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.

BONLAC *milks steel's benefits*

Project Summary

When Bonlac Foods Limited decided to build their new $150m high volume process plant to produce 60,000 tonnes per annum of dried milk for export, they engaged Fletcher Constructions Australia to provide design and construction services for all building and civil works. The project consists of several steel framed buildings including a 40 metre tall, seven level main drier building to produce milk powder, plus a number of one and two storey ancillary buildings, including one to house all utilities, a milk receivals building, a storage and dispatch building and the main office.

Located at Darnum near Warragul in Victoria, the plant incorporates a number of specific features including:

- ease of access for cleaning and servicing
- compliance with "dust free" surface requirements and clean building environment
- optimisation of useable space within the building envelope
- constructability to minimise building costs.

The main objectives of the project were:

- to create an aesthetically pleasing facility, providing uniformity of form across all major elements
- to respond to environmental and safety issues
- a design without compromising quality and performance of the facility
- an economical but durable design
- to allow for future expansion
- to comply with Statutory Authority requirements
- to attract both national and international interest.

Design Criteria

When Fletcher Constructions approached Ove Arup to assist with their bid to provide a state of the art milk processing plant, some recently constructed plants in Australia and New Zealand were visited to ascertain direction for structural engineering improvements. Primary structural design aims included:

- vibrational and acoustic damping within the structure
- minimisation of areas (joints) where bacteria can survive within the structure
- minimisation of 'ledges' where product can accumulate
- fast, economical construction
- durability and flexibility.

The drier building was designed for a base floor live load of 5 kPa, with additional capacity to support specific equipment loading up to 570 kN (57 tonnes) for any one item.

Drier Building

After investigation of different structural schemes for the drier building, it was decided to adopt a braced, steel framed structure with composite floor beams. The proposal provided sufficient dead mass to act as an efficient vibration and acoustic damper, but unlike a conventional concrete frame, showed considerable reduction in overall weight whilst delivering benefits of rapid "meccano type" site erection, off-site fabrication and cost savings.

The floor system developed for the project consisted of a thin (85mm thick) precast concrete slab section sitting on conventional Universal steel sections at maximum 2500 mm centres which varied in size from 250 UB 37 to 900 WB 175. Such sections were designed to have shedding plates fixed to the bottom flange to guard against dust collection. A variable depth topping slab was then poured over the precast slabs, with a total floor slab depth varying between 150 and 170 mm. The insitu slab encased the shear studs and provided general shear transfer to achieve composite action.

Tanker Building

Another building of significance is that designed for receival of milk from the tankers. This building had a number of specific design constraints including:

- there were to be no unsealed voids or ledges to the underside of the building to reduce the risk of attraction of vermin and/or roosting birds
- the building was to be designed as open on all sides without inclusion of any exposed cross bracing to provide lateral restraint.

As a solution, knee braced, two-way portal frames were adopted for the primary superstructure, utilising closed sections only (SHS and RHS) for all vertical and horizontal elements. Large span, curved closed sections were made up of open sections, which substantially reduced the cost and risk of damage (due to rolling the curve) of the structure.

Fabrication and Erection

Bahcon Pty Ltd was contracted to supply and erect some 1250 tonnes of structural steel. Detailing of most of the steelwork was carried out by Bahcon's in-house detailing team which ensured a smooth flow of work and enabled the fabricator to input on constructability on the project. Union Steel, the main steel distributor for the project, undertook intermediate processing of much of the steelwork by cutting it to length and drilling holes on their beamline.

Bonlac's new processing plant under construction

Due to various buildings and facilities being constructed simultaneously, both a tower crane and a 20 tonne all-terrain crane were used to erect the steel which covered approximately 4800m^2 of building space. On the drier building, the mobile crane was used up to 27m height and the tower crane was used beyond 27m. Connections were accessed using a scissor lift working from completed suspended slabs as the structure progressed.

Surface Treatment

Steel beams and columns were blast cleaned to Class $2^1/_2$ and primed with a zinc silicate to a minimum dry film thickness of 70 microns and top coated with an architectural urethane treatment. This treatment enabled a durable finish to the surface and provided resistance to chemicals.

Conclusion

In satisfying the design and construct criteria for serviceability, low cost and speedy construction, the use of steel as the primary structural element has achieved the main objectives. In addition, some sculpting of the forms has produced an aesthetically pleasing complex which is likely to be used as a benchmark for future design and construction of similar facilities in the international market.

Project Participants

Client:	Bonlac Foods Limited
Architect:	Peter McGann Architects
Builder:	Fletcher Constructions Australia
Civil & Structural Engineer:	Ove Arup & Partners
Quantity Surveyor:	WT Partnership
Fabrication, Shop Detailing & Erection:	Bahcon Pty. Ltd.
Steel Distribution (incl. Intermediate Processing):	Union Steel