This case study was written at the time when OneSteel was part of BHP. In that context, in some instances within this case study, reference may be made to BHP.

CURTIN UNIVERSITY OF TECHNOLOGY

More parking means students are on time

Structural steel framing provided the answer for the much needed additional car spaces at Perth's Curtin University of Technology. It most effectively satisfied the design criteria specified by the University, namely:

- to minimise cost ; and
- to complete construction within a tight timeframe during the summer break (19 weeks).

The lightweight, long-spanning characteristics of steel in combination with the fast erection capability of steel and precast concrete decking enabled builders, Merit Projects, to construct 290 new car spaces over the existing parking within the limited time.

Halpern Glick Maunsell, Engineers, investigated possible options and identified that a series of three interconnecting, elevated parking decks could be accommodated over the existing ground level car parking on the north western side of the campus. The existing carpark consisted of three terraced, right angle parking bays with a height difference of 1.5 m to 2.0 m between each terrace.

The terraced effect of the existing carpark was embraced in the design of the elevated decks to minimise the length of access ramps and thereby improve cost, the number of parking bays and traffic circulation.

Design options with steel

Structural steel with a concrete deck system proved to be the most economic solution and had the least impact on the existing parking space. Preliminary design work involved comparison of three steel framing options with various concrete deck schemes. The three options considered were:

1. a steel portalised frame with precast concrete Deltacore planks spanning parallel to the longitudinal axis of the deck. A cast in-situ concrete topping would be placed over the Deltacore planks ;
2. similar to option 1, but with the Deltacore planks spanning perpendicular to the longitudinal axis of the deck ; and
3. a steel portalised frame with precast, prestressed double-T concrete beams spanning parallel to the longitudinal axis of the deck. The cast in-situ topping was not required for this option.

Both ease of construction and the problem of limited accessibility for the cranage to site were additional factors considered in the preliminary design phase. Option 1 was selected as the most economical and appropriate solution.

The project also involved modification to the existing ground level carparking to improve traffic circulation, installation of a new drainage system to collect rainwater from the elevated decks, installation of lighting on the underside and tops of each deck and installation of boomgates.

Steel's flexibility

Architecturally, the structure needed to have a light frame to be harmonious with the environment. This was achieved by keeping the solid facing of the deck as thin as possible, using slender 500 mm deep precast concrete "L" shaped balustrade units with a tubular steel handrail on top.

Final design required the steel frame to be portalised in two dimensions, as vertical bracing to ground level along the longitudinal axis of the deck was not possible due to architectural considerations. The portal frames perpendicular to the longitudinal axis of the deck were spaced at every third parking bay with 200 mm thick Deltacore planks spanning 7.5 meters in between.

Column sizes needed to be as narrow as possible so as not to significantly constrict the size of the parking bays and also to be in keeping with aesthetic requirements. The portal frames perpendicular to the longitudinal axis of each deck consist of 700WB115 beams and 200 x 200 x 9 SHS, Grade C350-L0 columns supported on pad footings.

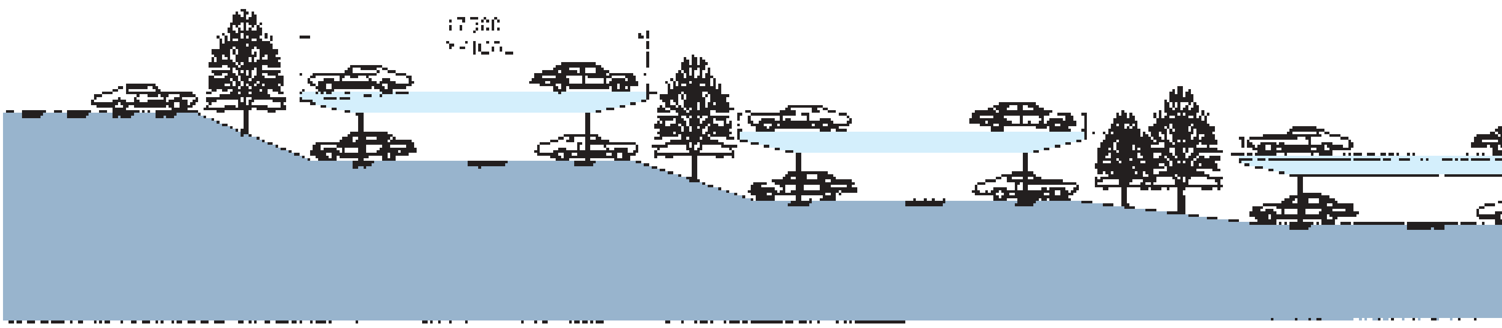
The 17.5 m long 700WB115 beams extend continuously over the single level columns with a 3.85 m cantilever at each end. These cantilevers are tapered to give a slender appearance to the slab edge from the carpark exterior.

All the main beam to column connections are bolted moment end plate connections. The governing condition for the columns resulted from the earthquake load case.

Less time / greater safety

The contract was awarded eight weeks prior to possession of site by the builder, allowing time for fabrication of steelwork and concrete work offsite.

John Deacon of Merit Projects said that the use of precast concrete with a structural steel frame reduced on-site construction time by two



weeks in comparison to a conventional in-situ concrete frame structure. “In addition to time savings, on site labour was also greatly reduced, with only a small crew of riggers required to erect the steel and concrete units, which improved site safety.”

A 23 tonne mobile crane was used to erect the steel columns. The steel beams and precast deck units were installed by locating the mobile crane within the centre aisle. Deck panels were then covered with a 75mm topping.

A grade across the decks was necessary for drainage and was simply achieved by inclining the beams. This had the advantage of allowing the concrete slab to be placed with constant thickness.

Surface treatment

All steel was hot dip galvanised to provide a robust corrosion protection system which would enable the columns to withstand abrasion from vehicles. The 17.5 m long beams were not spliced and therefore required double end dipping.

In accordance with the Building Code of Australia no fire protection to the steelwork was necessary.

Project Participants

Client:	Curtin University of Technology
Engineer:	Halpern Glick Maunsell
Architect:	Buchan Group
Contractor:	Merit Projects
Fabricator:	Fabricon Steel Fabricators
Erector:	J & C Rigging
Steel Distributor:	Steelmark Eagle & Globe