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.

Paterson Street West Carpark

Launceston

Motorists in Launceston, Tasmania, have recently witnessed the rapid rise of a new 305 bay parking facility at the western end of Paterson Street. Easy parking is facilitated by the large spans of the steel framed structure constructed over the wet winter months which would have slowed most other building systems.

The carpark is owned and operated by the Launceston City Council. Robert Luxmoore Pty Ltd, Project Manager, was engaged for the preparation of design documentation, tenders and construction. At an early stage, BHP's Structural Steel Development Group worked with the Project Manager, Structural Engineering Consultant Bonacci Winward, the Building Contractor and Steel Fabricator to examine options for a steel framed structure.

Early estimates and quotations indicated steel framing offered a $100,000 saving leading to the design being developed in this format. Hinman Wright & Manser, a prominent Tasmanian Builder, provided valuable assistance during initial cost assessment. Recognising the construction economies steel offered, they secured the project and developed a program which offered completion 10 weeks earlier than the alternatives. Steel framing has the benefit of minimising materials handling on-site due to temporary formwork and propping not being required. Exposure to weather is also reduced as structural members are pre-fabricated and simply bolted on-site. Construction speed advantage not only reduced site costs for the Builder, but also offered earlier usage or revenue for the Owner. The choice to use steel was vindicated as the structure was completed on time and within budget.

Tim Domeney, Manager Planning and Development at Launceston City Council, considers the steel solution satisfied all Council's requirements. Council's Project Manager for the carpark, David Crockett, said "The speed of construction was very good. Building during winter here is fraught with delays but with steel this was not a problem. The feeling around Council is that it has been a very successful project."

Also impressed by the project's speed was the Architect, Colin Stephenson of Glenn Smith Associates, who said "Once it started, the construction speed was fantastic, almost unbelievable. Curing of concrete was not critical for progress and with many operations occurring under cover of the steel decking overhead, materials handling did not hold up construction. The Builder has done a great job."

Structural design

Steel columns, primary beams, secondary beams and steel decking support the four suspended floor slabs. The parking floors are sloped, providing a gentle spiralling ramp arrangement for access to upper areas. This slope was accommodated by laying the primary beams across or perpendicular to the slope and the secondary beams parallel to the slope, allowing all beam webs to be kept vertical.

Compared to an earlier floor design, the selected steel solution involved larger spans which allowed a reduction in the number of footings and columns. This was also considered to improve the ease of parking.

At the carpark's centre, standard BHP welded beams are used as columns to carry the high axial forces and bending moments. Beam 'stubs' were prepared for field connection to the primary beams and welded to these columns in the fabrication shop. The 16.5m long primary beams were erected continuous over single level columns on the other side of the aisle, cantilevering

Columns prepared with beam 'stubs' provide large spans, improving footing costs and ease of parking.

Above: Nearing completion.

Left: Mobile cranes progressed around the carpark, with 4 levels being erected at a time.

approximately 4m to the perimeter. Secondary beams span 2 or 3 car bays between the primary frames and are connected conventionally using Australian Institute of Steel Construction (AISC) web side plate connections. Universal beams were used for the typical floor beams and columns where they supported cantilevering primary beams.

A plastic analysis was used in design of the primary beams. Beams were typically non-composite, except at the first suspended level, some composite beams were used to reduce the structural depth in order to meet clearance requirements.

Surface treatment

All steelwork was hot-dipped galvanized, after considerations including transport of fabricated steel to Tasmania and long term maintenance. The galvanized option was costed as being only marginally more expensive than the class 2.5 blast and inorganic zinc silicate option. A finishing coat of paint was applied to the steelwork along the perimeter.

Footings

Pad footings support the structure , with the soil having a relatively low bearing capacity of 200kPa. The relatively light steel structure and reduced number of footings produced significant savings in foundations.

Slabs

The typical slabs are N32 concrete, 130mm thick on Bondek II, which was Z450 (450 grams of zinc per m^2) for additional durability. Typically, F102 mesh is used in the slabs except F81 is used in the top floor slab to give a greater degree of crack control in this area, which is more exposed to rainfall and temperature variation. Concrete cover was 40mm. Radcon formula No 7 was applied to the top level slab to assist water proofing and other levels were coated with a hardener to reduce dusting and absorption of grease.

Fire protection

As the carpark is open-deck, the Building Code of Australia does not generally require applied fire protection material to steel beams or columns. Along the sides of the carpark, perimeter steelwork was mostly within 4.5m of the boundary or fire source feature. This would usually require a 60 minute fire resistance level. However the main columns were set back, well away from the boundary and primary beams cantilevered over these columns, supporting the perimeter steelwork. Therefore, mullions along the sides of the carpark were not required as structural members in the fire situation, so did not generally require applied fire protection material. For some isolated areas not meeting the above criteria, 150mm thick precast concrete panels were used for facade construction.

The carpark commenced trading in October 1996.

Project participants

Client:	Launceston City Council
Project Manager:	Robert Luxmoore Pty Ltd
Builder:	Hinman Wright & Manser
Structural Engineer:	Bonacci Winward
Architect:	Glenn Smith Associates
Steel Contractor:	Bahcon Pty Ltd
Steel Distributor:	Union Steel
Steel Detailer:	Bahcon Pty Ltd