TAURAPA BRIDGE: RECLAIMING THE RIVER'S EDGE WITH STEEL

SCNZ STEEL CONSTRUCTION NEW ZEALAND

STEEL, SCULPTED TO THE LANDSCAPE

THE FACTS

- 71m-long bridge
- 200 tonnes of weathering steel
- 195 tonnes of structural steel
- 25m-high upright steel masts
- 100m radius
- 3-span bridge
- 5-module construction

Taurapa Bridge is a striking new landmark on the southern outskirts of Hamilton — a functional crossing, cultural marker and architectural statement all in one. Designed to support the new Peacocke residential development, the 71m-long structural steel footbridge carries pedestrians and cyclists over a major arterial route and completes a critical link in the Te Awa River Ride, one of New Zealand's longest cycle trails.

The bridge forms a sculptural gateway, or waharoa, to the adjacent Te Ara Pekapeka Bridge, yet it almost didn't happen. Not envisaged within the original infrastructure programme, the footbridge emerged during design optioneering for the river crossing as an essential element that holistically achieved the project solution. Multidisciplinary firm BBO identified that a complementary active transport bridge could meet some of the broader goals of the project requirements — enhancing connectivity, supporting placemaking and expressing local culture — all within the original budget and programme.

Structural steel made the complex form possible, meeting tight spatial, aesthetic and performance demands. Its strength, adaptability and clean finish enabled a slender, curving structure that responds precisely to the site geometry and load requirements — without compromise.

Although just one part of a much larger infrastructure programme, the bridge has drawn strong community support, and its distinctive design and thoughtful integration with the landscape have been widely embraced. Delivered collaboratively by Hamilton-based firms BBO, Edwards White Architects and PFS Engineering, and influenced by mana whenua cultural artist Eugene Kara (representing the Waikato Tainui and Southern Links Tangata Whenua Working Group), Taurapa Bridge shows how a well-considered steel solution can do much more than span a gap — it can enrich infrastructure, honour local narratives and elevate the everyday journey.

PROJECT TEAM: ENGINEER – BBO **STRUCTURAL STEEL CONTRACTOR** – PFS ENGINEERING **BUILDER** – HEB CONSTRUCTION **ARCHITECT** – EDWARDS WHITE ARCHITECTS **CULTURAL ARTIST** – EUGENE KARA **DEVELOPER/OWNER** – HAMILTON CITY COUNCIL

"THE PROJECT IS AN IDEAL EXAMPLE OF HOW CLEVER AND EFFECTIVE USE OF STEEL CAN OFFER SIGNIFICANT ADVANTAGES, NOT JUST IN PRICE BUT IN MANAGING TIME AND SAFETY RISKS."

GRAHAM MCKELVEY, COMMERCIAL MANAGER, PFS ENGINEERING

FABRICATOR

The complexity of Taurapa Bridge demanded more than a traditional design-build handover. Fabricator PFS Engineering was brought in early under an early contractor involvement model, which proved pivotal in ensuring the bridge's ambitious architectural and structural goals could be realised efficiently and cost-effectively.

Though the design programme was fast-tracked, it retained a full sequence of concept, preliminary and detailed design. With the architect, engineer and fabricator engaged throughout, ideas could be tested and refined collaboratively. This integrated approach enabled robust, informed discussions — from cost estimates to buildability — and led to smarter, more practical outcomes.

An early technical contribution from PFS was the idea of alternate crosssections to suit the architectural profile. By quantifying the steel tonnage across options, the team iteratively refined plate thickness — especially across the large deck surface — using ribs and diaphragms to reduce mass without compromising structural integrity.

Recognising that steel curves well in two dimensions but resists twisting through three, PFS proposed modelling the bridge deck as a flat 71m-long segment with a constant 100m radius. Rather than introducing twist to accommodate camber and gradient simultaneously, the entire structure would be tilted post-fabrication to achieve the required 4m vertical rise. This avoided geometric twist, simplifying fabrication, and improving efficiency and precision.

To facilitate this, the bridge was fabricated upside-down on the workshop floor, allowing its complex geometry — curved in plan, raked in section, tapering in form — to be resolved in a controlled environment.

With steel sourced from overseas during the height of the COVID-19 pandemic, efficient use of materials and shipping capacity became critical. A rigorous rightsizing exercise optimised sheet sizes for fabrication and containerisation.

Further refinements were made in the design of the joints and welds. The box girders for each segment were fabricated with bolted connections, allowing the three major modules to be joined efficiently on site. Trap doors were incorporated in the deck to enable seal welding inside the closed box girders. Once complete, the trapdoors were welded shut, forming airtight jointing chambers that will protect the structure over time.

Fillet welds were used wherever possible, significantly reducing production time. These decisions were only possible through a close, iterative process with BBO, which verified the performance at each step.

Fabrication was driven by a 3D model, from which PFS generated detailed drawings for every component. These were nested to minimise plate waste, achieving significantly higher material efficiency than traditional methods.

The model also enabled accurate profiling and cutting, through an innovative 'tab-and-slot' system to streamline assembly. Components were designed to interlock, reducing manual measurement and adjustment during welding. This was particularly effective for the balustrades, which were built as repeatable panel units in jigs, allowing a mass-assembly approach that ensured consistency and speed.

PFS's 3D model also supported coordination with civil, structural and architectural disciplines. It incorporated full geometry and reduced levels relative to site survey data, allowing early detection of clashes — such as potential abutment slab conflicts — and ensuring accurate set-out on site.

Above: One of three 17m bridge modules is rotated mid-air in the workshop, allowing the V-shaped deck to be welded from above. Built spine-first with a box girder core, each module was assembled upside-down then flipped to complete the deck.

ENGINEER

The bridge's distinctive curvature in plan reflects both the design intent and a practical engineering response to earlier decisions. As part of the adjacent Te Ara Pekapeka Bridge project, the road level on the northern bank was lowered by approximately 7m to improve buildability and structural performance. This created a significant level difference between the altered roadway and the original riverbank. To reconcile the change in elevation, the pedestrian and cycle bridge was designed with a sweeping horizontal curve — an approximately 100m radius — that guides users back to the natural ground level and reinstates original riverbank vantage points. This solution not only resolves the grade transition effectively but also contributes to the bridge's floating appearance and strengthens its visual and spatial connection to the river corridor.

The three-span Taurapa Bridge is supported by reinforced concrete piles and piers, with cast-in-place concrete cradles forming the interface between the substructure and the steel superstructure. These cradles — positioned on opposing sides of each pier — accommodate the bridge's curved alignment, enabling the deck to weave between supports.

The steel superstructure connects to the concrete cradles via pin joints, allowing controlled movement and simplifying the structural interface. At the piers, custom steel shrouds conceal seismic bearings and the transition between reinforced concrete and cantilevered steel, preserving the bridge's clean architectural lines.

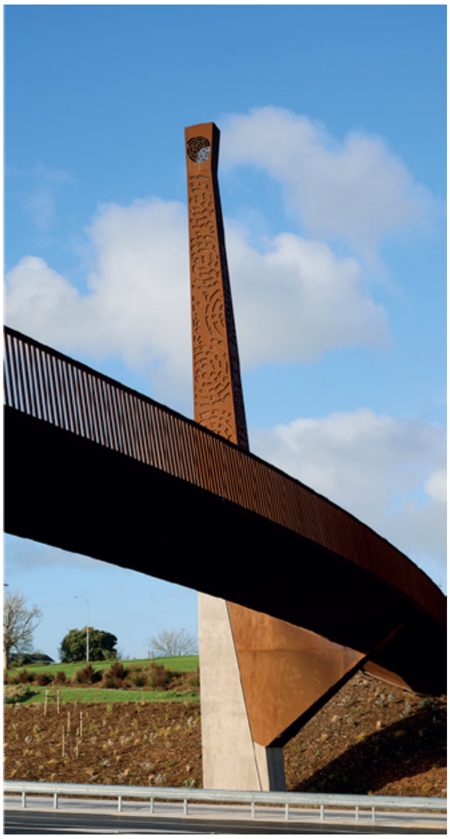
Achieving this level of refinement required meticulous attention to detail. The team developed innovative solutions to conceal structural connections, including the use of negative detailing to hide bolts and maintain smooth, uninterrupted steel surfaces. Custom cutouts in the deck skin further masked panel junctions and fastening points, contributing to the bridge's visually cohesive finish.

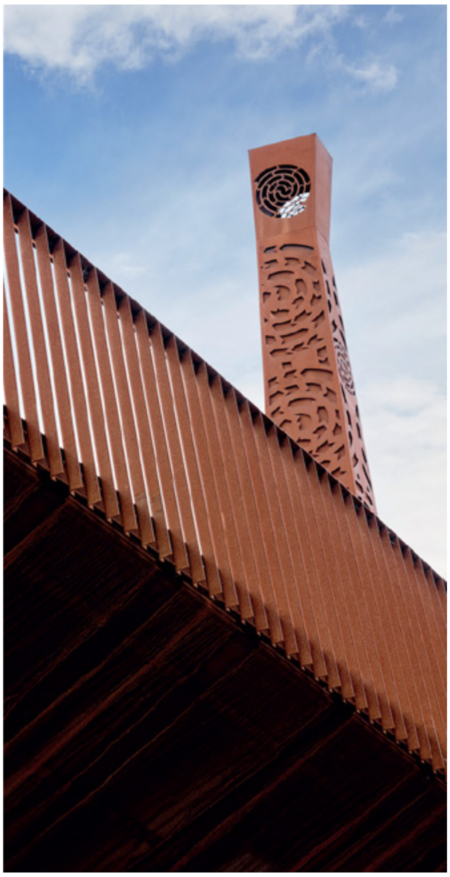
The bridge deck is 4m wide and gently cambered to achieve the required gradient. Structurally, it is formed from a triangular steel section built around a central box beam. Steel diaphragms radiate from the beam to define the triangular geometry, and a detached outer skin completes the crosssection. This configuration gave the designers the flexibility to control the structure's proportions while simplifying fabrication and assembly.

"THE DESIGN-CONSTRUCTION INTEGRATION PROCESS HAS BEEN ONE OF THE MOST SUCCESSFUL EXPERIENCES I˜HAVE BEEN INVOLVED WITH. WITHIN MOMENTS, THE PFS TEAM WAS CONTRIBUTING AS AN EQUAL PARTNER WITHIN THE DESIGN TEAM."

JEREMY GIBBONS, DIRECTOR, BBO

Below: Reinforced concrete piles and piers support the bridge, with cast-in-place cradles on either side of each pier connecting the substructure to the steel superstructure.





Left and above: Both steel masts, or taurapa, feature a twin-skinned steel form, with intricate Māori artwork laser-cut into the outer skin. Steel enabled the refined form envisioned by the architects, while meeting the bridge's structural demands.

"WITHOUT STEEL, WE SIMPLY COULDN'T HAVE ACHIEVED THE FINE AESTHETIC WE WERE AIMING FOR. TIMBER OR CONCRETE WOULD HAVE RESULTED IN A MUCH CHUNKIER FORM. STEEL GAVE US THE SLENDERNESS — IN THE DECK, THE CROSS-SECTION, THE BALUSTRADES — THAT DEFINES THE BRIDGE'S REFINED PROFILE."

GRANT EDWARDS, DIRECTOR, EDWARDS WHITE ARCHITECTS

ARCHITECT

Located on a bend in the Waikato River, Taurapa Bridge is more than a functional crossing — it was designed to respond to the site, the river and the cultural significance. The bridge curves gently to follow the riverbank, drawing people closer to the water and offering long, uninterrupted views both upstream and down.

Form was equally important. The bridge's triangular cross-section creates structural depth through the centre, where it's needed, while tapering toward the edges for a slender profile. Steel made it possible to achieve the refined form the architect intended, while still meeting the structural demands of the bridge.

Anchoring the design are two 25m-high upright steel masts, or taurapa, which rise from the concrete pier foundations. Their form references the stern posts of a waka, drawing inspiration from traditional Māori boatbuilding techniques. The transition from concrete to steel is expressed through a dovetail-like joint, resembling the spliced timber construction of waka˜hulls.

Storytelling is embedded in the design. Each taurapa features a twinskinned steel form, with intricate Māori artwork laser-cut into the outer skin. The artworks include takarangi — intersecting spiral motifs that symbolise connection, movement and balance. These motifs link the bridge to the wider cultural landscape.

Together, the curvature, slender profile and cultural detailing give the bridge its distinct architectural identity. The result is an elegant structure that responds to its surroundings and reflects the stories of the place.

CONSTRUCTION

Construction of Taurapa Bridge demanded precision planning, innovative sequencing and close collaboration across disciplines. The superstructure was fabricated in three large modules, dimensioned to suit the cranage and transport constraints. These were assembled on site and lifted into position in a single operation using a 600t crawler crane stationed on the northern abutment — a high-stakes operation requiring exact alignment with cast-in bolts. To avoid disrupting progress on the adjacent road, the bridge was installed without any temporary supports beneath it, enabling simultaneous construction activities and keeping the programme on track.

Speed and safety were key priorities. The closed shell geometry of the deck made welding the top plate to internal diaphragms and stiffeners difficult and potentially hazardous. To solve this, the team developed a detail where slots were cut into the deck plate to allow safe, external welding to components below. A landing plate and bevelled edges improved both tolerance and weld quality.

Seismic bearings were positioned at the piers, with complex geometry around the 'V' supports complicating bolt installation. The solution was to grout the hold-down bolts after the bridge was in position — a reversal of the usual sequence — with temporary jacks and stays used to support the structure while the grout cured.

The bridge's box girder spine was a key enabler of efficient site assembly works. It could be fabricated and assembled ahead of the rest of the superstructure, forming a stable base for attaching diaphragms, stiffeners and deck elements. By adopting modular construction, the team gained flexibility to optimise work fronts and sequencing. For example, the bridge was built from two 10m modules at the abutments and three 17m modules in the centre, which were preassembled on the ground, joined and lifted as one.

Several on-site strategies ensured visual precision and build quality. The twin masts, which rise from each pier, required perfect rotational alignment with the piers — any discrepancy would have been visually amplified. A steel pipe with a flanged head was cast into each pier using a steel formwork supplied by PFS. Once set, the masts were bolted to the exposed flange, ensuring precise vertical and rotational placement.

Together, these strategies — from modular sequencing to precision casting — enabled a highly complex structure to be delivered efficiently and true to the design intent, despite tight timelines and significant logistical constraints.

Above and below left: The fully fabricated main span — composed of three 17m modules — is lifted into place between the bridge masts, resting on two reinforced concrete corbels on opposite sides of the mast bases.

"PFS HAS DELIVERED AN OUTSTANDING PIECE OF STEELWORK THAT NOT ONLY ADDS TO HAMILTON'S DISTINCTIVE RIVER IDENTITY BUT SHOWCASES OUR LOCAL EXPERTISE AND THE BENEFITS OF PARTNERSHIPS."

ANDREW PARSONS, GENERAL MANAGER — INFRASTRUCTURE AND ASSETS, HAMILTON CITY COUNCIL

WEATHERING STEEL

Designed for a 100-year lifespan, Taurapa Bridge makes extensive use of weathering steel — a deliberate choice to enhance durability and reduce the environmental impact of long-term maintenance.

Unlike conventional steel, which depends on protective coatings to prevent corrosion, weathering steel forms a stable, rust-like patina that acts as a self-sealing barrier. This eliminates the need for repainting, touch-ups or routine washing — a major advantage for a pedestrian bridge spanning a busy arterial road, where maintenance access would be costly and disruptive.

The steel was sourced from Sweden and Finland to meet a conservative design temperature of –5°C ('Charpy' level), ensuring robust performance even in colder conditions.

The bridge comprises five steel modules, totalling approximately 200t of weathering steel. Detailing was critical to long-term performance: horizontal surfaces were avoided to promote water runoff and preserve the steel's protective patina.

The team embraced the natural oxidisation process, integrating discreet channels into the concrete piers to guide rust runoff, transforming a potential blemish into a deliberate architectural feature. As one team member noted: "We liked the idea of the steel making a patina on the concrete, but we wanted to control where it ran."

BAT CONSERVATION

Taurapa Bridge was designed not only for people but with the local ecology in mind, including long-tailed bats, or pekapeka-tou-roa, a nationally critical species known to inhabit the Hamilton area.

One key consenting requirement was to ensure the bridge had no adverse impact on Waikato's native bat populations. Bats in the area use vegetation along the riverbanks as natural navigation corridors. The removal of tall vegetation or addition of obstructions could disrupt established flight paths.

To address this, the bridge deck was carefully aligned with the original ground level, helping preserve the bats' existing flightline. What's more, the taurapa were designed to mirror the scale and structure of riparian vegetation. These tall, sculptural features help bats navigate the river corridor.

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