STEEL PROFILE

ARCHITECTURAL INNOVATION WITH BLUESCOPE NOVEMBER 2023 133

INTRO ARCHITECTURE WITH STUDIO GRAM
MONARTO SAFARI PARK VISITOR CENTRE

GRIMSHAW
MONASH UNIVERSITY WOODSIDE BUILDING FOR TECHNOLOGY AND DESIGN

TERROIR
PUFFING BILLY LAKESIDE VISITOR CENTRE

Editorial

Welcome to STEEL PROFILE® magazine edition 133. We are once again proud to draw together a dynamic set of projects, and their designers, to highlight just how strong, versatile and sustainable steel can be. We warmly invite you to join us for a tour of the material's contemporary possibilities.

Once seen as a straightforwardly industrial material, steel is now being used in more diverse and perhaps sensitive ways. In this edition, we see how designers – such as the architects working on Puffing Billy railway – are engaging closely with the natural landscape and topography. It's an approach that speaks more widely to a willingness on the part of design professionals to place heritage, community and learning at the heart of projects.

Indeed, the designers themselves have always been a focus for STEEL PROFILE® – we've been celebrating their achievements since 1981, and this edition is no different. From nationally recognised emerging architects to established practices, we are in direct conversation with the agenda-setters of contemporary architecture in order to share their insights, inspirations and innovations.

The projects explored here showcase variety and the fundamental versatility of steel, as well as a broad range of new directions that remain anchored in its reliability. We continue to marvel at what the architects can do with the material and remain proud to support them, especially the emerging designers who will be future leaders in the industry.

We certainly hope you enjoy this edition, but it doesn't stop there. Follow the QR code below for extended video content on our website. There, you can also try out Inspire Me, an exciting tool for exploring and creating your very own collections of architectural images.

We also encourage you to share your innovative projects for future consideration by scanning the QR code on the left. In the meantime, please enjoy the carefully curated collection presented to you in STEEL PROFILE® 133.

MELISSA BARLOW
BlueScope Managing Editor

RAJ NANDAN
Publisher

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PROJECT MONARTO SAFARI PARK VISITOR CENTRE **LOCATION** MONARTO, SOUTH AUSTRALIA

An Elemental Architecture

ARCHITECT INTRO ARCHITECTURE, WITH STUDIO GRAM
WORDS MICKY PINKERTON
PHOTOGRAPHY DAVID SIEVERS, FRANKIE THE CREATIVE, BRAD PORTER

Representing the meeting of two worlds, the intersecting circles of this symbolically rich building posed numerous technical challenges which were ultimately resolved through the strength and versatility of BlueScope steel walling and roofing.

"We kept coming back to the desire to have a building that would weather over time – something in this landscape shouldn't require treatment or maintenance."

TERRY BOXALL INTRO ARCHITECTURE

Spanning 1500 hectares and home to more than 500 animals, Monarto Safari Park is one of the largest open-range zoos in the world. As it emerged from the ground, this new Visitor Centre was probably only visible to the 11 giraffes that call the Park home, but it's difficult to imagine them being at all fazed by the experience, as the building seems like it's always been there.

The Centre's earthy hues – created by a virtuoso combination of interlocking panel walling made from REDCOR® weathering steel and rammed earth – unite with the curved forms of the design to produce a building that is as primordial as the animals within it and as elemental as the landscape it inhabits. While the landscape in this case might be the Mallee plains of Australia, with a careful rearrangement of similar elements you could just as easily be in the Matabo Hills of Africa.

Referencing the juxtapositions and connections between these two different worlds was one of the key launch points for the design concept. This idea is addressed in form – two ribbon-like curves meet and overlap to create a central gathering space – but also aesthetically, with each arc presenting in a different material.

A further central pillar of the brief was to reflect the Park's conservation message through the inclusion of sustainable design features and natural materials. While early concepts explored using different materials for each C-shape form, the architects, construction company and cladding contractor workshopped alternative options and came to a preferred option in the form of steel.

"We had a good hard look at ourselves and just asked, 'What are we trying to achieve?' We kept coming back to the desire to have a building that would weather over time – something in this landscape shouldn't require treatment or maintenance," explains Terry Boxall, architect and director at Intro Architecture. "I'd always wanted to use the weathering steel product, so we found the right pan profile and presented to our client, Zoos SA, the fact that it was a product manufactured in Australia and that we wouldn't have to re-treat it. It ticked all the right boxes and in the end the client loved it too – I couldn't imagine it being anything else now."

For project manager, David Harris of Mossop Construction + Interiors, the walling made from REDCOR® weathering steel delivered further benefits as a product for the client. "It was quite a significant cost saving. We were obviously trying to achieve the budget that the client had, and REDCOR® weathering steel was one of the ways of doing it while still maintaining the look and feel that the architect was looking for," says Harris.

When it came to covering the building's majestically curved form from above, the architects quickly settled on roofing made from COLORBOND® steel in the Shale Grey™, and the profile Fielders FreeForm™ to technically accomplish its shape.

The Fielders FreeForm™ profile's tapered application minimised the need for flashings – also made from COLORBOND® steel in the colour Shale Grey™ – offering watertightness with minimal material waste. "When we were first thinking about solutions for the roof, we went straight to Fielders FreeForm™," says Boxall. "We didn't go anywhere else because the Fielders FreeForm™ roofing product is one of the few roofing types that could achieve what we were looking for. Its pans are tapered and obviously the smallest taper in the pan is the tighter arc – and then when there's a larger arc, it's tapered out. There were two or three different roof radii and we spent a fair bit of time working on how those pans were going to come together."

OPENER Blending in with its natural surroundings, the structure itself seems elemental and at home in the landscape. Photo: Frankie The Creative.

OPPOSITE Two broad curves intersect, forming a tension between their circular geometry and freely tapering ends. Photo: Brad Porter.

Seasoned specifiers of the tapered application will know that to address the finer tolerances associated with the product and to stay true on-site, it is important to recheck drawings against cutting lists and also against real measurements as the roofing sheets are being laid. This process was made easier with the FreeForm™ sheets being rollformed at the zoo in batches in a transportable mill.

"Fielders had a 40-foot container that was sent to site on a side-loading truck or trailer and was all set up," explains Jarrad Morgan of cladding and roofing contractor, SA Construct, highlighting the specific production circumstances for this project in South Australia. "They ran the coil and when they ran it through with a taper, it went through the machine twice on each edge," says Morgan. "Every few panels, they were able to adjust the machine to open or close the taper a bit further. Then they put the panels into packs and craned them onto the roof."

[For STEEL PROFILE® readers in other states check with your rollformer on the availability of mobile rollforming.]

The roofing made from COLORBOND® steel in the colour Shale Grey™ was chosen as it absorbs less heat than darker colours, an important consideration in the harsh climate of the Mallee plains. Rainwater is also harvested from the roof for reuse in flushing toilets and the irrigation of the nearby landscaping elements. Swales have been used extensively to capture as much runoff as possible for the native plantings in the car park. Other building efficiencies include high performance double-glazed windows, optimal environmental orientation, high-efficiency cooling units and electricity generated from solar panels.

The use of rammed earth also provides passive cooling and insulating properties with little or no ongoing maintenance. Steel had a supporting role to play – literally – for this ancient construction technique, where a soil mix is compacted in formwork to roughly half its original volume. One of the more challenging zones of the build was where generous entryways cut through the rammed earth walls, framed by large steel lintels.

"The cave-like entry portal is a complex piece of geometry – the steel headers are curved in plan and in elevation," says Boxall. "Everything was modelled in three dimensions architecturally and by the structural steel fabricator. These steel lintels forming the portal opening are also structural, requiring a lot of back-and-forth with the rammed earth contractor and the steel fabricators to achieve the desired aesthetic."

Joining this back-and-forth was Ben Rice, structural engineer at MLEI. He explains that "the curved design resulted in a lot of lintels, in particular, that sit on the walls for the openings. Any beam that's on a curve is complex as it goes into bending and into twisting at the same time, so there's a lot more demand on all the steelwork

as a result of the curve, and additional challenges for us to be able to resist some of those loads."

Rice had worked with rammed earth previously on residential projects but Monarto was on a larger scale and following an engineering assessment, steel columns were embedded into the rammed earth in some locations for additional strength.

Rammed earth and steel need to be carefully managed as bedfellows, but the combination certainly provides an impressive arrival moment. Boxall said this was an essential device to signify the bridge between the various worlds that the Park brings together: animal, human and landscape.

"Entering through the main portal of the building is like discovering a different land, which is one of the original concepts of the project: that you've left Australia and entered Africa – you've physically passed through the portal, which is signified with the cave-like structure."

Awaiting new arrivals on the other side of the portal is a central courtyard or 'heart space' which offers a communal place of calm respite and which is Boxall's favourite part of the completed project. "It's about bringing people together before they head off for their adventure for the day. We drew on the concept of a 'camp', where there's a fireplace in the middle, a place to gather, tell stories, and then go off for your day and come back. That notion of a heart in the middle of the building was really strong [from the outset], with the resulting wrapping ribbon façade providing the protection to this space and further strengthening the 'heart' concept."

For a project that started with a heart, it's no surprise that it's now generating a lot of love. The client is delighted with the Park's new gateway which, thanks to Instagram, is increasingly recognisable to the global animal lovers who are known to travel long distances for new experiences. Visitor numbers are up, and Intro Architecture and studio gram have since been engaged to design a hotel on an adjacent site. We look forward to the next installment of this responsive architectural journey.

ABOVE, LEFT As the ribbon-like curves intersect and overlap, a central gathering space is created. Photo: David Sievers.

ABOVE, RIGHT While remaining relatively low to the ground and embedded in the landscape, moments for beautiful views nevertheless occur. Photo: David Sievers.

OPPOSITE Each of the building's curving parts is presented in different yet complementary materiality. Photo: David Sievers.

STEEL DETAILS | A TECHNICAL DIVE INTO MONARTO SAFARI PARK VISITOR CENTRE

With African and Indigenous references informing the design concept, it was important for the façade of Monarto Safari Park's new Visitor Centre to have the appearance of being natural in its setting. The deep ochre hues and patina of the walling made from REDCOR® weathering steel definitely help the Centre to meld with the surrounding landscape. Happily, the material had additional advantages for the project.

Material durability and longevity were a key issue for the client. REDCOR® weathering steel was suited to local conditions of an inland South Australian environment, developing a protective patina that tightly adheres to the base steel and consequently achieves a lower corrosion rate over extended timeframes compared with other conventional structural steels. The versatility of the product, in being able to be formed into 200-millimetre-wide interlocking panels, also allowed the cladding to deliver the tight curves of the building's design.

At this pan width, what is actually a faceted wall appears curved, which was critical to the architect's vision. SA Construct's Jarrad Morgan says it was a straightforward process to form the panels made from REDCOR® weathering steel coil.

"We bought the 0.7BMT weathering steel coils and slit them to size, then we ran them through a Schlebach Quadro machine [a sheet metal profile shaping system], and that formed them into interlocking panels," says Morgan.

"Those are cut to length, stop-ended and then installed on the top-hats in a left-to-right fashion. The top-hats were rolled follow the radius of the wall curve and keeping the panel width at only 200 millimetres meant that the individual panel pieces worked their way around the curve quite well. It was very successful."

Rather more challenging was the sheer volume of custom wall flashings made from COLORBOND® steel in the colour Terrain®, with Pittsburgh seams (a joint created with an extended straight flange and a pocket) which had to be created for each segment – and added up to over a kilometre's length in all.

Another detail developed through the collaborative relationship fostered amongst the construction team on this landmark project was addressing the propensity of weathering steel products to transfer an oxidised residue to other materials alongside or below them.

At ground level, the wall panels end in troughs of pebble mulch, which is a solution many would be aware of. But with a large, cantilevered section of the walling made from REDCOR® weathering steel overhanging the café area, a curved, hidden solution had to be devised for this above-ground wall termination.

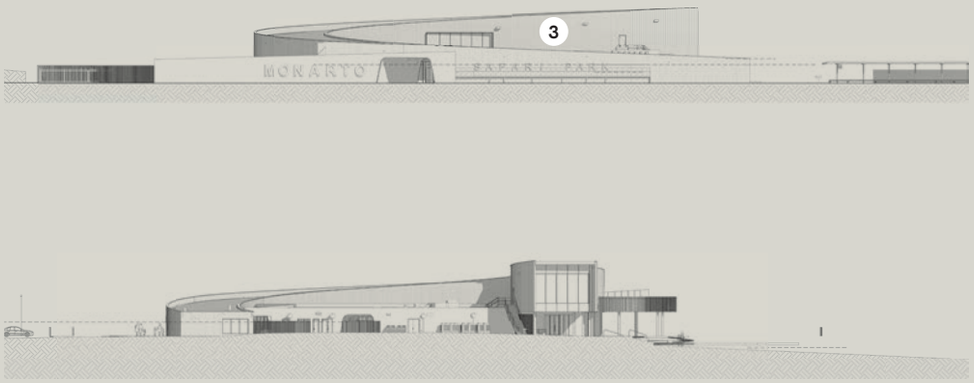
"It has a little channel that sits underneath [the panels], almost like a little box gutter, but very small and folded up at the base," says David Harris of Mossop Constructions. "The intent behind that was to try to direct it [the water] away from that overhang section, so it didn't drip on people, and divert it back to the pebble mulch area."

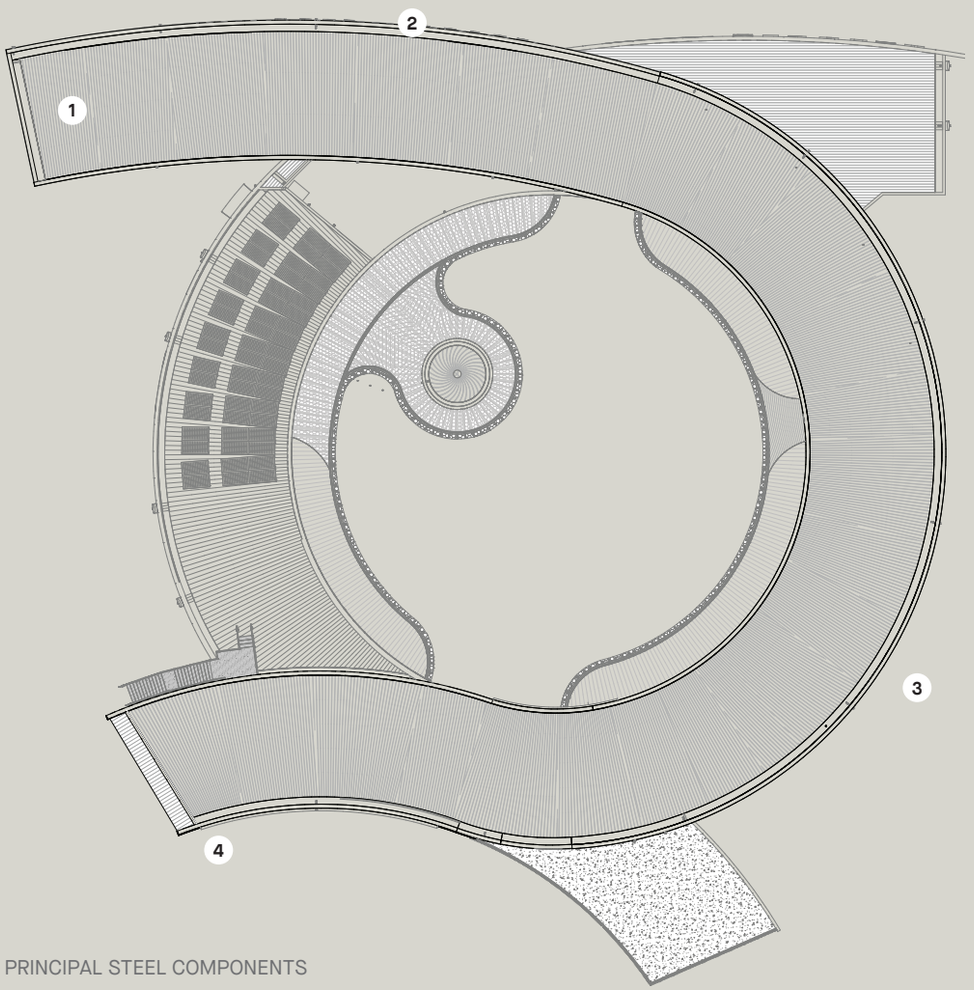
It all meant that, once again, the SA Construct team gave the Pittsburgh lock seam a good workout. "Anything that's horizontal and following a curve is difficult," says Morgan.

"Every segment is custom because the curvature of the wall might be changing slightly through manual tolerances. Everything's perfect on a drawing, but the way of construction might mean the radius in certain areas is just fluctuating, so what the curve is to that area has got to be marked out."

A template was made on-site and then taken back to the workshop to be cut from steel and then seamed by hand. Morgan acknowledges it is an 'old school', manual process, but both he and Harris agree that wall panelling made from REDCOR® weathering steel was the best solution for the job, with significant overall cost benefits arising from reduced ongoing maintenance.

The ability of the panels to give the appearance of a curve is just one of many attractive aspects of the design. Perhaps it's only fitting that in a project about different worlds meeting, we have both old and new methods of steel fabrication combining to resolve the increasingly complex aspirations of contemporary architecture.





PRINCIPAL STEEL COMPONENTS

1 Roofing made from COLORBOND® steel in FIELDERS FREEFORM® profile, in the colour Shale Grey™

2 Roof flashings and cappings made from COLORBOND® steel in the colour Shale Grey™; (1900m2 – sheets are typically 9-to-10m in length)

3 Walling made from REDCOR® weathering steel (approx. 1500m2)

4 Wall flashings made from COLORBOND® steel in the colour Terrain®.

ABOVE, TOP Elevation drawings show how the language of curves continues vertically.

ABOVE, BOTTOM In plan view, the intersecting curves form a neat central circle before ending with an organic flourish.

OPPOSITE Earthy hues define the materiality at a key threshold (left) while softer shade is provided within (right). Photo: David Sievers.

PROJECT INFORMATION

Architect
Intro Architecture with studio gram

Project Team
Terry Boxall, Samuel Toole, Graham Charbonneau, Dave Bickmore, Olivier Martin, René Majewski, Sam Broadbridge, Stavros Zacharia, Tess Sporn

Client
Zoos SA

Project Timeframe
June 2020 – February 2022

Building Size
Ground floor – 1770m^2
First floor – 500m^2

Project Cost
$16.8 million

Builder
Mossop Construction + Interiors

Shop Drawing Contractor
SA construct

Roofing and Cladding Contractor and Fabricator
SA Construct

Structural and Civil Engineer
MLEI

Landscape Architects
WAX Design

Awards
2023 Australian Institute of Architects South Australia Chapter Awards: Architecture Medal; Keith Neighbour Award for Commercial Architecture; Commendation – COLORBOND® Award for Steel Architecture; EmAGN Project Award

Scan to discover more about the project.

PROJECT WOODSIDE BUILDING FOR TECHNOLOGY AND DESIGN **LOCATION** CLAYTON, VICTORIA

Structure Steals the Show

ARCHITECT GRIMSHAW WITH MONASH UNIVERSITY
WORDS LEANNE AMODEO
PHOTOGRAPHY PETER BENNETTS, RORY GARDINER, MICHAEL KAI

Grimshaw has designed an award-winning education building for Monash University that showcases the lightness and flexibility of welded beams and columns made from XLERPLATE® steel. These are proudly expressed and set out a vast, open-plan interior.

"We realised that it could be built to Passive House standard and suggested it to the engineer, builder and client – and they agreed."

CRISTIAN CASTILLO GRIMSHAW

OPENER More than just exposed, the structure defines the building's interior character with its red hues and strong diagonals.
Photo: Peter Bennetts.

OPPOSITE Sightlines through the building create a sense of porosity and lightness amidst the sheer strength and presence of the structure.
Photo: Peter Bennetts.

Monash University has long championed the principles of sustainability, investing in highly efficient, innovative building design across all of its campuses throughout the greater Melbourne region. Upgrades and refurbishments have been especially plentiful at its largest campus, Clayton (south-east of Melbourne in the Eastern Kulin nation), with a recent masterplan involving three buildings coming to fruition. As an outstanding example of sustainable building design in Australia, one of the three buildings, the Woodside Building for Technology and Design, has adopted high targets in energy performance, challenging standard design solutions to become a 'living laboratory' – and all within an impressive structure of striking form and scale.

Designed by Grimshaw, the building spans a mighty 19,000 square metres across five levels and is currently the largest Passive House-certified project in the southern hemisphere, and arguably the largest Passive House-certified educational building in the world. Of the small number of Passive House buildings in Australia, nearly all of them are residential, so Grimshaw, along with design and engineering firm Aurecon and general contractor Lendlease, have set a new benchmark that is indeed very high.

It comes as no surprise that the Woodside Building has been awarded multiple times. In 2021, it was selected along with 17 other projects from around the globe to feature at the COP26 UN Climate Conference in Glasgow, demonstrating opportunities for sustainability in the built environment. It was here that the World Economic Forum voted it one of the top seven greenest buildings in the world. Interestingly, Passive House certification is a voluntary, internationally recognised set of building standards that demands energy efficiency and reduces a building's ecological footprint. Grimshaw recognised that the project's design principles could achieve the Passive House standard, supporting Monash's mandate that by 2030 the entire University has to be a net zero carbon emitter.

"The Grimshaw brand is based on our commitments to carbon mitigation and environmental and social sustainability, so we are indeed under significant obligation to meet these commitments and help our clients meet them too," says Sydney-based Cristian Castillo, project architect and principal at Grimshaw. "We in fact realised that the project could be built to Passive House standard, and suggested it to the engineer, builder and client – and they agreed."

The structure of Woodside Building was originally planned to be a complete CLT (cross-laminated timber) design, with all material sourced from Germany, but the design was changed just before tender to be entirely constructed from locally sourced steel. As Castillo explains, "Monash University had a very tight turnaround – the project was tendered in August 2018 and completed in April 2020 – and the desired outcome simply could not have been achieved in such a short timeframe using imported CLT." Regardless, the CLT design would have been a hybrid of timber and steel, so the change in material was both a logical and practical one.

"The thing about CLT, and the spans that the design called for, is that the timber would have required quite a lot of steel anyway because timber can't span as far as we needed horizontally, without a steel support," continues Castillo. "CLT would have added a different layer aesthetically, but the reality is that the change to steel didn't diminish the quality of the design at all."

BlueScope supplied structural materials for the building made from grade 250 and 350 XLERPLATE® steel welded into beams and columns, painted in a signature red, that serve as the interior's main form of expression, allowing the space to be as open as possible. It was conceived as a modular steel-framed armature ordered into a strict tartan-like geometry of three linear elements spanning 12 metres for the Design Build Studios and Co-Lab Spaces, 24 metres for the flat floor and tiered learning spaces below – and academic and research above – and six metres for the informal collaboration areas. The mix of double-height areas and a large centrally positioned full-height atrium gives students a range of different settings in which to study, with the emphasis squarely on their comfort and wellbeing.

“The building was deliberately designed to maximise daylight, so the internal spaces are full of natural light and feel very airy as a result.”

CRISTIAN CASTILLO GRIMSHAW

Learning spaces of varying dimensions are visually and spatially connected, supporting the current pedagogical focus on transparency, and a generous sequence of skylights further opens up the interior. “The building was deliberately designed to maximise daylight, so the internal spaces are full of natural light and feel very airy as a result,” says Castillo. “There are also views out to the Dandenong Ranges, along with the cross-views throughout the whole building. Early in the day, the popular auxiliary spaces such as the kitchenettes get very busy and benefit from the permeation of beautifully soft, even morning light.”

Regarding the building’s orientation, Grimshaw undertook energy modelling that determined the best alignment was actually not to design the long axis to run north-south, but east-west, allowing for greater maximisation of sunlight and ventilation. Air locks were also incorporated at each of the entrances to minimise air infiltration. The northern elevation receives the majority of the solar load between mid-morning and afternoon, so Castillo and the team clustered the plant rooms along this façade. It allows for an abundance of openings on the east and west elevations, with the eventual outcome achieving a 50:50 ratio between solid surface and windows.

To enhance performance internally, and in compliance with the Passive House requirements for energy consumption, the formal spaces, which have the highest usage of energy, are placed in the centre of the building. Circulation and informal teaching areas are positioned close to the façade, functioning as buffer zones that have greater access to natural light and a more variable environmental condition. Comfort is once again prioritised and the central spaces are where the greatest spans are, with rooms catering for up to 360 people. The skylights accommodate the offices on the upper floors and the large voids draw air up to be circulated.

Steel was ultimately chosen for its strength, with the steel structure fabricated in a neighbouring suburb and the large truss sections brought to the site in their entirety by an oversized truck during the

ABOVE The steel structure frames a generous and light-filled atrium. Photo: Michael Kai.

OPPOSITE The building’s sober exterior stands in dynamic contrast to the bold red tones of the interior. Photo: Michael Kai.

night. Three cranes put the steel in place because of the speed in which it needed to be constructed, erecting the trusses and bracing, as well as dropping the entire shaft and body in place faster than Castillo could even draw it.

The choice to finish the structural steel componentry in red may seem unexpected, but the effect is nothing short of exceptional. It lends the interior a very modern industrial aesthetic, contrasting with the naturally coloured scheme and highlighting the openness of each level. The colour was inspired by the bark and smaller branches of the surrounding Blue Gums, connecting the interior to the landscape and ensuring the building has a sense of being truly embedded in its natural setting.

This red colour, along with a dusty grey tone, extends to the exterior, which comprises an envelope of 50 per cent solid, 50 per cent transparent highly insulated metal curtain wall. High performance windows are double-glazed and a finely detailed latticework of louvres tempers the sun and provides shading. The stairs are fully glazed and also screened by the louvres to avoid overheating, and because they sit inside the thermal envelope, air spilled from the internal conditioned spaces allows the temperature to remain within the comfort range.

As hard-working as the interior spaces and façades are, Woodside Building's roof, at over 15,000 square metres, also plays a significant role in the project's performance-based design approach. Its spandrel panels range in thickness from 15 to 20 centimetres and incorporate insulation panels of 17.5 centimetre thickness. These panels are sandwiched between top and bottom layers made from COLORBOND® steel in LYSAGHT KLIP-LOK® 406 / 700 profile, in the colour Wallaby®.

For Castillo and the team, there was no question surrounding the use of COLORBOND® steel. As he explains, "Monash University has very strict guidelines in regards to material selection. We were also very familiar with this particular colour and specifically wanted to use it on this building."

The product is sturdy enough to accommodate a large quantity of photovoltaic (PV) panels connected to the Monash University campus-wide smart grid. They cover its surface and produce 273 MWh per annum, and are designed to produce one third of the total energy consumed by the building.

Along with producing renewable energy, the roof is also used as a catchment, and a rainwater-harvesting tank feeds flush devices and the irrigation system. It serves to highlight that every part of Woodside Building is a thoughtfully considered example of sustainable design.

Together, these parts showcase a performance-based approach that provides students with unique learning opportunities in a built environment that genuinely inspires. Its structural armature made from XLERPLATE® steel not only provides the interior with a memorable identity that has a surprisingly striking lightness – it also facilitates an openness that characterises today's universities by supporting a mix of diverse learning settings.

STEEL DETAILS | A TECHNICAL DIVE INTO WOODSIDE BUILDING FOR TECHNOLOGY AND DESIGN

In changing the design of Monash University's Woodside Building for Technology and Design from CLT to structural steel, the project found its definitive expression. The interior's red-painted steel armature (comprised of welded beams) and columns (made from XLERPLATE® steel) achieve impressive spans that open up the space, and which could not have been achieved in exactly the same way if constructed with CLT.

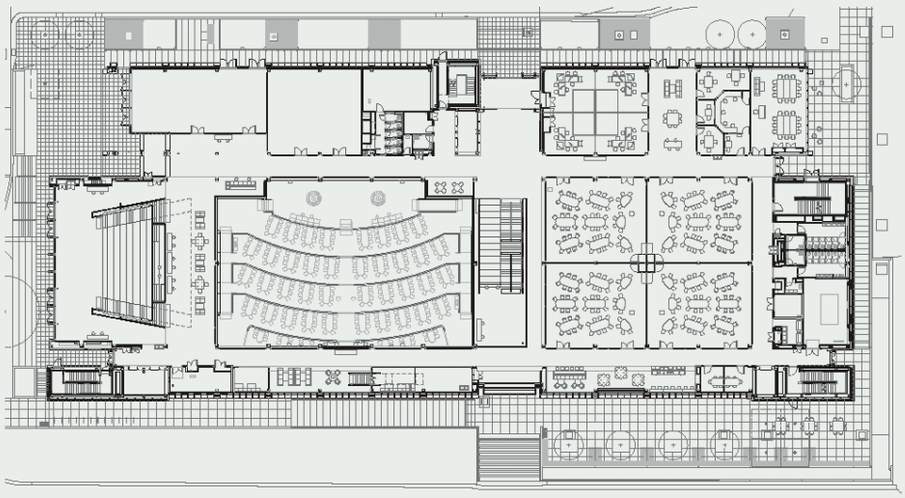
It was imperative that the project's construction be fast-tracked to meet Monash University's tight timeframe, so PlanIT Design Group was engaged as part of the design consultancy team. The steel 3D modelling, with consultant Ricky Hains as director, structural steel modeller and steel detailer, was responsible for putting the freehand sketches of the building's design into a 3D model prior to it being fully documented by the architects and engineers. As Hains explains, "Enabling that process of building an accurate structural steel 3D model and preparing shop drawings a lot earlier than is traditionally done meant the architects and engineers got practical feedback a lot sooner. This allowed them to adjust their design on the run so it didn't compromise design intent and still allowed the structure to be built. We probably saved around six months off the overall build time."

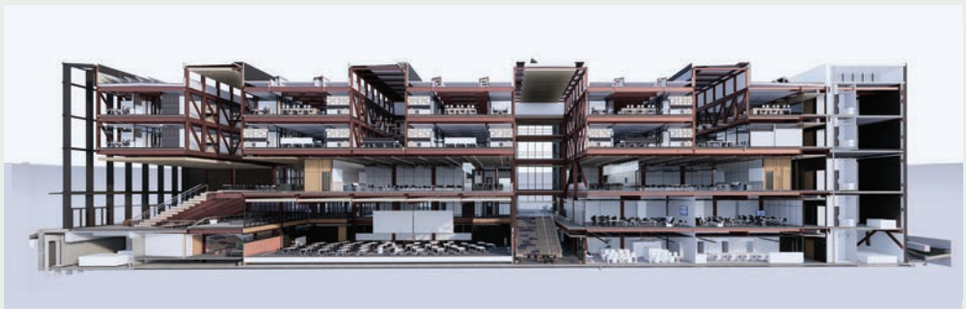
The building essentially went straight from shop drawings into fabrication, with the 3D model and shop drawings released in modular sections of one or two grids at a time – one level at a time – so the architects and engineers could review and sign off on them progressively in order to keep fabrication flowing at a rapid pace.

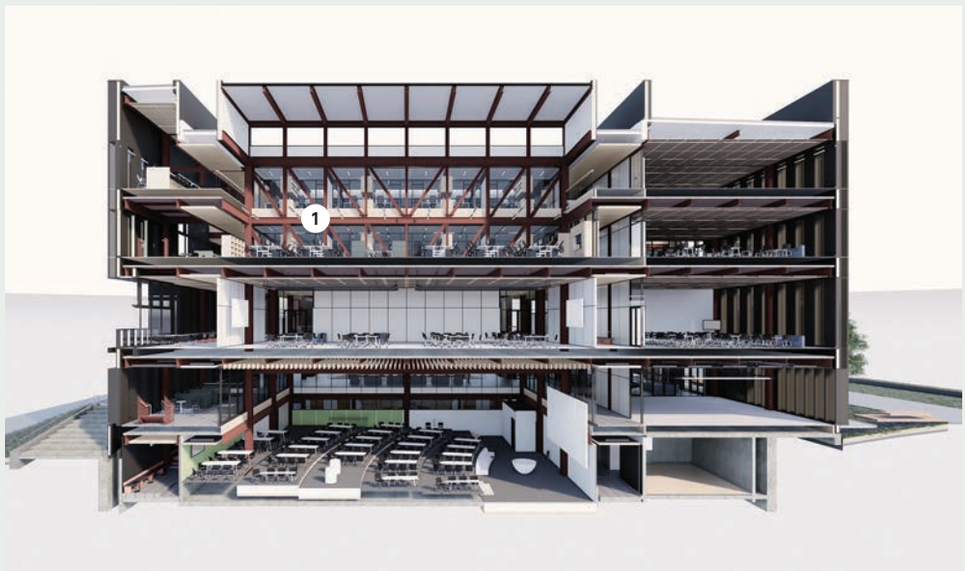
Collaborators GVP Fabricators also advised on transportation and lifting limitations to suit the cranes, and from there it was determined where the trusses needed to be spliced in order to transport them and bolt them together on-site. Some of these trusses needed a dual lift (two cranes instead of one) because of their weight.

The splice connections are worth noting as they add a unique element to the design and are crucial to the interior's aesthetic. "While the trusses needed to be spliced so they could be transported, they only needed to be spliced in one location," says Hains. "But because the steel is highly exposed, the architects wanted to maintain symmetry. Normally, if trusses are fully clad or concealed, you'd only have the one splice because no-one sees them. In this case, because the structure is highly visible, we incorporated a 'mock' splice in order to maintain a balanced appearance."

This cosmetic splice sits on one side of the truss' central member to match the structurally secured splice on the other side of the centre. The two-storey-high trusses are not only spliced at floor level (mid-height), they are also spliced just right-of-centre on the much heavier lower truss, due to transportation and crane capacity limitations. This has resulted in a highly refined interior characterised by balance and repetition, and architectural integrity underscored by a nuanced use of structural steel.







PRINCIPAL STEEL COMPONENTS

1 Structure: Welded beams and columns made from grade 250 and 350 XLERPLATE® steel.

2 Roofing (not shown): made from COLORBOND® steel in LYSAGHT KLIP-LOK® 406 / 700 profile, in the colour Wallaby®.

ABOVE Distinct axes organise the interior almost into quarters in plan (top), while the rendered section drawing (bottom) shows how spaces compress and open up throughout.

OPPOSITE Twilight brings out the play of visibility between inside and outside. Photo: Rory Gardiner.

PROJECT INFORMATION

Architect
Grimshaw with Monash University

Client
Monash University

Project Team
Andrew Cortese – design director and partner in charge; Michael Janeke – project director and partner; Cristian Castillo – project architect and principal

Project Timeframe
15 months (construction)

Building Size
19,000m²

Builder
Lendlease

Steel Fabricator
GVP Fabricators

Shop Drawing Contractor
PlanIT Design Group

Cladding Contractor
Minesco

Structural & Civil Engineer
Aurecon

Landscape Architects
ASPECT Studios

Awards
2021 Australian Institute of Architects National Awards: Sir Zelman Cowen Award for Public Architecture; David Oppenheim Award for Sustainable Architecture; 2021 Australian Institute of Architects Awards Victoria Chapter Awards: Victorian Architecture Medal; Melbourne Prize; COLORBOND® Award for Steel Architecture; Sustainable Architecture Award; Educational Architecture Award; 2020 Sustainability Awards – Best Education and Research Building

Scan to discover more about the project.

IN PROFILE

Daniel Moore

WORDS TIMOTHY ALOUANI-ROBY
PORTRAIT PHOTOGRAPHY PETER TARASIUK

Daniel Moore's multifaceted journeys with steel are crisp, adaptable and versatile – much like the career of this ambitious and accomplished young architect.

ABOVE At Thinking Paddock House, Tasmania, an enigmatic roofline and warm interiors frame stunning water views. Photo: Massimo Combi.

Named by the Australian Institute of Architects as the National Emerging Architect in 2022, Moore has had a richly varied career in architecture and adjacent fields so far. With steel projects at scales both large and small, he sees a world of possibilities as architects increasingly learn to connect with the specificities of place across Australia.

Speaking with Daniel Moore about his already accomplished career in architecture, the international variety of his experience is immediately impressive. Between studies at the University of Tasmania, he gained experience working in Melbourne before travelling to Denmark for a six-month exchange placement. His travel destinations have since included the US and Japan, with interspersed periods working for studios DesignInc and Breathe Architecture before setting up his own practice, Open Creative Studio. Further diversifying his professional career, Moore is currently Victorian state manager at the AIA.

With experience in architectural practice, advocacy and even as a voice-over artist and podcast producer, he is a prime example of how professional architectural training can create the foundations for a wide variety of experience and skills across the workplace and civil society.

Amidst the exciting diversity, steel stands out as a consistent feature of Moore's architecture. There are parallels between his career trajectory and the story of steel as a construction material — from a foundation of versatility and global exposure to an increasingly refined and locally specific sense of place.

Steel has been one of the defining materials of modern architecture, but its twentieth century ubiquity is evolving into more nuanced uses that respond to site specificity.

Similarly, Moore speaks about the importance of place in his practice. In particular, his experiences on the recent AIA Emerging Architect Prize Tour have directly translated into a more locally sensitive understanding of place across Australia: "Actually meeting people from different cities and hearing about their perspectives on architecture — which are completely different to ours in Victoria or Tasmania — makes you realise how the same solutions don't play out across an entire continent. I think it's really important for all architects to visit different parts of Australia and learn that every single architect, no matter where they are, is dealing with very specific climatic and geographic considerations."

As a practising architect, a number of Moore's projects are notable for their use of steel. What is really striking about them when viewed as a whole portfolio, however, is his wide-ranging and versatile application of the material — from refined, bespoke detailing to grand sculptural gesture. Thinking Paddock House on Tasmania's South Arm Peninsula is a prominent example of the latter. It's a residential project that Moore completed for his parents, and its stand-out architectural feature is a show-stopping, mind-bending roof made from COLORBOND® steel.

"One of the first design considerations was for a house that would be contemporary at the same time as blending in and referencing some of the surrounding architectural landscape," says Moore with reference to the widespread use of gable roofs in the area. Combining this conceptual principle with practical factors such as the strong winds on the site led to the design of a roof that is gabled while achieving a sense of flattening off at the back end to meet the site's gradient. "As you move around the house, the roof looks like it twists and moves. There are two hyperbolic paraboloids in it and I felt that was only achievable using a steel profile," explains Moore. With such complex geometry, it's the kind of design that requires a highly malleable material, like steel, in an age of advanced digital design tools.

On a wholly different, zoomed-in scale, projects such as the Melbourne headquarters for La Marzocco Espresso Machines and Allpress Roastery and Café demonstrate a highly nuanced and refined use of steel as a detailing material. From door handles and track sliding doors to balustrades and window frames, Moore's work on these Melbourne projects highlights the capacities of steel as a bespoke design element.

This kind of versatility is just one of the qualities of steel that Moore admires. "I love the tactility of many building products but there's something about the weight and sharpness of steel," he notes. "When you install it, you can see that it's as crisp as the way you drew it and that's a really

> "I think we're going to be exploring steel a lot more. The benefits won't go away, but the aesthetic of steel can be almost infinitely adapted."
>
> **DANIEL MOORE** OPEN CREATIVE STUDIO

attractive thing for me." This sense of exactitude even speaks to a generational passion for making things: Moore tells how his grandfather (who worked with steel) would tease his brother (who worked with timber) about not measuring things as a carpenter would.

Malleability, versatility, crispness, precision – these are some of the architectural qualities of steel, but the question of sustainability is also a crucial one. Two aspects of steel stand out from this perspective: longevity and material circularity.

New and innovative forms of reuse are becoming increasingly popular with steel, allowing for the material to be reused and later recycled, while longevity often comes down to sheer durability.

"The first thing is that, if you're going to build something, build it so that it doesn't have to be torn down in 30 or 40 years," says Moore. "Make it so that it's going to be in place as long as possible, hopefully something that can eventually be adapted rather than completely torn down."

"The durability of steel is such that it gives architects an opportunity to realise this kind of sustainable design; the corollary is that a sense of real responsibility accompanies such work."

Moore is excited about the kinds of opportunities that come with thinking about city futures on a scale of decades, and the potential that steel provides for realising them. When asked what his dream project brief might be, the answer ties together strands from the specificity of place across Australia to the functional capacities of steel as a design and construction material. "I think architects are always up for a challenge and, after the Black Summer fires (2019), we had hundreds asking how they could help as part of the AIA's scheme, Architects Assist," he explains. "The ideal steel brief would be creating a house that can resist fire and flood while being adaptable and meeting the needs of people in regional Australia."

For Moore, steel is a versatile, exact and aesthetically rich material that continues to inspire and facilitate his work. From the high functionalism of designing for climate risk in regional Australia to sculpturally complex Tasmanian roofs and bespoke detailing in inner city Melbourne, his architectural record proves the possibilities.

ABOVE Allpress Roastery and Café, Melbourne. Photo: Trent Perrett.

OPPOSITE La Marzocco HQ. Photo: Alexander McIntyre. Here, both projects demonstrate the versatility of steel as a bespoke material for detailing.

Scan to discover more about Daniel Moore

PROJECT PUFFING BILLY LAKESIDE VISITOR CENTRE **LOCATION** EMERALD, VICTORIA

Quietly Audacious

ARCHITECT TERROIR
WORDS ROB GILLAM
PHOTOGRAPHY PETER BENNETTS, RORY GARDINER

Set in the Dandenong Ranges of Victoria, TERROIR has designed the Puffing Billy Railway Visitor Centre to be ruggedly cloaked in COLORBOND® steel roofing and cladding. Using the dark shade of Monument® Matt finish, it achieves new levels of functionality while speaking poetically to both landscape and locomotive history.

> "Our challenge was to celebrate the 'dance' of the railway and allow it to remain the hero."
>
> **EMILY SLEVIN** TERROIR

Set amidst the verdant fern gullies and towering Mountain Ash rainforest of the Dandenong Ranges, east of Melbourne, it's easy to see why Puffing Billy Railway is such a cherished and iconic site. Its fleet of steam-powered, century-old locomotives chug slowly through the landscape, taking us back to the magic of historical train travel.

Puffing Billy Railway, however, had a problem: the railway was becoming overwhelmed and, bogged down with visitor numbers that the site couldn't handle, the continuity and flow of its journey from start to end was being stifled. The decision to create a dedicated Discovery Centre at Emerald Lake Park, located centrally on the railway, has provided a platform for TERROIR to propose a daring solution that provides a world-class visitor centre while also streamlining the railway experience.

Architecturally, the response by TERROIR is multifaceted. It is at once quiet and quietly audacious – sensitive to the site's historic context and heritage while also expressing form and function in a novel way.

"The idea of the building was not to be the immediate hero," explains TERROIR associate and project lead, Emily Slevin. "There can be a dilemma with tourism projects, a pressure to build an icon. Our challenge was to celebrate the 'dance' of the railway and steam engine experience, allowing it to remain the hero and accentuate it by adding new dimensions and perspectives that enhance the railway's visceral qualities."

Here, the architects have worked with steel to craft a dialogue with the railway's history as well as its contemporary presence. In particular, the use of COLORBOND® steel in Monument® Matt finish for all roofing and walling has allowed the designers to make a number of notable architectural statements.

The material creates a muted, monochromatic presence for the building that allows it to recede visually and function in part as a silhouetted background against which the action of the railway unfolds. "I was fortunate to go back recently and I was amazed that, as you approach from Emerald Lake Park, you almost cannot pick out the building," notes Slevin. "It's quite an achievement to have a 2000-square-metre building sit so delicately amongst the trees."

The siting of the multifunctional Visitor Centre is a direct response to the historic railway because the broad sweep of the building follows the curve of the railway line. While this setting allows the building to play a support role to the railway itself, it nevertheless has not stopped TERROIR from making some important formal moves with the architecture.

ABOVE Timber materiality within the building connects with the natural surrounds, while architectural openings maintain the angular design language. Photo: Peter Bennetts.

OPPOSITE At once monumental and quielty nestled into the landscape, the exterior maintains a striking presence. Photo: Peter Bennetts.

OPENER The architecture connects deeply with the existing sweep of the railway, its Monument® Matt finish evoking the train carriages themselves. Photo: Rory Gardiner.

"The original station building informs the height of the new undercover walkway."

EMILY SLEVIN TERROIR

Offset against the long, slow curve of the historic railway, the Visitor Centre speaks a more modern language with its angular layout. Indeed, it's a language of sharpness that fits well with the use of steel, providing a spatial variety and dynamism that belies the monochromatic exterior. This delicate balancing act – at once quietly respecting the heritage and using a formally dynamic, modern architectural language of angular geometry – is at the core of what distinguishes this design.

"The selected project site was originally a carpark with a few trees and picnic shelters, and the existing station building stock is relatively small in its scale. We tried to be respectful of the existing parts, whilst accommodating the new building's spatial program," says Slevin.

"The original station building informs the height of the new undercover walkway. That horizontal line is maintained at the same height as it presses on into the main building itself. The slope of the ground subtly falls away as you walk, so the height of the building increases in scale as you progress further from the existing station. By the time you reach the cantilevered canopy of the Great Hall at the far northern end, you're in the tallest vertical space."

This sensitivity to the topographical dimensions of the site continues through to another important consideration in terms of landscape. In the wider context of the Lakeside Station setting, the new Visitor Centre delineates two distinct landscapes by bridging them. On one side, it quietly overlooks the manicured gardens of Emerald Lake Park while, on the other, it melts into the native bushland behind.

The delicate capacity to delineate aspects of the site while receding into the background comes on the back of considered material choices. The first step was to place the Visitor Centre's most visible part – its external façade – into conversation with the railway's history. The COLORBOND® steel cladding evokes the robustness of the trains' very own cast metal, providing a clear connection between the heritage centrepiece and the modern facilities. The Visitor Centre is itself presented as a deliberate whole, a singular object with everything under one roof in a snaking, carriage-like organisation that once again recalls a locomotive body. As with some of the most interesting heritage work, what TERROIR is doing is not mimicry but rather reinterpretation – and, as a modern, versatile construction material, steel provides a fitting medium for doing exactly that.

The flow of spaces in the Visitor Centre's layout continues with the ribbing alignment of the Mack Bros Straightline 406 Plain Pan

ABOVE Timber panelling provides a counterpoint to the dark façade as visitors move under cover. Photo: Peter Bennetts.

OPPOSITE The building's snaking layout is formed in response to both topography and the existing railway line. Photo: Peter Bennetts.

Deck cladding profile at the roof and wall junctions, giving the impression that the two seamlessly flow into each other. (The technical resolution of this is explored in Steel Details, page 30-31).

Similarly, the architects employ a hidden gutter made with pre-painted steel. “We’ve incorporated a box gutter system within the cladding profile that is not evident when looking at the roof, even from an elevated position,” Slevin explains. “The folded eaves gutter continues as a datum over the standing seams of the Straightline 406 wall cladding to offer an inbuilt overflow.

“We have a gutter guard finished to match the Monument® colour which assists with bushfire compliance – all external cladding had to achieve BAL-19 bushfire attack level – by preventing debris from accumulating in the box gutters. It also provides an almost continuous reading of the roofing material, with the box gutter acting as a straight line to the edge of the building.”

Details such as the gutter serve to draw renewed attention to the multifaceted nature of TERROIR’s design in the way that it operates at multiple scales, from the overall site layout to the smallest detail or joint. The gutter detailing is just one example of the attention to detail needed to create the purposeful exterior forms. Meanwhile, the layout of the interior floor plans avoids simple straight paths to create a more subtle sense of continuity; each jutting angle invites the visitor to proceed to the next space. In this way, the architecture captures the material presence of the railway as well as something of the poetics of its history.

In-line with both the architects’ ethos and Victorian Government incentives, the design for Puffing Billy Lakeside Visitor Centre displays a strong preference for locally processed materials in achieving its architectural effects. “Using BlueScope’s COLORBOND® steel in Monument® Matt finish was a significant design decision and aligned with the client, contractor and design team’s desire to locally source,” explains Slevin. “It was nice to have a regional connection to the Straightline 406 profile cladding, with the Mack Bros warehouse located less than one hour from site.”

Slevin is keen to note how the boldly ribbed Straightline 406 profile forms a dynamic interplay with the organic forms of its bushland surrounds. “The profile’s flat pan and standing seam are quite dynamic, creating depth and visual interest through the length of shadows cast across the façade. The façade becomes a canvas for the shadows of the eucalypts to dance across. You get a secondary understanding of the bushland and the way it interacts with the building’s surface.”

In a similar fashion, TERROIR chose steel with its durability and recyclability in mind. Slevin explains further: “Materiality was very important for this project. Our aim is for materials to have minimal environmental impact and part of that is lifecycle. COLORBOND® steel was selected in part for its durability and lifespan, and also that it could be recycled at the end of its functional life. From a construction perspective, its transportability and speed of assembly were also highly beneficial.”

The durability of the material is also a sustainability consideration and, just like Puffing Billy’s ageless steam locomotives, the building has been designed to endure. “I’m not surprised, but I’m really impressed at the qualities of the COLORBOND® steel,” Slevin notes. “The cladding looks as good today as it did the day it was installed. It’s always pleasing to come back and find the material on one of our buildings is unchanged.”

TERROIR’s use of steel speaks to the adaptable and versatile possibilities of the material. It achieves a strong combination of pragmatic, functional, material and conceptual successes that make this visitor centre newly engaging, architecturally exciting and historically literate. In a measured exercise of architectural restraint, the architects have built new facilities that allow the protagonist, Puffing Billy, to shine.

STEEL DETAILS | A TECHNICAL DIVE INTO PUFFING BILLY LAKESIDE VISITOR CENTRE

Hardily encased in roofing and walling made from COLORBOND® steel, Puffing Billy Lakeside Visitor Centre intentionally presents as a single continuous form, resembling sleek cast iron engine bodies and enclosed steel carriages.

The idea of the building as a seamless, singular object is achieved with especially fine detailing of the junctions between the steel roof and wall cladding, which transition as crisp, straight edges featuring no overhangs or eaves.

This signature architectural feature is resolved at the roof and wall plane intersections by the meticulous alignment of vertically styled ribs sported by the Mack Bros Straightline 406 Plain Pan Deck cladding profile. As such, it reads as a singular, continuous material flowing from roof to wall.

In material terms, this outcome required design innovation and conceptual resolution from TERROIR and its team of trusted specialists – starting with the architects workshopping ideas with builder Kane Constructions to carry it through to full effect.

A custom-fabricated mansard cap to the ridges was settled on and affixed to each individual profile seam between the wall and roof planes on the building's western side, visually and functionally joining the two.

These cappings appear as feathers bristling above the roofline when viewed from below and connect the façade vertically to the bushland behind.

On the building's eastern side, where the roofscape is clearly visible from above, a 'hidden' box gutter finish runs between roof and wall, creating a straight line to the building edge. Structural engineers Stantec Australia oversaw all structural steel elements, and ensured the wall and roof cladding junctions were appropriately framed for support.

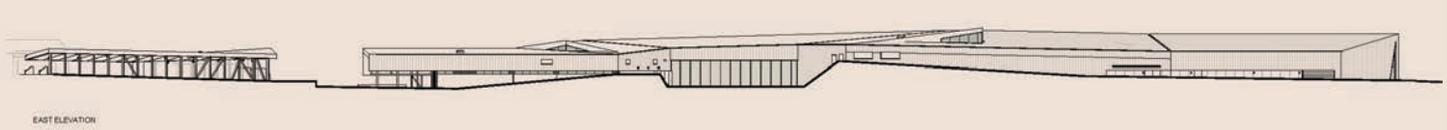
Structural group leader and associate director, Tim Mansfield, explains: "We worked with the builder to accommodate secondary fabrication elements for the roofing and cladding beyond the primary portal frames. For the junctions, we developed bespoke steel details to reduce the amount of plate projection past the steel member, and then to allow for the secondary framing structure – the purlins and girts for the roofing and walling respectively – to pick up the custom edge detail and ensure the standing seam Straightline cladding was adequately supported."

Kane Constructions project manager, Brendan de Neef, says it was pleasing to see such attention to detail on a commercial project. "A roofer would ordinarily just put a barge flashing there – one long box wrapped over the top – which would be a quick and easy way to achieve waterproofing," he says. "TERROIR, though, had very specific ideas for that area and so we worked collaboratively with them, Zinc Cladding Australia and Mack Bros to come up with a custom mansard cap that maintained a clean line between the roofing and wall cladding.

"Basically, a length of rollformed sheeting is folded at 90 degrees to create a cap that matches the rib of the roof and wall sections. The ridgelines had to marry up and there was a small gap left for the mansard caps to cover. It was all very meticulous," adds de Neef.

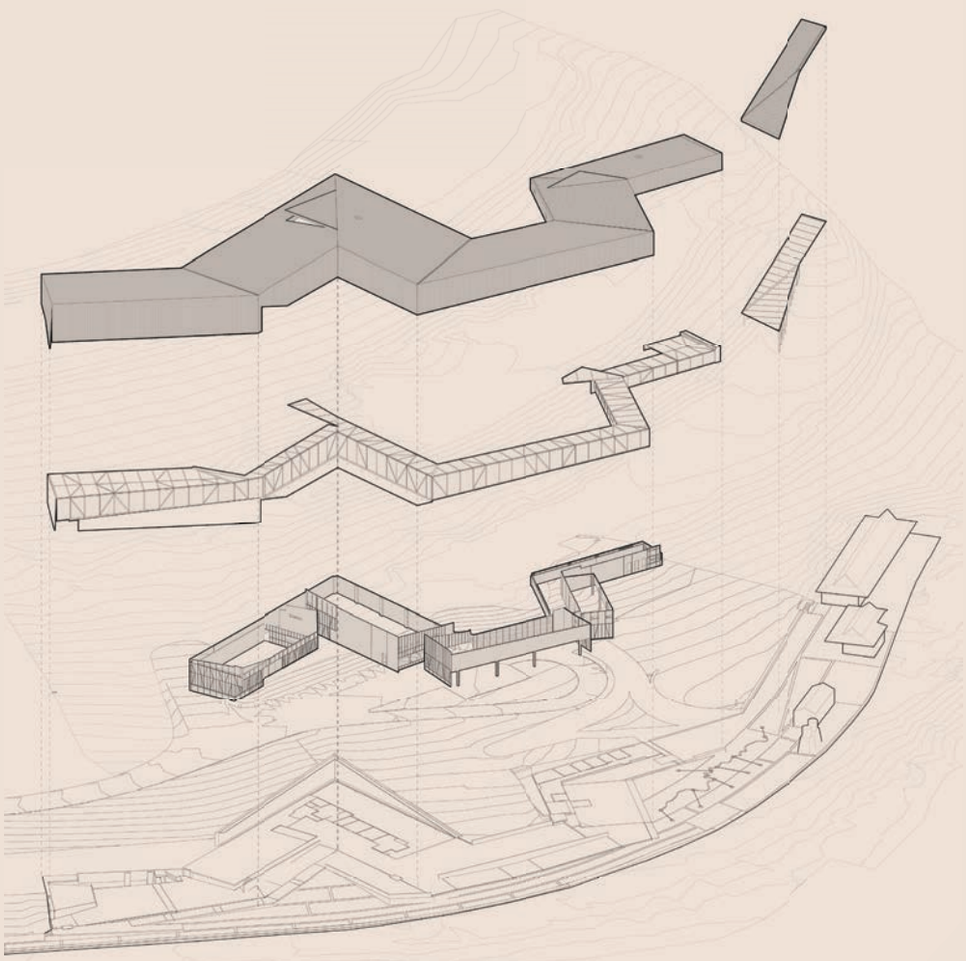
Zinc Cladding Australia general manager, Matt Guerin, notes that lining up the roofing and cladding sheets required technical precision. "We start with all the roof sheets," Guerin says. "Then you have to be careful the wall sheet tolerances don't creep. You need to constantly check the ribs are lining up and the sheets are laying close to plumb."

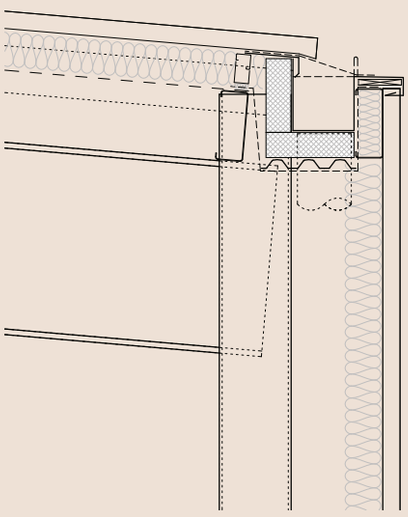
Mack Bros director, Ian Mack, says his family have been rollforming pioneers since 1958 and, naturally, have accumulated specialised tooling including for customising steel details. "We have in-house machinery for producing unique gutters and gutter-brackets that we can modify for jobs such as the mansard caps for Puffing Billy," says Mack. "We were happy to contribute our craft to a local project close to our hearts."



EAST ELEVATION

WEST ELEVATION





PRINCIPAL STEEL COMPONENTS

1 Roofing and cladding made from COLORBOND® steel Matt in Mack Bros Straightline 406 Plain Pan Deck profile, in the colour Monument®

2 Box gutter, flashings and cappings made from COLORBOND® steel Matt in the colour Monument®.

ABOVE, TOP The exploded axonometric drawing shows a variety of layers, from the monolithic exterior to enclosed internal room.

ABOVE, BOTTOM A hidden box gutter system is incorporated within the cladding profile, providing seamless legibility of the roofing material.

OPPOSITE Elevation drawings illustrate the long, low profile of the building as it juts across the landscape.

PROJECT INFORMATION

Architect
TERROIR

Client
Emerald Tourist Railway Board

Project Team
Scott Balmforth, Gerard Reinmuth, Emily Slevin, Paul Sayers, Michael Carlotto, Jack Andrews

Project Timeframe
September 2019 – March 2021

Building Size
2654m²

Project Cost
$20 million

Builder
Kane Constructions

Project Manager
Aecom

Steel Fabricator
ICE Engineering (VIC)

Cladding Contractor
Zinc Cladding Australia

Structure, Civil and Mechanical Engineer
Stantec Australia

Shop Drawing Contractor
ICE Engineering

Facade Engineer
Inhabit Group

Landscape Architects
Tract

Interpretations
Thylacine

Landscape Contractor
ACE Landscaping Services

Awards
2022 Australian Institute of Architects Victorian Chapter Awards, Public Architecture – Commendation; World Architecture Festival, Future Projects – Finalist 2019; World Architecture Festival, Completed Buildings – Finalist 2023; The Chicago Athenaeum/The European Centre for Architecture Art Design and Urban Studies, International Design Award – Winner 2022

Scan to discover more about the project.

PROJECT WARREN INTEGRATED STUDIES HUB **LOCATION** COBBITTY, NEW SOUTH WALES

Natural Wonder

ARCHITECT MAYOH ARCHITECTS
WORDS MICKY PINKERTON
PHOTOGRAPHY JARRYD SINCLAIR, CHRIS WARNES

Informed by biophilic design, this eye-catching roof made from COLORBOND® steel in the colour Surfmist® on the new wing of a Sydney school swoops and swirls, inspiring students and providing the perfect project to showcase an adaptable LYSAGHT LONGLINE® roofing profile.

> “Design that mimics nature makes people feel more comfortable. [The natural environment] is the place we feel most tranquil.”
>
> **JONATHAN HENLEY** MAYOH ARCHITECTS

There’s a reason why most buildings are rectangular – it’s an easier shape to build. Throw in a curve and you’re upping the ante on the abilities of all involved – and asking a lot more from your materials. But with increasing trends supporting the benefits of educational environments with designs drawn from the natural world, Mayoh Architects was undaunted. The design draws on the outstanding technical properties of a steel roofing product that marries the renowned proven qualities of COLORBOND® steel with a specialised LYSAGHT LONGLINE® profile that tapers to achieve the impressive organic arc of the building’s roof.

That tenacity and daring has since been rewarded with the 2023 Australian Institute of Architects NSW Chapter COLORBOND® Award for Steel Architecture, and the rounded roof in Surfmist® has become symbolic of the school’s identity, proudly demonstrating innovation in construction and aptly reflecting the scientific learning happening beneath it.

Mayoh associate, Jonathan Henley, explains that the LYSAGHT LONGLINE® 305 tapered profile was the preferred product to meet the objectives of the brief. In fact, this design decision also led to a reduction in waste due to the form of the panels. “It was cost-effective, required little maintenance and resulted in less construction waste from a sustainability perspective, as well as meeting the aesthetic aspirations of the design,” explains Henley.

“We looked into a few different options that would help with the curves,” continues Henley. “What we really didn’t want was a series of straight roof sheets with overlapping flashings in triangular form – that could have been problematic for water leaking and it’s a real maintenance issue. So we reached out to Lysaght and we said, “This is our design, what can we do?”

LYSAGHT LONGLINE® 305 was identified as a product solution which would allow the custom rolling of tapered sheets to match the curve of the roof shape. In short, a standard 305-millimetre-width cover is concertinaed at one end to a narrow dimension of 155 millimetres, with ribs radiating from a central point, creating a beautiful fan effect. The same concealed fixings as the standard LYSAGHT LONGLINE® 305 product are used to clip sheets together, meaning that there are no penetrations.

The architects, meanwhile, observed significantly reduced material waste in general, thanks to the design decisions that the material was able to facilitate. “The steel roof was a much more sensible option than other materials, which could have had a lot of wastage in that curve form, whereas the roofing made from COLORBOND® steel in tapered LYSAGHT LONGLINE® profile, and even the structural steel supporting it, was much more flexible,” says Henley.

Sustainability was a key client focus, not just in design and construction but also for ongoing operation and maintenance. The building features abundant natural light, natural ventilation (on all but the hottest and coldest days of the year), large overhangs for sun shading and quality insulation, while water is harvested from the roof into the courtyard’s dry riverbed plantings.

OPPOSITE Topped by the roof profile, the curved building creates an open, green space at the centre. Photo: Jarryd Sinclair.

OPENER The curvaceous language of the layout becomes fully apparent viewed from above. Photo: Jarryd Sinclair.

> "Something that we generally do in all of our school designs is plan for the future."
>
> **JONATHAN HENLEY** MAYOH ARCHITECTS

The roof, made from COLORBOND® steel in the colour Surfmist®, was selected as it also contributed to better thermal performance, being one of eleven shades in the COLORBOND® steel core colour range which feature low Solar Absorptance (SA) values of less than or equal to 0.45 and meet Section J energy efficiency provisions to mitigate against the effects of Urban Heat Islands.

"At all of our meetings that we had with the school, the maintenance team was there as well," says Henley. "We really wanted all of the materials, and especially the roof, to be low-maintenance or essentially maintenance-free.

"Something that we generally do in all of our school designs is plan for the future. So that flexibility – being able to have a portal frame that allows all the internal walls to be non-structural so the school can change that in 10 or 15 years, and maintain the life of the building through changing uses – that was very useful."

For indicative lifespan, the school had the adjacent Arts building with 20-year-old roofing made from COLORBOND® steel, which Mayoh Architects assessed for refurbishment as part of the same engagement. The old roof sheets made from COLORBOND® steel were still in excellent condition and only a small portion had to be replaced at the new junction between the two buildings.

Resolving the complex design, however, was not without its challenges. The calculations required to determine the radius of each separate LYSAGHT LONGLINE® 305 roof sheet made from COLORBOND® steel were significant (see Steel Details), a hidden guttering system had to be devised and a flashing solution arrived at for the tight inside curve of the roof's upper edge.

Due to the large overhang, having gutters on the exterior of the building would have required downpipes to penetrate the continuous vertical louvres around the perimeter – an unsightly response which would have impacted on the carefully designed blades that vary in spacing and depth to suit the solar orientation inherent in a radial external façade, and meet Section J compliance. A hidden gutter detail was developed to solve this, allowing the downpipes to run along the exterior walls. As these were spaced at the vertex of each faceted section of wall, these corners were hidden, accentuating the building's sense of curvature. A coordinated effort between Mayoh Architects, builder Reitsma Constructions and roofing contractor BRC made this possible.

A further challenge was the roof span, which was slightly longer than the maximum length of sheet possible at the radiuses required. "So we had a maximum spacing at gutter, and then it splayed in to a narrower spacing on the inside of the curve," explains Henley. "But at that point, we were still short of the width of the building. We essentially have about 700 millimetres of flashing to the curved steel PFC beam on the inside edge, and that worked out really well."

This solution is visible on the inside curve at the high point of the roof and, again, was arrived at through on-the-ground brainstorming with the builder and roofing contractor.

Reistma Constructions manager, Matthew van Bentum, says collaboration is critical for these more challenging designs: "There's lots of workshopping that has to be done, because it's not just a square or rectangular building, everything is worked off radius points. There's lots of set-out to work through from a site perspective – a lot of coordination needs to happen with the roofer and the architect around some of that additional detailing that's required. But to be honest, there's not really any other option on a curved building like this."

Van Bentum agrees that the tapered LYSAGHT LONGLINE® 305 profile is an ideal product for such a roof design. "Because you don't want to have a scenario where you're trying to do cut sheets and flashings to try and draw in profiles all the way around the building, you need to be able to have the sheet interlock all the way around,

to have a seamless transition around the length of the building," he says. "The most effective way you can achieve that is through tapering of the roof sheets."

The spirit of collaboration that underpinned the building's construction is now evident in the work of the students within it. Given that more traditional classrooms were formerly prevalent across the campus, there was a desire from the school and the architects to deliver flexible learning environments that support teamwork, creativity and critical thinking. These spaces have a strong visual and physical connection to the central courtyard with its soft, permeable edges. It is this courtyard which Henley says has become his favourite part of the project for the different ways that the students use it: racing robots made in the new makerspace being run along its paths; the rain chain in the dry riverbed being used for science experiments and art projects; student-generated signage about the sustainability of the building dotted around the space.

"Being able to see all the different disciplines having those connections from one central area feels like a real precinct for learning STEAM projects, rather than a series of separate disciplines," Henley says.

Henley is convinced of the merits of biophilic design: "There's a lot of research indicating students who have natural airflow or natural light and connection to nature are calmer – they have better learning outcomes, and it's just a more pleasant space to be in, so they can focus.

"Design that mimics nature makes people feel more comfortable. We evolved in the natural environment and that's the place we feel most tranquil, so I think the way to go is to mimic that as much as we can with our built environment."

No doubt the generations of Australians who started school in boxy, sweaty demountables will agree. With tapered roofing products now making curved constructions such as Warren Integrated Studies Hub easier and more affordable, it looks like we'll be seeing more organic shapes at the school gate in future.

ABOVE Peaceful outdoor spaces are framed internally as the roofline's forms guard against any sense of harshness. Photo: Chris Warnes.

OPPOSITE Rigid shapes are all but absent, curves instead allowing for a connection with the outdoors. Photo: Chris Warnes.

STEEL DETAILS | A TECHNICAL DIVE INTO WARREN INTEGRATED STUDIES HUB

LYSAGHT LONGLINE® 305's tapering capabilities allows fanned- and rounded-plan roof shapes to be clad with ribs radiating from a central point. In short, it is a game-changer for achieving the natural forms associated with biophilic design. However, its use requires some 'curly' calculations and Mayoh Architects called on the experience of two individuals in particular to help understand what was involved: Will Pereyra at LYSAGHT and Blake Allen, director at BRC Roofing and Cladding.

Pereyra started his career as a structural and architectural draughtsperson for a number of engineering firms and says this background has been hugely beneficial in his role as a business development manager with Fielders and Lysaght. With an inherent knowledge of the LYSAGHT LONGLINE® 305 product, even he concedes that the Warren Integrated Studies Hub required some intricate pre-planning.

"The project had its complexities in the fact that it snaked in the other direction and you were dealing with different radiuses, and also the falls and levels are in different directions," says Pereyra. "It took eight hours' worth of calculations just working out the tapers, the quantities and what percentage of sizing was required for one section."

Tapering introduces much finer tolerances (both on-site and on the machines rollforming the sheets) where just a couple of millimetres can be critical. So while plans and 3D models provided crucial guidance and intent, the individual segments were ultimately measured from the physical steel structure for greater accuracy.

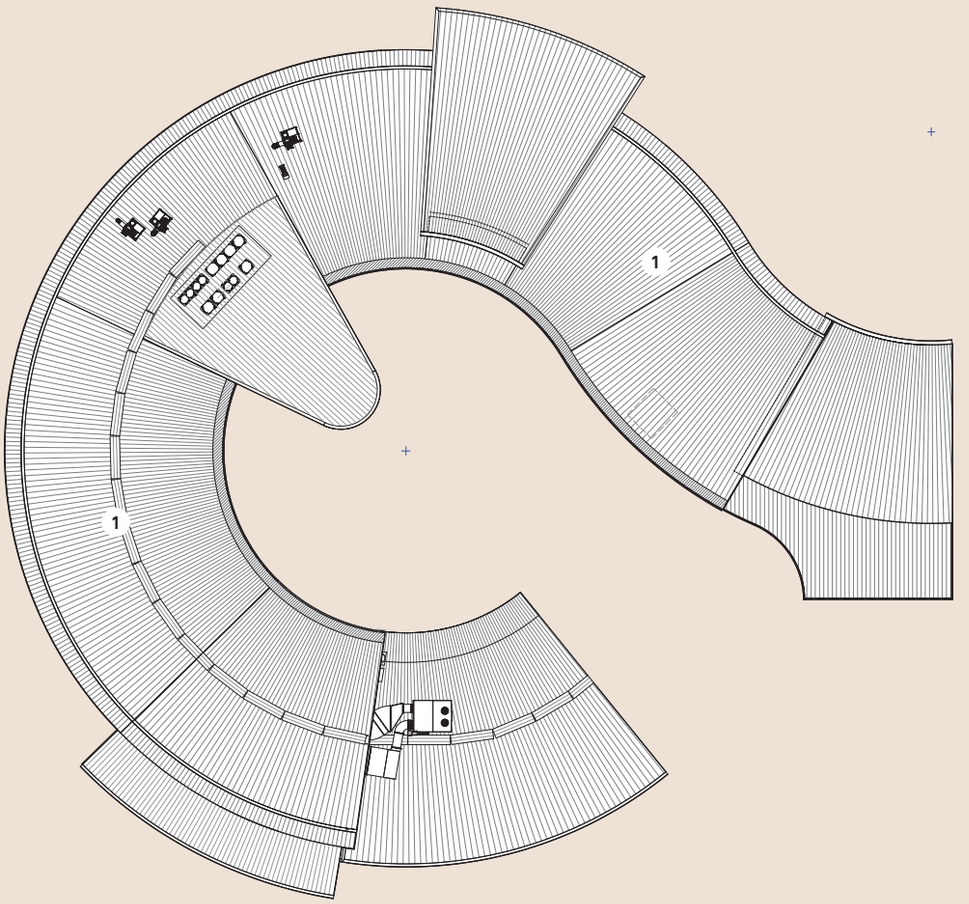
"Lysaght LONGLINE® is not like our other profiles such as CUSTOM ORB®, where you can actually stand on it and spread it out, and sort of massage it into place," Pereyra says. "We really need to work with what's on-site with Lysaght LONGLINE®, so that's when I got a bit more involved with the builder and the installer and explained how the curve could start pulling in towards itself, if you don't keep checking these things."

For Allen, who had worked with the product before but not on this scale, that meant "recalibrating regularly on every stage of it, on every order. That was one of the challenges, getting the taper exactly right," he adds.

"For each few sheets we laid, we would have a datum point and that might give us a reading that we needed to step back this much, and so we'd need to increase the next 30 sheets by maybe one millimetre here or there".

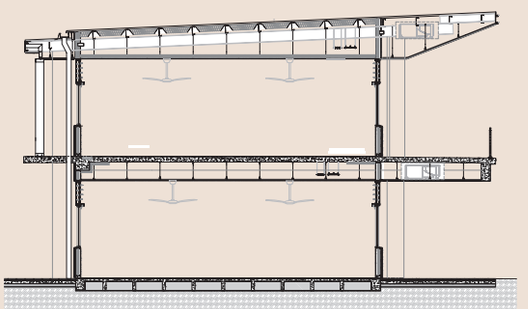
To assist with this process, Allen and Pereyra developed a flat sheet template which showed the radius of the sheet direction and allowed them to double check that they were staying true, before confirming the size and taper of the panel as marked-off on-site. Sheets were then produced back at the Lysaght factory and delivered in stages. Allen says such projects are challenging in every respect but add vital experience – for example, even setting up safety rail and safety mesh on a curved edge is a different process.

"I like these projects because, on paper, we don't know exactly how we're going to do them but we pull together a team around us," he says. "We had our external stakeholders such as Will at Lysaght, and we were going to pull together and roll our sleeves up and have a go. So that aspect is a driver, because it feeds our passion and purpose."



PRINCIPAL STEEL COMPONENTS

1 Roofing made from COLORBOND® steel in custom tapered Lysaght LONGLINE 305®, in the colour Surfmist®.



ABOVE Elevation and plan drawings clearly stay away from linear forms, while the section illustrates the tapering roof.

OPPOSITE An oversized, generous entrance gradually narrows as it brings people into the space from outside. Photo: Jarryd Sinclair.

PROJECT INFORMATION

Architect
Mayoh Architects

Project Team
Jonathan Henley, Peter Mayoh, Dan Hartcher, Holly de Jong

Client
Macarthur Anglican School

Project Timeframe
August 2020 – September 2021

Building Size
2282m²

Project Cost
$13.5 million

Builder
Reitsma Constructions

Project Manager
LMG Property

Roofing Contractor / Shop Drawing Contractor
BRC Cladding and Roofing

Steel Fabricator
MRVS

Structural and Civil Engineer
TTW

Building Services
Vos Group

ESD Consultant
Steensen Varming

BCA and Access
A&D Consulting

Landscape Architects
Place Design Group

Awards
2023 Australian Institute of Architects NSW Chapter – COLORBOND® Award for Steel Architecture Learning Environments Australasia, NSW Chapter – New Facility (Winner 2023); Learning Environments Australasia - New Building or Facility – Large (Commendation 2023); Learning Environments Australasia – New Construction Over $8m (Commendation 2022); Urban Development Institute Australia (UDIA) – Social & Community Infrastructure (Finalist 2022)

Scan to discover more about the project.

TERROIR

WORDS IAN HENDERSON
PORTRAIT PHOTOGRAPHY JONATHAN WHERRETT

Inspired by nature and creating architecture in the landscape is the essence of TERROIR, an architectural practice that has created its own pathway to success. From its earliest projects, steel has been harnessed and favoured as a material to showcase its abstracted, angular designs.

ABOVE At Penguin Parade Visitor Centre, the forms are dramatic but merge nevertheless into the surrounding landscape. Photo: Peter Bennetts.

OPPOSITE Scott Balmforth (left) and Gerard Reinmuth (right). Photo: Jonathan Wherrett.

As an architectural practice, TERROIR leaves its mark by creating buildings that pay tribute to the beauty of nature through the man-made. More than 24 years since the studio was established by Scott Balmforth, Gerard Reinmuth and Richard Blythe, it has evolved to become a leader in architecture and design, both in Australia and on the world stage.

The story of TERROIR is of three friends who grew up in Tasmania. Balmforth and Reinmuth met on the cricket pitch at a young age and then commenced architecture studies in the same year at the University of Tasmania. Blythe, on the other hand, was a few years older, and was their tutor for the first three years.

Each man had their own pathway in architecture that then intersected. Balmforth worked the last two years of his Master's degree in architecture at a practice in Hobart, Reinmuth moved to New South Wales for employment and Blythe went on to become the deputy head of the University of Tasmania's School of Architecture. Soon after, Reinmuth moved to Scotland and, with Blythe becoming more involved with academic life, Balmforth was the man on the ground in Tasmania.

And so TERROIR was born on 1st March, 1999. At the time (and still today), the practice model was very progressive, with principals in different countries or cities. It has served TERROIR well and has become a popular template for other architecture and design studios to adopt.

The name TERROIR comes from French and means, 'the complete natural environment in which a particular wine is produced, including factors such as the soil, topography and climate' (Oxford Languages). After European travels, this was a word that held meaning for Balmforth and encapsulated the ideas that each architect held about the Tasmanian landscape – albeit with architecture, not wine, central to the meaning.

TERROIR was up and running, creating projects and winning awards. Change was in the air and in 2013 Blythe moved away from the practice, following his own academic career. Balmforth and Reinmuth continued to create with the practice as they had begun, designing outstanding projects with exemplary outcomes.

The continuum between projects and the style of TERROIR is the connection to place. Tasmania and its lush natural environment is innate to both men and it shows in their designs. That's not to say that the studio's projects are reticent in any way. Each is a singular design statement, with long lines and geometric angles, substantial buildings that rise above the ground as a celebration of outstanding architecture – whether a residence, a public building or a commercial commission.

“The strength, resilience and thinness that we can get from steel is really important – it just lends itself to malleability...”

SCOTT BALMFORTH TERROIR

Materiality is important for the practice and the use of steel is integral to creation. From one of the first projects the studio undertook in 2003, steel has been the material of choice. That project was Peppermint Bay, a hospitality venue some 40 minutes south of Hobart, and it prominently featured roofing and wall cladding made from COLORBOND® steel.

As a three-dimensional building, the steel lent gravitas to the Peppermint Bay concept and helped translate the design intention to reality. Balmforth explains: “It was a project we look back on because it signalled that we were interested in ideas about landscape and about architecture in the landscape,” he says. “We used COLORBOND® steel and it was a fantastic material for the job. We were able to translate the early cardboard models (of the building) into a built form with a singular material whether it was on the roof or walls. It was a lean material and had to be cost-effective.”

Since then, steel has become a much-loved material employed in a variety of projects. As Balmforth says, “Steel became a logical choice, whether it was a house or a commercial building.” Not only is steel favoured for its strength and durability but the range of colours available, especially the greys and greens, is ideal for most projects and complements the landscape.

While TERROIR’s commissions vary between educational projects, visitor centres, museums, community centres, single homes, multi-residential and social housing projects, one of its latest commissions is the Mallanganee Lookout, a 10-metre-diameter structure sited in northern New South Wales.

Positioned on the precise latitude where the centre of the Milky Way galaxy crosses directly overhead every day, the project will be technologically advanced and built with steel, deemed the most suitable material for the concept and the site’s landscape. Balmforth explains: “The strength, resilience and thinness that we can get from steel is really important, and it just lends itself to malleability to really enhance and interpret the project.”

With a multitude of commissions under its belt, TERROIR is now helping to lead the next generation of architecture practices by example. In the early days, Reinmuth and Balmforth were inspired by the likes of icons such as Glenn Murcutt, supported by their peers and, importantly, each other. With the duo having completed an invited Master’s program at RMIT in 2008 under the tutelage of Professor Leon van Schaik, there was the opportunity to investigate and refine their particular design voice, as well as create lasting connections to other practices. Now as an established and revered architectural force, TERROIR’s work is proof-perfect that a studio emanating from the smallest state in Australia can make a lasting imprint on the face of the design industry.

TERROIR has studios in Hobart, Tasmania where Balmforth is situated, in Sydney, New South Wales and also Copenhagen, Denmark, where Reinmuth lives. The two architects and great friends have a deep personal connection and catch up face-to-face wherever and whenever possible. They continue to talk daily and their partnership is a key driver to the practice.

While each architect oversees particular projects, it is the practice team members, working with their principals, who help conceive and realise the projects. Balmforth explains: “It’s great to sit back and look at people in the practice who’ve been with us for so long and have skills that set them apart from others. We have great pride in watching them grow.

“I think there’s a maturing and a payback for 20 years of hard work to then really flourish and look forward to the next 10 years with great excitement. We think that we haven’t completed our best building yet and we’re constantly eager to prove what we have learnt.”

It’s not only the people who grow in an architecture practice – so too does the voice of a studio such as TERROIR. Creating buildings that articulate a place and a space, that meet and exceed a brief, is what TERROIR does best.

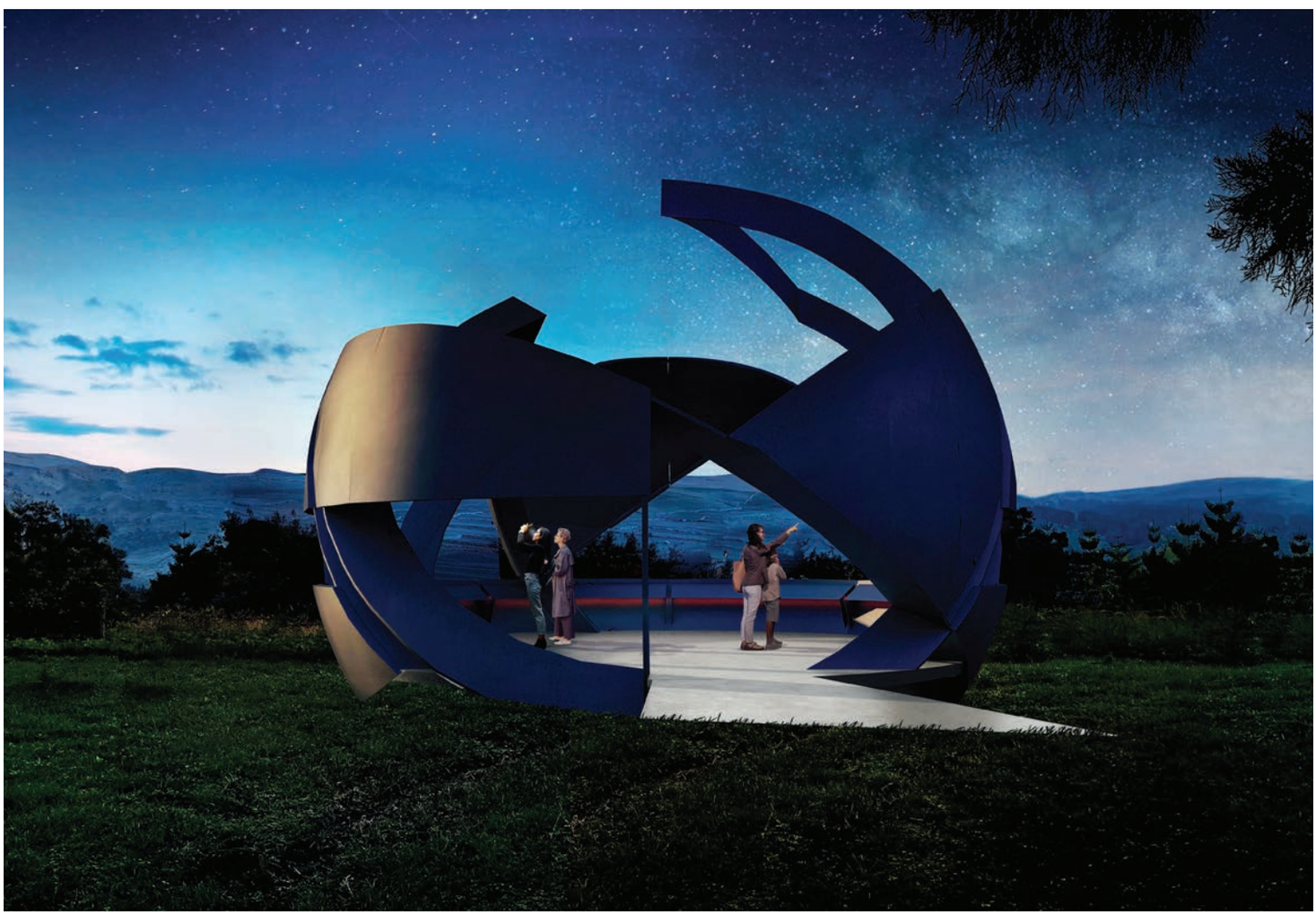
As Balmforth reflects, “I suppose there’s something about the Tasmanian landscape that we grew up in. Often, we’ll talk about the lines, and that means the shapes of the mountain, or the way you move through the landscape with those constructed paths that take straight elements and move them through a dramatic landscape. It is influential and tends to come through in our work.”

In the case of TERROIR, it is nature and the human-made working together in harmony. Balmforth and Reinmuth, and their team, have found just the right balance to create profound architecture with buildings that stand the test of time and create a connection to people and place.

OPPOSITE, TOP The climactic room at Peppermint Bay, whose height is derived from an adjacent tree. Photo: Shannon McGrath.

OPPOSITE, BOTTOM Mallanganee Lookout in northern NSW provides an elevated view over an extraordinary sub-tropical landscape that has World Heritage status. Image: Courtesy of TERROIR.

Scan to discover more about TERROIR



PROJECT RIDGEWOOD HOUSE **LOCATION** RIDGEWOOD, QUEENSLAND

The Finest Possible Edge

ARCHITECT ROBINSON ARCHITECTS
WORDS ROB GILLAM
PHOTOGRAPHY NIC GRANLEESE

With its light, flysheet-like roof that seemingly wants to float away, this house for the subtropics harnesses and celebrates a deep connection to place with its elegant archetypal forms. Wall cladding made from COLORBOND® steel in the colour Night Sky® and galvanised steel roofing make up key parts of its overall daring, yet sparing, forms.

"I wanted finer buildings – as fine as I could make them, with edges you could sharpen pencils on."

JOLYON ROBINSON ROBINSON ARCHITECTS

ABOVE Materials range from light to heavy in a varied composition.

OPPOSITE The rear features a terraced outdoor area with decking and generous eaves.

OPENER The scale of roof and eaves made from galvanised steel in LYSAGHT SPANDEK® echo the work of Geoffrey Bawa.

The architectural journey culminating in Ridgewood House stretches back to Jolyon Robinson's childhood. His father, Ken, also an architect, embraced the aesthetic and practicality of rural steel sheds, particularly their roofing structure. It's a typology he first discovered on an old Sunshine Coast railway building.

"There were several donga-style railway buildings around the Yandina Station at that time – long since gone – which had gabled steel roofs independently flying over the top, providing shade and ventilation to the main building roof below," says Robinson.

The experiences and memories of this kind of design seem to have rubbed off on Robinson senior and, ultimately, Robinson junior. The latter describes how "my father did a similar thing on a bigger scale with our family home at Doonan; building a plywood roof with bituminous membrane and then a big, gabled steel fly roof over the top of it. The approach was very successful."

The Doonan house is still standing and it even has a recent serendipitous renovation by the practice, setting it up to provide comfortable, robust shelter for many more years. "Ken even came out of retirement and gave us a few pointers," Robinson laughs.

A more seminal influence came from a trip to Sri Lanka where Robinson experienced first-hand the final work of the late architect, Geoffrey Bawa. With its lightweight steel roof supported by sparsely rowed steel columns amidst a virtual absence of walls, Bawa's Pradeep Jayewardene House is a portrait of extreme minimalism.

The roof and eaves of Ridgewood House are made from galvanised steel in LYSAGHT SPANDEK® profile and echoes of Bawa's work are clearly evident. The roof hovers on a layer of steel-framed clerestory glazing, while a steel frame further propels it beyond the house where it juts out over an external deck. It creates an illusion of gravity-defying outdoor shelter bearing more than a passing resemblance to Jayewardene House.

Robinson reflects on a return to the purity and uniqueness of that building: "Bawa had done a lot of resort-style work with the terracotta roofs you see in traditional Sri Lankan buildings. Jayewardene House was a radical departure. It's a steel building that appears as little more than a giant roof with columns and struts taking on this enormous low-lying skillion shelter that people sit underneath during the day, making the most of its shade and the coastal breezes, yet protected from the rain.

“I went on an expedition to find it and was lucky enough to talk my way into spending four days and nights there with family and good friends. It was, and still is, the most pared-back building that I had ever seen.

“I learned a hell of a lot from that building. It was the genesis for a change in my architecture. When I came back, I started using more steel and in a similar fashion, with bigger eaves and longer cantilevers on struts. I wanted finer buildings – as fine as I could make them, with edges you could sharpen pencils on.”

Robinson’s return to Australia also coincided with the Global Financial Crisis, further prompting a directional shift. He had been working on large-scale projects – as he puts it, “big, bloated houses for money guys in Hong Kong and so on.” With those jobs grinding to a halt, he instead sought clients with more modest, yet aspirational, goals.

“The people who were gutsy enough to build at that time had the opportunity to reassess what they really needed from a house – and the answer wasn’t the fourth or fifth bedroom, or media room. So, I went out with a leaner, more streamlined approach. Working more from a grid to achieve less wasted space and ‘pushing’ steel to achieve results sparingly.”

In terms of layout and program, Ridgewood House is long and linear in plan, with two linked parallel wings intersected by the entryway. Robinson explains: “There is an axis in the centre that separates the two wings. As is the case with a lot of our buildings, as soon as you open the front door you are looking outside again – straight across it from one side to the other, rather than a room or a wall.”

A rear wing features a small, screened, south-facing deck which separates a second lounge from the main bathroom and guestroom. The other (main) wing comprises two identical master bedrooms with ensuites as well as kitchen and living/dining areas.

The smaller rear wing features exterior wall cladding made from COLORBOND® steel in LYSAGHT CUSTOM ORB® profile. Finished in the colour Night Sky®, its dark form blends subtly into the landscaping and native bushland.

The owners initially had a basic steel shed on site which the architects later renovated by optimising internal spaces for the clients. The work involved removing all cladding and then replacing it with galvanised steel in LYSAGHT CUSTOM ORB® profile and roofing made from galvanised steel in LYSAGHT SPANDEK® profile.

“We stripped off the old steel and the new galvanised steel is a lovely material that harks back to old country buildings,” Robinson says. Elsewhere, the architects added a fine new awning to the shed in the same roofing material; while detached, it nevertheless allows for further additions to the rainwater catchment.

Ridgewood House also provided an opportunity to repeat the shed’s 10-degree roof pitch at the main house, visually harmonising it with the closest wing of the house to the east. Meanwhile, the shed wall cladding in LYSAGHT CUSTOM ORB® profile runs vertically “for a soft appearance”, as it does in the COLORBOND® steel Night Sky® at the house’s southern wall. Another splash of Night Sky® appears at the awning outside the main door entry.

Creating an entrance sequence, the comparatively ‘closed-off’ shed and rear wing to the south deliberately contrast with the openness of the northern face, where the architectural party really gets going. Here, the main design device contributing to building’s signature floating effect is found in the form of a slender structural steel portal frame that cantilevers the roof out past the main building line (technical elaboration of which is explored in Steel Details, page 50-51).

LEFT Open space abruptly meets a heavy wall as the eye is directed up and out towards the thin roof line.

OPPOSITE The façade features no shortage of detail or nuance with its glazing and shading options.

"The support for the roof at that point has been taken outside the house line with a freestanding portal frame that is independent of the main house," explains Robinson.

This roof extension-cum-awning creates a heroic outdoor shelter and interior protection for the house underneath – much like the Jayewardene House – and is a space highly prized by the clients. Indeed, they often describe sitting on the deck enjoying the sunshine or listening to rain on the roof as their favourite part.

Ridgewood House is set within 20 acres of lush and tranquil rainforest near Eumundi in the Noosa hinterland. With the property purchased by a couple seeking more sustainable living, the architects were highly cognisant of the need for design principles that championed self-sufficiency. These principles are realised through solar, rainwater and wastewater facilities at the house.

Meanwhile, the efficiency of steel as a building material achieves some similarly waste-reducing results. Savings made through prefabrication, transportability and erection speed bring costs and material waste down, as Robinson shares: "One of the things I really love about steel is that time spent in preparation is saved in assembly. With a 400-metre driveway dropping steeply, twisting and turning through the rainforest before rising again to the elevated house site, access was always going to be challenging. It was clear from the outset that getting trucks and materials to the building platform was going to be not only a consideration in material selection but an ongoing issue during construction.

"Sustainability principles were applied to the architectural language of the project but there were also matters of material practicality. The steel frame was fabricated in a factory before being assembled on-site. The members were deliberately kept as lightweight as possible to reduce the spans and weight – evident in the fine struts that hold the large roof canopy up over the main living deck. This enabled smaller trucks to navigate the track," Robinson continues.

"Steel roof sheeting and wall cladding was used for a variety of reasons. It could lie flat in transport and is relatively lightweight, as opposed to, say, concrete blocks. The building was built during the COVID period when labour was scarce and expensive, but steel greatly reduced the amount of carpentry required and helped to preserve labour budget."

On reflection, then, what does Robinson love most about Ridgewood House? "Firstly, of course, that our clients love living there. It was a wonderful collaboration between them, Monique and me," he answers. "In terms of the house itself, it's got to be the fineness of the oversized steel roof eaves, lightweight supports and cantilevers. When you see it from a distance in the landscape, it looks like it sits in the box seat of a natural amphitheatre, ready to soar off into the sky at any time."

With its heavenly roof, Ridgewood House is a resplendent marker in the practice's quest to find the "finest possible edge". Continuing such refinement, the architect's proverbial pencil might be sharpened yet.

PRINCIPAL STEEL COMPONENTS

1 House wall cladding made from COLORBOND® steel in LYSAGHT CUSTOM ORB® profile, in the colour Night Sky®.

2 House roofing made from galvanised steel in LYSAGHT SPANDEK® profile.

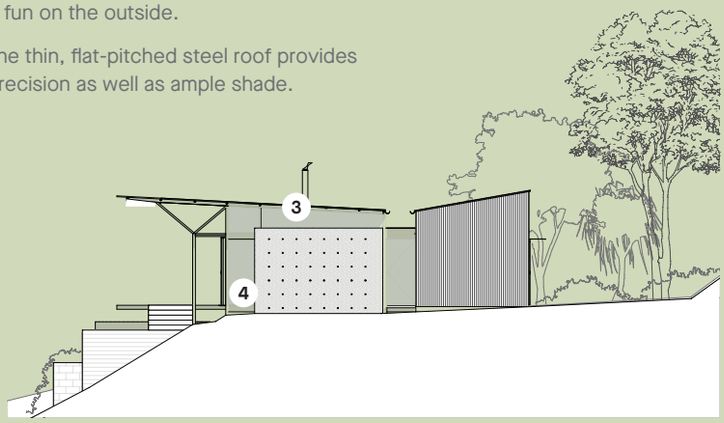
3 Shed roofing made from galvanisedsteel in LYSAGHT SPANDEK® profile.

4 Shed wall cladding made from galvanised steel in LYSAGHT CUSTOM ORB® profile.

5 House gutter made from COLORBOND® steel in Stratco Smoothline Slottedprofile, in the colour Night Sky®. House box gutter made from stainless steel. Bathroom and ensuite pop-outs made from folded steel plate. Box windows and fireplace stand made from steelplate. Metal entryway awning. Structural steelincluding custom-welded plate, CHS, RHS, UB,tapered UB

BELOW The site is distinctive for having a steep drop-off on one side, allowing for some architectural fun on the outside.

OPPOSITE The thin, flat-pitched steel roof provides a sense of precision as well as ample shade.



STEEL DETAILS | A TECHNICAL DIVE INTO RIDGEWOOD HOUSE

Like the thin, flat-pitched steel roof of Geoffrey Bawa's Jayewardene House which inspired it, Robinson Architects' Ridgewood House – with roofing made from galvanised steel in LYSAGHT SPANDEK® profile – provides generous shelter to large swathes of open and transparent space below it.

With minimal support visible, the roof perches lightly above the structure below. Architect Jolyon Robinson explains that if the roof appears disconnected from the house's main structure, it's because it mostly is. "There is off-form concrete at the base but the steel framing for the roof doesn't even touch it – it soars right over the top of it," Robinson says.

Similarly, the eave that cantilevers out from the main roof to cover the outdoor deck is supported by a freestanding portal frame independent of the house. "There's an additional portal frame on the side with the struts going up to do the heavy lifting once the roof has gone out past the house. Between the struts are the fine roof purlins on which the roof sheeting sits, and then the roof flashing extending at its edges."

The architect favours steel for its hardworking capabilities: "Every bit of steel in the building is being pushed as hard and far as possible without needing more support – particularly in the roof. Each connected part has a job to extend the roof away from the building so it soars out to its limits, becoming finer and finer until it reaches a knife-edge."

The structural steel portal frame begins with CHS columns rising from the ground and a combination of RHS and diagonal CHS as roof strut members, the main roof beams being UBs and PFC sections before the steel roof sheeting.

Robinson says the basic structural components themselves aren't overly complicated, but combining them in practice to meet his ambitious design goals presented engineering, fabrication and building challenges that required close teamwork to overcome.

As structural design engineer, Ben Hopkins of SCG Consulting Engineers, puts it: "When I first saw Robinson's design vision, I knew there would be some structural gymnastics required for the roof."

Hopkins explains further: "Jolyon liked the idea of 60-millimetre CHS as architectural purlin. To keep the overall visual lightness and a consistent rhythm to the exposed structural steel, we had to repeat the same sizes – even in order to achieve the largest spans.

"There actually are sections of the roof where there is a larger-than-typical purlin span. We had to come up with a way of giving the visual illusion that the standard purlin span was spanning the grid distance. That was done by installing a separate cantilevered 'T-beam', with tapered end, above the roof sheeting, from which the exposed CHS purlins are suspended. This cantilevered beam takes the bulk of the load back through to the main internal roof frame, where more substantial support could be architecturally accommodated."

The roof struts are designed to provide vertical support for the roof beams, which in turn support the main roof purlins.

PROJECT INFORMATION

Architect
Robinson Architects

Project Team
Architects Jolyon Robinson, Monique Watt

Building Size
224m² GFA (plus decks)

Project Timeframe
Six months (design and documentation), 13 months (build)

Project Cost
$1.5 million

Builder and Cladding Contractor
AMBuild Construction

Steel Fabricator and Shop Drawing Contractor
Phoenix Steel

Structural and Civil Engineer
SCG Engineers

Awards
Australian Institute of Architects Awards 2022 Sunshine Coast Regional Architecture Awards – Commendation and Gabriel Pool Building of the Year, Australian Institute of Architects Awards 2022 Queensland Architecture Award Winner – COLORBOND® Award for Steel Architecture

However, Hopkins adds, "Whilst the main struts take the vertical roof load path back down into the portal frame posts, mirrored counter-struts were installed in key locations to transfer the horizontal forces back up into the roof beams. So, the vertical load paths in fact run through the structure horizontally and in upwards vertical directions too."

Hopkins points to other areas of the build where custom steelwork provided visual detailing, including a horizontal RHS steel wall beam line that seats the whole house to one reference level for the clerestory windows. Fine steel junctions were detailed for where the support posts and struts meet the roof frame, while custom steel pelmets were made to both reinforce the larger RHS wall beam spans and hide the tracks for the folding doors to the deck. Site welding was also used to reduce the bulk of traditional bolted steel connections around the glazing frames.

Builder, Andy Martin of AMBuild Construction, collaborated on a solution to extend the house's roof via customised flashing. "Usually a flashing just gets riveted onto a roof and hooked back up, but in this case we wanted a really fine edge which wraps back underneath.

"We hung the flashing out 200 millimetres further than the roof's raw edge and ran our rib screws through into the outriggers. You can't see the ends of the roof sheets or the fixings holding them in place because they return back to the first purlin line."

Universal praise was sung of the project's steel fabricator, Dylan Gilbertson of Phoenix Steel. In a process responsive to on-site conditions rather than theoretical modelling alone, shop drawings for every steel member were created by hand.

Quizzed on his methodology and specialised skills, Gilbertson responds humbly: "It's pretty much just trigonometry and being able to model in my brain. I don't like doing things twice, so I'm quite fastidious. I spend a lot of time on-site measuring and re-measuring. If something doesn't add up, then I'll return to site until it does."

Scan to discover more about the project.

STEEL PROFILE

BlueScope

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