InfraBuild

Auckland Sky City Casino

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

AUCKLAND

SKY CITY CASIN

Construction of Auckland's structural steel and concrete Casino - along with its associated carpark, conference facilities, restaurants, hotel, shops and theatre, was a concentrated high-speed, high profile project, built over two years and completed in January 1996.

The Casino was the first stage of the development, with the 326 metre Sky Tower as Stage Two. It was built on a 1.26 hectare site in central Auckland, New Zealand, for Sky City Casino Ltd, a joint venture between Brierley Holdings Ltd and Harrahs Club Inc, which was granted the fiercely contested Auckland Casino Licence in January 1994.

Steel was chosen for reasons of quality, flexibility of design and availability of materials. BHP worked with the design team, steel merchants and fabricators to ensure that the steel components were available when required by the construction team.

The steel option

There were two fundamental objectives which drove the Casino construction project:
1. the specification for a quality, contemporary multi-use complex, built within budget; and
2. the requirement that the Casino be opened within two years of the licence being granted, imposing a tight deadline.

The tight deadline cut into design and detailing time and pointed to the use of steel:
1. steel offered the flexibility to accommodate design changes
2. steel supported the use of the innovative up-up construction method
3. steel components were fabricated off site - particularly useful in a tight construction program
4. proprietary systems using steel components slotted easily into project detailing
5. steel components were supplied to a guaranteed quality and strength
6. the use of steel without passive fire protection in the carpark resulted in reduced cost.

Important to the smooth running of the project was the efficiency of the steel industry supply chain - manufacturer, merchants, fabricators and erectors, as well as manufacturers of proprietary systems.

BHP coordinated steel supply from its New Zealand and Australian steel mills.

BHP Steltech Structural Ltd, in New Zealand, worked with the Engineers, Beca Carter Hollings & Ferner, in finalising the design of the welded beams. As manufacturing progressed, production was scheduled to suit the fabricator's program.

The tight program depended on supplies of steel to the fabricator, Grayson Engineering Ltd. Grayson was involved with all stages of the Casino construction. Critical to the construction timetable was Grayson's fabrication of the Humes spiral welded pipes into columns, enabling the simultaneous construction of the basement carpark and the above-ground floors.

The precision of steel fabrication techniques has enabled savings in construction time and materials. An example on this project was the beam end plate detailing, where the cross-beams were bolted directly to end plates welded to the main beams. This cut out the need for the use of web plates on support beams - saving erection time and materials.

Steel solutions

Up-Up construction

Simultaneous construction of the basement carpark and the above-ground Casino floors accelerated the project. The construction program was greatly assisted by the ability to build the Casino / hotel floors at the same time as the carpark floors were being built six floors below ground.

Steel was a vital factor in the up-up construction method.

After the six-level carpark had been excavated to bedrock, foundations were poured for Humes steel spiral welded pipes - standing six levels high - which were filled with concrete to become the foundations for the lower floors of the Casino and Hotel. These pipes are 650mm diameter, with a wall thickness of 8mm, manufactured from hot-rolled coil.

These columns, once braced with structural members, enabled construction of the superstructure while the carpark decks were being built in the basement.

Basement carpark

"The main reason for the use of steel was the ease of construction," said Dale Turkington of Beca Carter Hollings & Ferner. High levels of fire resistance were able to be avoided by incorporating a sprinkler system. This system is commonly used in carparks in New Zealand.

The span of the carpark beams varied between 8 and 9 metres, and were designed to carry the New Zealand carpark loading of 2.5kPa.

Carpark decks were built using 70,000 sq metres of Dimond Hi-Bond high strength composite steel / concrete floor system. The corrugations of Hi-Bond mean the composite is a lightweight option for achieving a deeper slab and increased strength.

As it was not an option to use cranes in the basement area, Grayson devised a monorail system for moving steel components around the carpark decks. A system which would not have been practicable with any other building material.

Entry atrium

The atrium is the main entrance to the Casino and Hotel. It is built independently of the main structure, with extensive use of steel.

One of the reasons for choosing steel for this area was the complex design with no repetition between components. Steel beams and other components could easily be fabricated individually.

The atrium also demonstrates, in the cantilevered staircase and beams, structural steel's aesthetic qualities as a design feature.

The Casino's main gaming area

While many of the reasons for using steel in the Casino's construction were structural, in the main gaming hall aesthetics were equally important.

In this gaming hall, with its 9.5 metre high ceiling, the aim was to create an open air, night sky feeling - a Southern Hemisphere night sky lit by fibre optics. The Architect, Gordon Moller, made the comment that the high exposed ceiling "helps explain the building" - hence the almost invisible tubular trusses spanning the 27 metre gaming hall.

Steel trusses are ideal for this environment, where strength and minimum weight are important. The 'clear sky' effect is achieved because the fine lines of the steel structure melt into the background. The trusses support the roof and mechanical plant for air conditioning, as well as video cameras which record every gaming transaction.

Theatre

The theatre at the north-western end of the building is steel framed. Again steel was the ideal material for this type of facility, with its high stud and large void. Steel trusses were used to span the 35 metre roof span, and are hidden by the acoustic baffles. These and the theatre's lightweight roof structure were fabricated by Grayson Engineering.

Service / transfer floor

The flexibility offered by steel components meant that the services floor for the entire complex was constructed after the main framework was in place. As with the carpark floors, the Dimond Hi-Bond system was used to construct the floor. Besides the dead load of the floor itself, the transfer floor has a live loading of 5kPa, including wiring and steel building services equipment.

Architectural features

Steel was used for many architectural features on the Casino project. Some were structural - for instance the beams over the bus bay entrance - while many other were purely aesthetic. Decorative features included the large woven mesh screens above the entrance of the building, screen details in the atrium, steel handrails, balustrades and a variety of artwork.

Summary

Steel, and the rapid construction techniques associated with steel, enabled Sky City Casino Ltd to commission a complex, multi-use building, which was ready for use within two years of the first carpark excavation.

Advantages that steel provided to the design team included:

1. strength without bulk
2. space efficiency due to steel's high strength to weight ratio
3. design flexibility
4. it is a structural material that can be used extensively for architectural features.

The extensive use of steel in the project provided benefits to the construction contractor:

1. enabling up-up construction which made the early stages of the construction timetable feasible
2. steel components could be moved around the site by forklifts and monorail, which freed up cranes on site for other work
3. efficient delivery systems ensured that the steel was there when it was needed
4. steel allowed rapid construction which is vital in today's commercial climate.

Project participants

Client:	Sky City Casino Ltd
Contractor:	Fletcher Construction NZ & South Pacific Ltd
Engineer & Design Manager:	Beca Carter Hollings & Ferner Ltd
Architect:	Craig Craig Moller
Fabricators & Erectors:	Grayson Engineering and Panama Riggers