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.

Topping off a good education

All Hallows' School, new Mercy Hall

The Sisters of Mercy founded a school in Brisbane in 1861 on the site of St Stephens Cathedral in Elizabeth Street. In 1863, the school was relocated to Duncan's Hill, Ann Street; a magnificent location perched high above the Town Reach of the Brisbane River, and the school was named All Hallows'. It was the first secondary school for girls in Queensland, and the early intention of the Sisters to provide a curriculum through which students might become accomplished women of faith and sound learning, continues to the present time.

The school educates young women from varying socio-economic and cultural backgrounds, and in this context seeks to foster a sense of responsibility to the wider community and to work for justice in continuance of the tradition established by Catherine McAuley, founder of the Sisters of Mercy in Australia.

In accepting the responsibility of educating girls for leadership in Australian society in the next century, the school led by the Principal, Sr Anne O'Farrell R.S.M., realised that its vision for educational and cultural outcomes would be compromised by inadequacies in its building infrastructure.

The challenge, taken up by architects and planners Daryl Jackson Pty Ltd in their Master Plan, was to enhance the built environment of All Hallows' School whilst recognising and integrating the unique and historical features of the site. Significant early buildings located on the site are shown in the table below, in chronological order.

Architecture

Daryl Jackson associate director, Mark Roehrs, led the development of the Master Plan and subsequent architectural design and coordination. Stage 1 of the refurbishment comprises the new Mercy Hall and Potter Building (Library / Science). Whilst the inner city campus contains a significant building stock, recreation space is very restricted and few building sites are available for this purpose. Consequently, the new $1M Mercy Hall was created by the enclosure of the existing tennis court roof of Loretto Hall. Mercy Hall consists of a gymnasium and indoor sports centre and although the idea was simple in concept, it was extremely challenging in implementation. The existing Loretto Hall occupies the south-eastern corner of the site and sits precariously over and along a cliff face, some 30m above Ivory Street. The building is substantially landlocked on the other three sides. Panoramic views of the Story Bridge and the Brisbane River to the south-east also means high exposure to prevailing winds.

According to project architect Gilda Donegan, the strength, long span, and lightweight characteristics of steel were essential to the project. The ability of steel to be pre-assembled and erected in large panels assisted in overcoming the site inaccessibility problems. All internal and external linings and fit-out materials were pre-packaged and lifted on to the roof terrace prior to framing the roof.

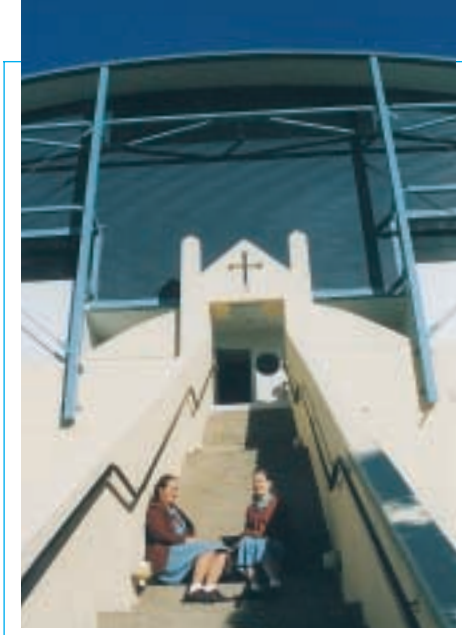
The architects created a building form which comprises a curved roof structure that flows down the south-eastern wall in a wave-like motion, floating lightly above the cubic base of Loretto Hall. The expressed 'All Hallows' blue' steel structure connects base to roof with a filigree of steelwork whilst the deep blue walls differentiate base from roof – old from new. The steel frame incorporates a scaffold support system that enabled scaffolding to be simply inserted into the frame, thus ensuring that all construction and access occurred from the roof terrace. This system also enables future maintenance of the external walls to be simply carried out by placing scaffold planks at various levels on the external frame.

A computer thermal modelling study by John Kendrick of Lincolne Scott Pty Ltd ensured that optimum cross-ventilated cooling occurs without the need for mechanical ventilation, by utilising Korab steel louvring of facades. The perimeter wall construction comprises a high level band of translucent wall panelling to allow the penetration of natural lighting, minimising energy costs. Below this, steel louvres are located above and below a steel sandwich panel. The sandwich panel is clad externally with BHP Colorbond 'Mountain Blue' Custom Orb 0.42mm BMT sheeting

Steel-framed Mercy Hall sits lightly over concrete structure of Loretto Hall.

	Building	Architect	Builder
1858	Adderton		John Petrie
1878	Convent		
1879	The Gateway	Reverend Joseph Canali	O'Keaffe, Masterson, Martin
1882	Main Building	Andrea Stombucco	Edward Vallely
1890	Convent Extension	Hunter & Corrie	Woollam & Norman
1894	St Ann's	Andrea Stombucco & FDG Stanley	Woollam & Norman
1901	Main Building extension	Hall & Dods	John Watson

(Source - Michael Kennedy Architect, Heritage Consultant)



"The education of women" – Elizabeth Anderson and Mariana Lee discuss possibilities at Mercy Hall.

placed horizontally, and internally with BHP Colorbond 'Off White' Custom Orb 0.42mm BMT perforated 11% acoustic pattern sheeting. The sandwich panel core consists of a 100mm thick insulation blanket and reflective foil barrier.

The roof is clad in BHP Colorbond 'Gull Grey' Custom Orb 0.48mm BMT sheeting fixed to the top flange of cold rolled steel purlins. The ceiling is fixed to the bottom flange of the purlins and comprises the same BHP acoustic sheeting as used for the internal wall lining. Electrical services and insulation are concealed within both the roof and wall sandwich construction, contributing to a neat and visually clean building interior. The mezzanine floors are framed with structural steel bearers, cold rolled steel joists and plywood flooring, whilst internal walls are framed in steel studwork. The main floor construction is a proprietary timber sport floor built on top of the existing concrete slab.

Structure

Although the roof slab (existing tennis court) is supported by large, composite steel beams, and has a 1500mm high reinforced concrete parapet wall around the perimeter, the foundations had not been designed to take an additional storey of construction. The design engineer, John Gibson of McWilliam Consulting Engineers, determined however that the existing foundations would support a steel framed structure with lightweight walling, and that the concrete parapet, if strengthened at the steel column connection points, would provide suitable support for the main frames.

The 39m long building comprises 6 bays each 6.2m wide, with an additional 1.1m wide bay at each end. The end bay of 1.1m is required because the end frame of the building is located beyond the supporting parapet wall. An additional frame is provided, with a trussed connection to the end frame, to ensure load sharing between the two frames and effective load transfer to the wall. The space between the frames provides an opportunity for storage, as well as a mezzanine floor.

The typical bowstring roof truss spans 22m and has a parabolic shaped 100x100x5 SHS top chord. The horizontal bottom chord comprises a 100x100x9 SHS over the middle third and a 100x100x6 SHS at each end third of the span. Web members are 100x50x3 RHS. The truss is supported on 8m high, 200x200x6 SHS columns. The truss bottom chord is restrained laterally at the third points by 100x75x6 RHS struts, which run the length of the building. Lateral stability is provided in both directions by horizontal bracing trusses at the roof truss bottom chord level and comprises typically 24mm and 30mm diameter crossed rods. Wall bracing similarly utilises crossed rods.

A major challenge was to achieve an effective connection of the column base to the existing concrete perimeter upstand. By widening the existing concrete from 150mm to 300mm over an 800mm length and over the full 1500mm height of wall, sufficient anchorage was achieved to ensure the stability of the frame during the critical erection stage. The SHS column is bolted completely through the 300mm wide concrete upstand with 4 M36 8.8 Bolts – two at the top of the wall and two at the base.

Dave Handy, Construction Manager for builder G & J Box, acknowledged the access difficulties faced during construction, and the tight timetable for the project. The ability of steel to be erected in large panels and assemblies simplified construction. The fact that steel workshop drawings and fabrication commenced prior to G & J Box starting on site, effectively reduced the construction duration.

According to G & J Box Chief Estimator, John Gaggin, within two weeks of steel erection commencing, the builder was ready for the other trades to start work. "Only structural steel could give us that performance," said John. Additionally, building construction access was greatly improved by incorporating a scaffold support system into the steel structure. Both time and cost were saved, and the system provides permanent scaffold support for future maintenance. According to John, "no other construction material could be utilised to provide a scaffold support system, at such an economical cost".

Fabrication & Erection

Jenark Engineering fabricated a total of 49 tonnes of structural steel for the project. According to Jenark Managing Director, Dennis McCarthy, the practical yet lightweight engineering design, with the emphasis on buildability and practicality of connections, contributed to the success of the steel fabrication.

The 22m long x 2.5m high bow trusses were fabricated and transported to site in one piece.

Top: Consulting engineer John Gibson at heritage-listed Ann Street gateway, showing temporary bollards. St Ann's in background.

Above: End bay framing, showing column base connection to parapet wall.

The pronounced parabolic curve in the south-eastern sunshade frames was achieved by cold rolling three separate lengths of 300PLUS 200x75PFC, on the flat, in a beam roller, and then welding them together to form the 9m long frame. A similar process was used for the 100x100x5 SHS roof truss top chord.

Steel erectors M.A.N. Rigging overcame the challenge of the difficult-to-access site and the height of lift by pre-assembling steel components on the ground. Wall frames, including columns, sunshade frames and ties etc, were coupled in pairs and lifted using a 30 tonne hydraulic mobile crane. Maximum lift was 2.6 tonne at 48m radius. The 1.2 tonne, 22m long roof trusses were lifted by a 140 tonne Brambles hydraulic mobile crane having 39m of luffing slide offset at 5^0. The trusses were lifted over an 18m high wall and the maximum crane outreach was 62m.

Erection commenced with the installation of the 1.1m end bay and continued along the building, away from the end bay, with the coupled 6.2m bays. Steelwork connections, including purlins, were made using two scissor lifts with extendable platforms to reach beyond the outside walls. Static lines could not be used for fixing the roof purlins because of the curvature of the truss top chord and the difficulty in achieving adequate anchorage of the static line posts to the small top chord member. The speed of steel erection was enhanced by the precise fit of steel components on site, and despite the site constraints, took only six days.

Internal structural steelwork was abrasive blast cleaned to Class $2^1/_2$ and prime coated with 75 microns of zinc phosphate epoxy. External steelwork was similarly prime coated but was over-coated with an additional 50 microns of Dulux Acrathane epoxy acrylic.

Conclusion

Imaginative design and innovative building techniques using steel framed and steel clad construction has delivered yet another unique building to All Hallows' campus. Mercy Hall is a strong, durable and attractive building addition to Loretto Hall and provides a striking landmark in one of Brisbane City's most inaccessible but highly visible locations.

Just as Catherine McAuley stood as an icon in the educational history of Australian women, so to Mercy Hall stands as a beacon in the built environment of historic All Hallows' School.

"Nothing is more conducive to society than the education of women" Catherine McAuley, founder of the Sisters of Mercy in Australia.

Client:	The Corporation of the Trustees of the Order of the Sisters of Mercy in Queensland (All Hallows' School)
Architect:	Daryl Jackson
Engineer:	McWilliam Consulting Engineers
Builder:	G & J Box
Steel Fabricator:	Jenark Engineering
Shop Detailer:	KDC Drafting

Left: 300PLUS 200x75PFC sunshade frames cold rolled to shape.

Below: Completed steel frame using scissor lift for connections.