

Taking it higher

Steel extensions enhance viability of multi-level buildings

The height allowances for multi-storey buildings that are a defining feature of today's commercial centres have regenerated interest in building atop existing structures rather than starting from scratch. Add to this the increasing concern over conservation issues and the ready availability of high quality structural steel means that 'extending' is not just the buzz around the suburbs anymore, it's becoming a rally call to help maintain the commercial viability of multi-level buildings. *Steel Australia* editor **Alan Marshall** dons his safety harness to review the telescoping world of Australian tall buildings.*



Scots Church in Sydney's CBD

Photo courtesy of OneSteel

There are probably more reasons than floors in the Empire State Building for extending multi-storey buildings further skyward.

Top of the list no doubt has to do with optimising the use of astronomically expensive CBD real estate, extracting maximum value from each square metre of a building's footprint. There's also the allure of the higher, more valuable floor space with better views outward as well as higher level exposure for paid corporate signage.

And then there's the conservation side. Extending upward provides options that preserve existing heritage structures, whilst the fusing of the old with the new has inspired the sort of breathtakingly new architectural styles that win awards, an approach reflecting the mindset shift from 'town planning' to 'environment and planning' department identities within local government.

Few within the Australian steel fraternity are upset by that turn of events as the material has proven the preferred meta-building option, with towering reasons.

Steelwork eases the extra load on existing structures by being lightweight compared to other building options. The material also provides space efficiencies, not only in terms of allowing provision for service access, but through pre-fabrication offsite which saves undue construction site disruption. And as with most high-rise builds, the material also speeds construction times and provides flexibility of design, a Godsend especially when adapting existing buildings to spilt roles.

Got to be light to lift

Amongst the most crucial aspects is ensuring that extensions do not create extra unnecessary burden to existing structures and original foundations beneath.

The main controlling factor on the vertical extension of Scots Church in Sydney's CBD was that it had to be light as the building sits atop rail tunnels approaching Wynyard Station. RailCorp covenants restrict the amount of bearing pressure that can be carried above.

Steel columns within the building were already designed to take additional vertical loads and had been built with the top extended 300mm above the existing roof slab. The large transfer trusses, which span the width of the building, were erected to carry the new works and shift loads away from the assembly hall inside. Composite floor slabs spanning 4.3 or 5.3 metres allowed the primary structural floors to be spaced at every second level. In an effort to reduce the weight of the concrete, even the slab depths were varied from 110 to 150mm according to the span. The floor-to-floor heights were tight, but achievable with steel.

Underground transport routes aside, a growing number of construction jobs call for building atop elevated car parks. The World Square site toward the south end of Sydney's CBD was home solely to a multi-level car parking station during the 1990s, but has recently seen a flourish of new building activity overhead.

For the Ernst & Young Centre at World Square, the support slab was temporarily propped at the mid span during construction by a simple lightweight truss system supported from the lower flange of OneSteel 300PLUS® 610UB101s. The lighter frame greatly reduced the degree to which the existing structure needed to be strengthened. For the Latitude East building on the same site, only 30 columns needed to be strengthened for structural reasons of over 200 existing ones due to the lighter weight steel framing system.

For Brisbane Airport passenger terminal, the steel frame option provided three new levels of car parking space without the need to strengthen the lower structure.

Defying time and space

The Latitude and Brisbane Airport projects are also fine examples of how the structural steel approach saved precious space and time during construction.

For the Brisbane Airport extension, the steel floor beams were cut to length and drilled by the steel distributor. The beams were cambered by passing them through a set of rolls to offset the deflection from the

slab's self weight. This produced a high weekly throughput that was very cost effective.

The lightweight truss system, supported from the lower flange of the OneSteel 300PLUS 610UB101s on Latitude at World Square allowed full access to the floor below the deck under construction while satisfying the maximum allowable beam spacing for the profiled steel deck under the wet concrete weight. All the steelwork for a typical floor could be delivered on 13 trucks.

Construction of the floors on Latitude was fast and the absence of formwork allowed earlier access to work, the project completed five months ahead of schedule. The single angle cleat connections for the job meant many of the primary beams and all the secondary beams could be processed on a beam line, speeding fabrication and easing transport. The composite floor solution for Latitude allowed the smaller concrete pours to eliminate risk from unplanned interruptions to the often massive concrete pours associated with post tensioned or reinforced concrete buildings.

Extending the 18-level Mercantile Mutual Centre another eight storeys in Sydney's CBD was organised so extensive construction works were undertaken while the existing building below continued to provide a safe working environment for 1000 staff.

Having site members fabricated off-site minimised on-site activity, thus easing extraneous noise from concrete pumping at street level. Fabricated beams were lifted from street level directly into their final position with no multiple handling of members. Choosing the structural steel solution meant that barely one quarter of the number of people worked on site than would have been required with alternative construction systems.

Sustainable construction can often entail utilising or reusing existing resources to their best value. The above examples of buildings being extended cost effectively, with off-site fabrication providing lightweight structures with minimum disruption to the site and with minimum waste, must be desirable for both the social and economic environment.

* Project information courtesy: OneSteel



The Latitude East building, World Square, Sydney

Photo courtesy of OneSteel