

JUNE 2018



JUST AS LAW IS A CORNERSTONE FOR SOCIETY, SO IS TE PIRINGA FOR THE UNIVERSITY OF WAIKATO (UOW)

Completed in 2017, the bold structure of the new tower is an unmissable and fitting gateway to Te Piringa, which houses the Faculty of Law, Waikato Management School's Centre for Corporate and Executive Education, and student services.

The opening of this \$35 million state-of-the-art campus facility marked the University's 50th anniversary and was a welcome addition for the law faculty, which has been housed in a temporary building since 1991.

The University envisioned an iconic structure that would become part of a legacy for the community and future generations of students. This was realised, along with the provision of world-class spaces and facilities, to create a student experience second to none.

➔ THE FACTS

- \$35m project
- 25,000 individual steel components
- 3,800 assemblies
- 475 tonnes of structural steel
- \$2.9m worth of steel
- 120 contractors
- 3 buildings erected
- 275 precast concrete panels

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“THE NEW LAW AND MANAGEMENT BUILDING MAKES A FORCEFUL STATEMENT AND ATTRACTS ATTENTION – NOT ONLY BECAUSE OF ITS UNIQUE DESIGN FEATURES AND CLEVER USE OF MATERIALS, BUT ALSO BECAUSE OF INTELLIGENT INTERIOR DESIGN ALLOWING MULTIFUNCTIONAL USE OF ROOMS. USING STEEL IN CREATIVE WAYS HAS CONTRIBUTED SIGNIFICANTLY TO THE SUCCESS OF THE PROJECT.”

– HENDRIK F VERMEULEN, PRINCIPAL ARCHITECT, WSP OPUS

Focusing on light and open areas, WSP Opus architects created a ‘sculptural’ experience with the end user in mind.

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ARCHITECTURE

WSP Opus architects were set a challenge by UoW: design a modern faculty building that reflects the Waikato region’s cultural identity and provides future-proof, flexible spaces.

The result: a sleek, statement building that celebrates the Waikato’s renowned natural environment, filled with contemporary facilities to support students’ success.

Structural steel was key to the building’s architectural design. The lightweight yet strong material can support significant loads, which was essential to Te Piringa’s overall architecture.

The dramatic structure is characterised by three main sections: the tower, gateway to the law faculty; a shared underground space housing a mock courtroom and executive education areas; and a glass box-style entrance to the existing management

school. The tower marks its highest point at seven storeys above ground, with 35 metres between the ground floor and the roof.

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One of the biggest architectural challenges was designing to the sloping site. WSP Opus embraced this and used it to create a central sunken courtyard, a bright, open area that allows natural light to penetrate the underground level. Structural steel beams were central to the area’s success as they enabled the large, open spaces.

Exposed structural steel beams feature throughout the interior to achieve a modern, industrial look and visibly allude to the strength of the building.

The structure’s materials allowed the architects to play with big shapes and design a building that breaks from tradition.

Steel was used to support the 275 precast concrete panels, a key feature of Te Piringa inside and out, giving the impression of a solid mass. Steel columns and beams, fitted with glass panels on the eastern end, provide an unobstructed view of the ranges and flood the building with natural light.

FABRICATION AND ERECTION

For a state-of-the-art building, only state-of-the-art modelling will do – especially when there are more than 25,000 individual steel components to work with.

Approximately 475 tonnes of structural steel worth \$2.9 million were required to build the architectural vision of Te Piringa. Structural steel contractor Bedford Engineering tackled the complex steel fabrication of the building using Tekla Structures, one of the most powerful modelling programmes in use around the world. The software combined the architectural and engineering



Designed after the Christchurch earthquakes, Te Piringa's seismic preparedness was considered – and it's impressive. Even when exposed to large earthquakes, the steel absorbs seismic forces beam to beam due to their rotation capacity. This system is an alternative in New Zealand and a proprietary product, with just a few global suppliers.

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“THE TOWER’S STRUCTURE AND MONOLITHIC APPEARANCE EXUDE STRENGTH AND RIGIDITY. TE PIRINGA PAYS TRIBUTE TO LAW, WHICH IS A CORNERSTONE OF ANY CIVILISED SOCIETY.”

– KRIS BACON, CONTRACT MANAGER, BEDFORD ENGINEERING

designs to build a comprehensive 3D CAD model with detail down to the last nut and bolt.

Management information and production system Strumis was used to control inventory, optimise steel use, budget and reduce waste. The Strumis system enables traceability of project materials so compliance to the project specification can be confirmed. Computer numerical control fabrication equipment ensured steel cutting precision and a high-quality finish of the many exposed steel components and connections that feature throughout the building.

Te Piringa's design required stringent and time-consuming welding processes, with numerous full-strength welded connections. This was better suited to a controlled workshop environment with no space, access or weather restrictions. To allow this, Bedford Engineering opted for additional bolted connections to be

designed into the tower structure, reducing installation time and minimising welding on site. The 25-metre-high tower required frames up to 20-metres long, 6.5 metres wide and weighing 16 tonnes in single welded assemblies.

To optimise workshop welding, the latest technology from Germany was used. The bigger, more powerful machines used forced-arc technology, which deposits weld metal at a faster rate.

The precast concrete panels throughout Te Piringa all rely on structural steel to support the building. The panels hang off structural steel beams – a challenging process to install. Despite steel's strength, it is susceptible to deflection. To counter this, the team designed sliding, galvanised steel brackets that sit at the top and bottom of each concrete panel to allow adjustment and ensure alignment.

Designed after the Christchurch earthquakes,

Te Piringa's seismic preparedness was considered – and it's impressive. Structural steel was used to create a damage-controlled structure that separates the main frame from the buckling-restrained braces (BRBs) that function as energy absorbers. The main frame is kept within the elastic range and movement is collectively absorbed by the BRBs. Even when exposed to large earthquakes, the steel absorbs seismic forces beam to beam due to their rotation capacity. This system is an alternative in New Zealand and a proprietary product, with just a few global suppliers.

CONSTRUCTION

Steel is essentially the backbone of Te Piringa. Its strength was chosen specifically with the construction of the complex structure in mind. Structural steel was used to build a big truss at the top of the building and the rest of the materials were hung down off it like a bridge. As a result,



“STEEL IS ESSENTIALLY THE BACKBONE OF TE PIRINGA.”

– NICK WILEY, PROJECT MANAGER, FLETCHER CONSTRUCTION

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Concrete columns are much more time consuming to construct, using reinforcing steel and a boxing process. Steel beams, on the other hand, are quick to erect and allow for a clear, open space – one of the main objectives of the architectural vision. Steel was also the preferred material for the tower's lift shafts. Two lift and stair cores were constructed using structural steel and BRBs.

Te Piringa's sloping grounds posed a challenge for construction. The fact the building site could only be entered by the lower, southern end meant access and space restrictions. On the confined site, structural steel was an ideal, flexible solution. It can be prefabricated off site and is fast to install, allowing other parts of the project to progress.

So, it was important to send the right sections to site, at the right time and in the right order. Of the 475 tonnes of steel used, the maximum load for a truck was just 20 tonnes. The four structural cones and bridges comprise 21-metre-long steel sections weighing up to 20 tonnes and were delivered overnight to prevent road closures. These impressive steel structures required complex lifts using the project tower crane combined with a supplementary 300-tonne mobile. The accuracy of the builder's set out and steel fabrication ensured the steel was swiftly slotted into place and secured, advancing the building 21 metres in a few days.

For the construction team, the steel erection is a major transition point. It shifts the trajectory of the project from horizontal to vertical construction. After digging for six months and laying foundations over four

months, major structural steel components, like the tower, were erected on site taking the structure up to level seven in just a couple of weeks.

Structural steel highlighted its advantage during the challenging construction of the new entrance to the existing UoW Management Building. A brief University shut down window over Christmas was the only time allowed to construct a new three-level building. The construction team had to remove a 200m² concrete roof off a live plant room containing the campus' air conditioning, boiler and electric system. Structural steel's precise prefabrication and flexibility made the time-critical build possible – steel sections were quickly erected in and around the existing structure and services equipment, forming the three-level building above ground in just five days.