Royal Adelaide Hospital Car Park

WHY COST-EFFECTIVE COMPOSITE STEEL CONSTRUCTION WAS THE PREFERRED OPTION.

Past experiences by both Wallbridge and Gilbert and John Hindmarsh with steel framed car parks had proved them to be cost-effective and fast to construct.

The Royal Adelaide Hospital (RAH) has one of the newest, and at 10 storeys one of the largest, car parks in the Adelaide central business district.

Constructed over a 12 month period by the developer and builder, John Hindmarsh (South Australia) Pty Ltd, for the RAH as a built/own/operate/transfer (BOOT) arrangement.

The purpose built structure accommodates 1440 vehicles, 1100 provided for the Hospital and 340 operated commercially.

The RAH car park was designed to be a composite steel construction by Ted Strange of Wallbridge and Gilbert, an Adelaide based structural engineering firm with considerable expertise in both car park design and steel structures. Loreto Taglienti, who was part of the design engineering team on the project, said that "the key issues in the choice of a steel composite structure were the height and size of the car park, the soil conditions on site, and the time-frame in which the structure needed to be erected."

The design and construction of the foundation system was one of the challenges on this project. The site is close to the Torrens River on soft alluvial soils so the foundations had to be deep piled. In these conditions the relatively lighter weight of a steel structure led to footing cost savings. Adelaide's high seismic zone indicated the further wisdom of a lighter structure.

"The simplicity of composite steel construction was the preferred option"

The car park has been built to the maximum height permitted on the site. Because of the size of the car park - 32,000 square metres over 10 storeys – the engineers needed a construction system that was both simple and repetitious. "So from the outset,"

On the east facing the Botanical Gardens a decorative pattern has been added for aesthetic appeal.

Loreto Taglienti said "a composite steel construction system was the preferred option."

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The conventional steel framed construction has a composite concrete slab between the secondary and primary steel beam framework. The construction was unpropped, except for the primary beams, which were propped in the long 9 metre spans.

This avoided the potential site problems of propped construction and eliminated the need for the subcontractor to return for prop removal.

OneSteel 300PLUS® 460UB74 and 82 primary beams, supported by 310UC columns at 7.8 metres centres with 310UB40 secondary beams at 2.8 metre centres, all unpropped during construction, make up the structure. The column grids are at intervals of 4 metres, 9 metres, 7.6 metres, 9 metres and 4 metres and from 0 to 4 metres the primary beam cantilevers out off the first internal column.

The floor-to-floor height is 2.7 metres with a 2.1 metre clear height span. The 2.5 metre wide car bays have three bays between the 0.3 metre columns and are designed so that the columns align to the rear wheels of the vehicles.

Precast and insitu concrete shear walls provide stability to the steel frame on the north and south faces and in some locations vertical support also. Façade screens of perforated metal on steel subframes have been added to the west and east sides. On the east facing the Botanical Gardens a decorative pattern has been added for aesthetic appeal.

The protective treatment applied to the structural steelwork was 75µm of inorganic zinc silicate on class 2.5 shot blast surface. However, to assist with stud welding on site, the top flange of beams were either unpainted or the centre strip was left unpainted.

The project was originally issued for tender using a traditional re-entrant profile but a new trapezoidal decking profile, KF70 from Fielders, was selected. Fielders provided the alternative KF70 design for the project with the cooperation of the developers, contractors and engineers and formworkers.

Specifically, the original design called for a 1.00 mm BMT traditional re-entrant profile, unpropped. Due to the stiffness of the KF70 profile, the same unpropped spans using a 0.75mm BMT, while still complying with the deflection requirements of the project, were achieved. The slab depth in the original design was 125mm but 130mm with the KingFlor alternative. However, there was less concrete overall due to voids giving a significant cost saving.

THE CONTRACT PRICE FOR THE PROJECT WAS $11 MILLION, AROUND $1 MILLION CHEAPER THAN THE CONCRETE ALTERNATIVE.

John Hindmarsh's original working budget was $10,000 per bay but actually came in at a figure well below that. Peter Gibberd of John Hindmarsh said he was generally pleased with this 1,440 bay carpark.

Using a composite steel solution (1,100 tonne of OneSteel structural steel sections) saved approximately four weeks on the construction time.

Peter added that by using a more economical deck (KF70) which also resulted in less concrete in the slab, total savings of approximately $3.50/sqm (excluding savings due to earlier completion) were made on the project. Independent cost analysis by Rider Hunt showed that KF70, and reduced concrete, had the potential to save a quarter of a million dollars over the specified re-entrant profile.

In reviewing the project Peter felt that involving a fabricator early in the life of the project ensured realistic costs for the supply, fabrication, surface treatment and erection of the structural steelwork. The final cost on the steelwork was approximately $87/sqm this was approximately 15% below the quantity surveyor's estimate.

DEVELOPER
Royal Adelaide Hospital

BUILDER/OWNER/ OPERATOR
John Hindmarsh (South Australia) Pty Ltd

STRUCTURAL ENGINEERS
Wallbridge and Gilbert

QUANTITY SURVEYORS
Currie & Brown

FABRICATOR/ERECTOR
Samaras Structural Engineers

DECKING SUPPLIER
Fielders

DECK FIXER
King Formwork

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