost decked level, which afforded protection from weather and acted as a safety protection barrier from work at the upper levels. The 18 metre continuous lengths of structural decking were used to minimise end-laps, and to further reduce erection time.

This, combined with the elimination of all internal propping, resulted in a cleaner than expected site so that occupational health and safety issues were negligible.

The structural steel option meeting the challenges faced in today's modern construction projects

Fire Safety – Performance Design

YOUR PATHWAY TO COST-EFFECTIVE DESIGN

Above: Vehicle service area.

Creating a Fire Safe Building at 209 Kings Way, South Melbourne.

The fire-engineering for this eleven storey building with a total floor area of 45,000 square metres, incorporating a showroom for BMW vehicles at ground level and offices for the ANZ bank, was undertaken by Norman Disney and Young Pty Ltd with assistance from OneSteel's fire research at the Victoria University of Technology (VUT).

The building is required to have a sprinkler system and was designed to satisfy the performance requirements of the Building Code of Australia (BCA) through the application of a fire-engineering methodology developed from OneSteel's structural products.

Dr Ian Bennetts from VUT said that the beams within the open-deck carpark levels were specified in accordance with the BCA deemed-to-satisfy provisions which allowed them to be unprotected. The columns are also unprotected in the carpark levels and this was justified on the basis of their low exposed surface area to mass ratio and the results of fire tests in open – deck carparks. These tests showed that the columns would not reach temperatures that would impact on their load carrying capacity required in a fire.

A PATHWAY TO COST EFFECTIVE DESIGN

In the office levels, most of the steel floor beams also did not require passive fire protection.

Exceptions included members within the vehicle service areas, where the fire load is potentially high, and some of the more critical floor beams within the office levels. Only relatively few of the other structural elements, such as some bracing members, needed passive fire protection.

The level of fire resistance specified for structural members was 120 minutes. This was most economically achieved by the application of sprayed fire protection.

Columns and steel members within the composite lift and service shafts are unprotected. This was validated on the basis of full scale fire tests that simulated the effects of fire inside and outside the core construction.

The fire safety strategy is centred on the incorporation of a commissioned and properly managed sprinkler system. The sprinkler system includes:

- fast response heads
- monitored isolation valves for each level of the building
- end-of-line taps to check the presence of water on a regular basis, or after modification of the sprinkler pipe work on the floors in the event of a tenancy upgrade, and
- a management protocol detailing specific requirements to be met when sprinklers are altered on a floor.

Norman Disney and Young developed the egress strategies using fire engineering principles ensuring the egress system allowed for swift evacuation in accordance with the performance requirements of the regulations.

Potential smoke hazards are managed by an exhaust system.The ability of the building to provide resistance to a rare, severe fire is due to a number of factors:

- only parts of a floor will be affected by a fire at a given time
- vertical support will be maintained by the many protected columns
- the floor slab and the beams will exhibit an enhanced ability to resist load under fire conditions through the development of membrane action.

There is more than sufficient time for evacuation of the occupants in the event of such a fire.

In achieving the required levels of fire safety many of the structural steel members did not require the added cost of protective coatings

209 KINGS WAY SOUTH MELBOURNE – FIRE RESISTANCE REQUIREMENTS SUMMARY

AREA	BUILDING ELEMENT	FIRE RESISTANCE – MINUTES (* ESA/M less than - m^2/tonne)
Open Deck Carpark	Beams Columns	0/-/- or (30*) 0/-/- or (26*)
Office	Beams (generally) Beams – Critical Columns	0/-/- 120/-/- Protected by Fire Spray 120/-/- Protected by Fire Spray
Vehicle Service Area	Beams Columns	120/-/- Protected by Fire Spray 120/-/- Protected by Fire Spray
Composite Lift & Services Shaft	Beams Columns	0/-/- or (30*) 0/-/- or (26*)

ESA/M = Exposed Surface Area to Mass Ratio