

**Submission to Infrastructure Victoria on opportunities to reduce greenhouse gas emissions of Victorian Government infrastructure**

12 May 2023

Dear Alison,

This submission has been prepared by the [Australian Steel Institute](#) (ASI), the peak body representing the Australian steel industry, in conjunction with BlueScope Steel and InfraBuild Steel.

ASI welcomes any further consultation on opportunities to reduce greenhouse gas emissions of Victorian government infrastructure using steel.

Regards,

[Redacted signature block]

**SUBMISSION FORM**

Evidence-based opportunities to reduce greenhouse gas emissions of Victorian government infrastructure – please include references for your evidence.

What are the key opportunities for the Victorian government to identify, prioritise, quantify, incentivise, and track reductions in infrastructure emissions at early strategic planning and investment decision making stages?

- **Early engagement with the steel supply chain** for the design of projects that enables the full supply chain to provide innovative sustainability solutions such as design optimisation and de-materialisation, best practice use of innovative materials [lower embodied carbon] and off-site [factory controlled] prefabrication, as well as the Design for Manufacture and Assembly [DfMA] for prefabricated elements.  
Refer to *Case Study: Construction of the Murra Warra wind farm* (attached). Early engagement enabled the steel contractor to design and construct an anchor cage solution for the wind turbines using metal reusable rings (rather than traditional rubberised foam ingots) – a more cost effective and low carbon solution compared to using overseas imports. Refer to attached headed ‘Robust anchor cage solution’, ‘Competing on value and innovation, not cost’ and ‘Project Highlights’.
- **Use consistent methods and data to measure embodied carbon.** Appropriate data verification is important when calculating and tracking emissions and embodied carbon. Environment Product Declarations (EPDs) should be used to assess and compare carbon for products using the same Product Category Rules. The best way to compare products

and materiality of differences is to place them into the context of a structure across the whole life cycle.

We support the use of product-specific EPDs as an appropriate measure for tracking and quantifying emissions. It is essential however, that any EPDs which are referenced, are specific to the steel product range being specified e.g., 'structural steel universal sections' would be acceptable but 'structural steel' would be too general.

- Specify materials that are verified by an accredited 3<sup>rd</sup> party conformity assessment body to ensure that they comply with the relevant Australian Standards, therefore significantly reducing the likelihood of rework or remediation.

How can the Victorian Government improve or amend existing policies, guidelines, regulatory tools, standards, and frameworks for infrastructure investment and procurement assessment to reduce emissions?

Please provide detailed actions for these improvements if possible.

- **Reward and incentivise the hierarchy of circular economy principles in design** (reuse – remanufacture – recycle) – by re-using materials and refurbishing assets rather than remanufacturing/recycling or building new achieves the most significant reductions in embodied carbon. For this reason, a whole life cycle analysis view (rather than just Modules A1-A5 focus) should be considered when designing assets and making decisions. Making decisions based purely on A1-A5 lifecycle stages and not considering end of life impacts (Module D) shifts the carbon burden to future generations.

Steel enables the transition to a circular economy through its reusability, recycled content, recyclability, recoverability at end of life, and material efficiency in production. The following qualities of steel further support the decarbonisation of infrastructure;

- Potential to refurb, reuse or recycle construction materials at a building's end-of-life (LCA - module D)
- High recycling rates (+90%)
- High strength, durability for long structure life cycles: refer to [weathering steel](#) (BlueScope product)
- High grade / strength products to reduce mass /dematerialisation
- High design flexibility: significant load spans, light gauge steel solutions
- Prefabrication and modularisation - pre-engineered structures to minimise transportation footprint
- Design for disassembly – reduce upfront carbon and cost

#### **Research evidence**

According to a [report](#) prepared for the Clean Energy Finance Corporation in collaboration with the Green Building Council of Australia and the Infrastructure Sustainability Council “majority of the initiatives for reducing embodied carbon emissions in infrastructure projects are based on dematerialisation” (page 33). Data from the Infrastructure Sustainability As-Built rating tool (by ISC) was analysed to understand the scale of embodied carbon reductions and strategies used to achieve them.

According to a research paper [Design for Deconstruction](#), designing buildings and infrastructure with materials suitable for re-use or disassembly can minimise embodied carbon and energy levels for the lifecycle of the asset by increasing the number of times a construction material can be re-used without serious depreciation, loss of strength, rigidity and other factors associated with wear and tear. A re-used material usually has

virtually no embodied energy costs associated with reprocessing (Morgan et. al., 2005, pg., 12).

**For real-life examples of how these qualities relate to quantifiable sustainable outcomes refer to the case studies below:**

*Case Study: [ACT Covid-19 Surge Centre Delivered In Record Time With Pre-Fab Steel \(attached\)](#)*

A 17,000m<sup>2</sup> medical facility was erected in 36 days using prefabricated wall frames and roof trusses. Approximately 90% of the materials used in the construction of the building can be reclaimed and nearly all the building can be flat packed and re-established in a different location, either locally or internationally. Manteena are currently in discussions with the ACT Government as to where they will relocate and reuse the building. There was also minimal waste as a result of the build.

*Case Study: [Berry to Bomaderry Princes Highway Upgrade](#) (refer to page 7 'Key Benefits Delivered')*

The use of REDCOR® weathering steel for two long-span bridges provided a multitude of advantages to the Transport for NSW South Coast Princes Highway Upgrade, and key stakeholders praised the many benefits of this solution.

Two composite bridges constructed using trough girders fabricated from BlueScope's REDCOR® weathering steel. REDCOR® weathering steel has excellent circular economy potential as its inherent properties allow it to be reused, remanufactured or recycled enabling its transformation into new products. Additionally, REDCOR® weathering steel used for bridges is prefabricated meaning minimal onsite waste.

*Case Study: [Reuse and Recycling on the London 2012 Olympic Park](#)*

34 buildings containing steel; 26 steel portal frame buildings and 8 buildings containing elements of structural steel were reclaimed for reuse. In one building approximately 190 tonnes of steel with an embodied CO<sub>2</sub> of 345 tonnes was reclaimed resulting in an embodied CO<sub>2</sub> saving of 84 tonnes compared with recycling, with further reductions once used for another purpose. The embodied carbon reductions exponentially increase each time the steel is reused.

- **Specify sustainability requirements for steel using industry-led specifications.** The Australian Steel Institute (ASI)'s sustainability specifications for steel can be accessed online: <https://www.steelsustainability.com.au/resources/specification/>. The specification is also freely downloadable in [pdf](#) and [word](#) format.
- **Procure steel from SSA Certified Steel Suppliers.** The [Steel Sustainability Australia \(SSA\) Certification program](#) accredits steel suppliers against a best practice ESG sustainability standard. It is an open access program that assesses steelwork suppliers and their sourcing, manufacturing, fabrication and/or processing of finished steel products. The SSA certification program is a recognised initiative under Green Building Council of Australia's (GBCA) Responsible Product Framework and Green Star rating tools and assures certified steel suppliers and their products are more sustainably manufactured and processed and are sourced through responsible and ethical supply chains and. It mandates sourcing steel from steel producers that have been verified to be actively decarbonising steel making operations.

- Don't simply specify high recycled content in steel.** Australian Steel manufacturers are increasing the use of scrap to an aggregated 2.5 million tonnes over the next 5 years, however there are technical and sourcing limitations on how much recycled content can be used. Recycled steel scrap is used in both steel making routes; Blast Furnace – Basic Oxygen (BF-BOS) and Electric Arc Furnace (EAF) however there are currently technical limitations to the proportion of recycled scrap steel that can be utilised in the (BF-BOS) steelmaking process by which all Australian flat steel products, and some long products are currently produced. This technical limitation arises from the fundamental process heat balance whereby heat generated from exothermic chemical reactions is used to melt scrap. EAF steelmaking can utilise 100% recycled content however there is not enough scrap available worldwide to be able to meet the demand of steelmaking via this route. One possible scenario of specifying high recycled content in all steel projects is that steel would need to be imported and the displaced locally produced steel exported. The net outcome would be an overall increase in emissions because of the additional two-way steel 'transport miles' impact, which would be a perverse outcome. It should be noted that the entire steel industry in Australia is actively engaged in the evaluation of a wide range of emission reduction initiatives with impact over the short, medium, and long term, including the ability to increase the amount of scrap being used in primary steel making or replacing coke as the reductant in the primary process with lower carbon alternatives.
- Exercise caution when setting emissions reductions targets as they relate to steel**  
The decarbonisation of the steel industry is a shared, global challenge and must be addressed at the systems level. Setting emissions reduction targets for steel on projects is unlikely to contribute to the decarbonisation of the sector and may cause perverse outcomes in the steel value chain. New methodologies, tools and guidance are being developed by organisations to enable steel companies to set targets that align with science-based decarbonisation pathways and consider the unique context of the sector. As such, rather than specifying a GHG reduction target for steel products, adoption of steel certification schemes is recommended.  
Refer to the ASI Sustainability specification for full details:  
<https://www.steelsustainability.com.au/resources/specification/>.
- Support existing sustainability certifications, such as those that are already recognised by the leading sustainability Australian based ratings tools, including GBCA Green Star and IS Council IS Tool.

How can the Victorian Government incentivise or encourage private industry to increase the production and adoption of low-carbon materials and/or delivery methods through infrastructure procurement?

- Support procurement of local Australian steel which helps to support our economy** through the economic multiplier that flows from local jobs, which in turn encourages local businesses to increase their investment in product and process innovation for sustainability. The steel industry is committed to reducing the embodied carbon and GHG emissions associated with their products. [InfraBuild Steel](#) and [Liberty Primary Steel](#) have set a net-zero by 2030 target. [BlueScope](#) has set a goal of net-zero GHG emissions across its operations by 2050, with a mid-term target of reducing scope 1 and 2 GHG emissions intensity by 12 % by 2030. Australian Manufacturers welcome any questions or discussion on their decarbonisation strategies.

- **Specify steel specific sustainability certification schemes developed by the global steel industry, and recognised by leading authorities on sustainable built environment such as the [Green Building Council of Australia \(GBCA\)](https://www.steelsustainability.com.au/resources/specification/)**  
<https://www.steelsustainability.com.au/resources/specification/>.

What enablers or barriers need to be addressed? What are the impacts on reducing emissions, increasing productivity, and decreasing costs?  
Please provide evidence or case studies that highlight the impacts of infrastructure decarbonisation on costs and benefits for stakeholders across the supply chain.

Enablers:

- **Early engagement with the steel supply chain** for the design of projects such that innovative solutions are enabled, as well as the possibility of alternative design approaches being able to be proposed to achieve goals such as de-materialisation.
- **Facilitating outcomes such as more infrastructure is designed for disassembly**
- **Increase procurement of local Australian steel which helps to support our economy** through the economic multiplier that flows from local jobs, which in turn encourages local businesses to increase their investment in product and process innovation for sustainability.

Barriers:

- **Lack of opportunity to propose innovative solutions** due to not being involved at the design and concept stage of a project.
- **De-specification during project procurement/execution.** De-specification is the term given to the practice of a given design being changed after project commencement, typically at the instigation of the project manager, and often in order to reduce costs relative to their tender pricing. De-specification typically increases the risk of fabricated steelwork being non-compliant with Australian Standards and therefore potentially not meeting the required quality. In the context of sustainability, it also runs the risk of undermining the intended ESG benefits that have been embedded in the design parameters if these are changed without the knowledge of the design engineer.
- **Unintended consequences due to lack of early engagement with industry experts.** When the steel industry is treated purely as a supplier of a commodity input rather than a value-adding partner, there is very little or no opportunity to make a positive contribution to the project. Positive contributions could range from suggesting alternative steel types that lower carbon embodied solutions, through to overall supply chain collaboration that may allow the reduction of cost via improved efficiencies in fabrication, logistics, and installation.
- **Regulatory inertia** Product and design innovation is hampered by the extended timeframes required to deliver updates and revisions to Australian Standards. Ongoing innovation in the design process and the individual steel building products is essential to unlock more sustainable construction solutions.

Is there anything specific to the timing or sequencing of recommendations that Infrastructure Victoria should consider in our advice? Please consider how best to maximise long-term outcomes and minimise transitional costs for the government, the industry and the community in your response.

Nil

# ACT COVID-19 SURGE CENTRE DELIVERED IN RECORD TIME WITH PRE-FAB STEEL

IN THE GRIP OF THE GLOBAL COVID-19 PANDEMIC, CONSTRUCTION COMPANY MANTEENA AND PRE-FABRICATION SPECIALISTS AUSTRUSS DELIVERED A WORLD CLASS COVID-19 SURGE CENTRE IN JUST 36 DAYS. MANTEENA WAS ENGAGED BY ASPEN MEDICAL UNDER A DESIGN AND CONSTRUCT CONTRACT TO DELIVER A 17,000m<sup>2</sup> 51-BED MEDICAL FACILITY FOR THE ACT AND SURROUNDING REGION. WORKING DAY AND NIGHT SHIFTS, THE TEAM HAD UPWARDS OF 130 CONTRACTORS ON-SITE AND COMPLETED 22,000 MAN HOURS. THE FACILITY WAS BUILT USING PRE-FABRICATED WALL FRAMES AND ROOF TRUSSES MADE FROM TRUECORE® STEEL, MANUFACTURED OFF-SITE BY AUSTRUSS. THE HIGHLY COLLABORATIVE RELATIONSHIP BETWEEN MANTEENA, AUSTRUSS AND ASPEN MEDICAL WAS ESSENTIAL TO ON-TIME DELIVERY OF THE PROJECT, AS WAS THE PRE-FABRICATED, HIGHLY FLEXIBLE LIGHT GAUGE STEEL DESIGN.

On 9 April 2020, construction company Manteena commenced the delivery of a COVID-19 Surge Centre on Garran Oval, adjacent to Canberra Hospital.

The project team achieved practical completion after an initial design phase of seven days and a construction period of just 36 days—not only achieving the goal of a very, very tight program but delivering a facility built to Australian Standards, as well as the World Health Organisation (WHO) Sudden Acute Respiratory Infection Treatment Centre manual.

According to Damien Crough (Executive Chairman, prefabAUS), "This COVID specific project was delivered in an unprecedented timescale with the use of prefabricated frames and trusses, wall and ceiling systems, and bathroom pods."

"Australia's prefab industry is merging to mainstream, with significant projects such as the COVID-19 Surge Centre in Canberra taking full advantage of the benefits it has to offer. The focus on design for disassembly and re-use is an inherent sustainability benefit for prefabricated construction."

"Prefabrication has a crucial role to play in transforming Australia's built environment through decreasing construction time frames and construction waste, while increasing quality, productivity and affordability."

Rod Mitton (Design Manager, Manteena) described how the project initially commenced. "I received a phone call from Manteena CEO Simon Butt on 1 April 2020 asking if I thought we could undertake design and construction of a new medical facility within the next 40 days. Without looking at the date—which just so happened to be April Fool's

Day—my answer was, 'Yes, of course we can'."

The brief provided by the client, Aspen Medical, called for the construction of a 17,000m<sup>2</sup> medical facility, consisting of 51 patient beds, including patient services panels, treatment areas, administration and nurse stations and staffing facilities. The structure was to be built to cyclone standards to account for the helicopter landing deck near the hospital.

"Simon also explained that the design was only at concept stage at that point. There were no working plans to start the process. The location of the building was not even confirmed," said Mitton.

"We knew that in order to get the project off the ground quickly, we'd have to develop the internal designs sufficiently so as to declare a footprint and begin manufacture of the facility structure and construction foundations immediately. We'd also need to determine construction methodology

for the project. There was no tolerance for long lead times, which meant that all technology and equipment would have to be 'off the shelf', or quickly or locally assembled."

"Having undertaken a number of projects with Austruss in the past, I phoned Andrew Fowler [Founder and Managing Director of Austruss] to sound him out on the project. Before the end of the day, Andrew and I had mapped out a plan on how we'd deliver the project using BlueScope's Truecore® steel," said Mitton.

## A FLEXIBLE DESIGN

According to Andrew Fowler (Founder and Managing Director, Austruss), a flexible design was key. "After speaking with Rod, I worked with one of my detailers on a concept based on a sketched-up drawing that Rod had given us. This allowed us to work out how we could finalise some dimensions."

"The brief required that the design be flexible, allow hospital live loads, withstand high wind loads, be reusable, and be able to be packed in a shipping container at end of use. Plus, the product needed to be designed to Australian Standards and on-site within just eight days."

"And we did just that," said Fowler.

"We took each section of the building and broke it into certain elements. The only way we thought we could achieve the compressed delivery timeframe was to use a simple kit of parts that were interchangeable. So we designed trusses on either side of the building

and they were all standardised. The walls were all standardised. We came up with a telescopic wall frame system to give flexibility to the whole assembly process."

"The key was as many repeatable elements as possible to simplify the delivery process," said Fowler.

## SITE ESTABLISHMENT

By the time a site location was identified one week later, the project team had created a building footprint and established a flexible work-in-progress floorplan.

As such, site establishment was rapid and footings were in place, ready for delivery of the sub-floor structure, three days after taking possession of the site on Thursday 9 April 2020.

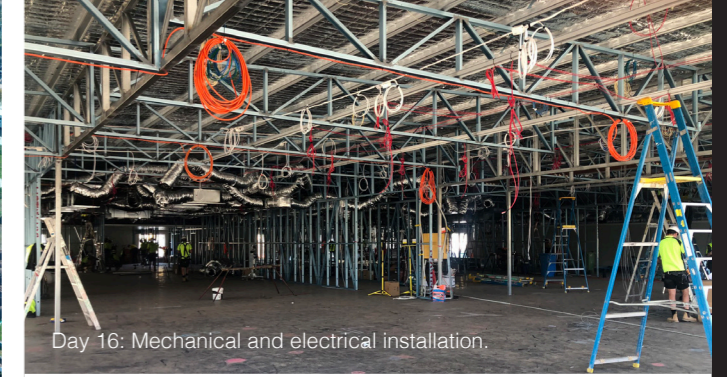
Austruss worked throughout the Easter period, delivering the first lot of wall frames to site on Easter Sunday.

"The whole delivery of this project was just in time to suit what Manteena needed and so that the site wasn't too cluttered," said Fowler.

The remaining internal design continued in parallel with manufacture of the structure. Within seven days of the initial engagement, the design team had a preliminary design for which the remaining packages of works could be constructed. In a highly flexible arrangement with the client, stakeholders, architects, engineers and suppliers such as Austruss, the design was finessed throughout the build to accommodate the client's specific needs.



Day 15: Roof sheeting installation.



Day 16: Mechanical and electrical installation.



Day 20: Wall cladding installation.



Day 1: Site establishment.



Day 10: Wall frames.



Day 3: Installation of joists.



Day 13: Chasing trades.

“ The key was as many repeatable elements as possible to simplify the delivery process.”

Andrew Fowler, Founder and Managing Director, Austruss



Day 37: Handover of the ACT's COVID-19 Surge Centre.

### LIGHT WEIGHT STEEL CONSTRUCTION

"There was a lot of detail packed into the very short period. Probably the most crucial decision that was made in the first few days of the project was selecting light weight steel construction," said Mitton.

Before contacting Manteena, Aspen Medical had already undertaken enquiries into some Design for Manufacturing and Assembly (DfMA) products. As the design was still evolving, most volumetric options did not provide the flexibility required of the design that was still being decided. More importantly, advice was that other manufacturers were unable to meet the timeframes set out by the ACT Government.

"From Manteena's perspective, Truecore's strength to weight ratio makes it a very viable option for this type of delivery. Its main attributes are that it doubles as a structural frame, as well as providing a substrate to directly affix cladding. It also provides flexibility for wall set out, and running services that heavy gauge structural steel doesn't always provide. It can be produced efficiently without shop drawings if necessary. It's quick to manufacture and easy to erect, negating the need for large in-ground foundations and cranes," said Mitton.

### ASSEMBLY AND INSTALLATION

"For the assembly and installation process, our site team divided the floor plate into six stages. As foundations were drilled and concreted in first stage,

the flooring team followed immediately behind installing posts and sub-flooring elements. As soon as they finished, the frame erectors started on walls and trusses, and so on. This allowed each trade to completely finish a section without other trades restricting progress. Night shifts were introduced to ensure that no stages fell behind," said Mitton.

"The building was spaced appropriately to allow for changes and finessing of internal design within the first two weeks of construction. As the design set out of the rooms was still being detailed, manufacturing of the frames needed to start in advance of the design if we were going to meet the tight timeframes."

"Austruss came up with the idea of making standard modular frames to meet this purpose. When erected on site, the install team was able to measure the run of the wall and then equally spread the frames to suit. No two frames were greater than 600mm apart as this was the maximum stud spacing allowed to distribute the roof load. Even as wall frames were being delivered, changes were being made to the floor. The Truecore steel was strong enough to facilitate these changes and adapt to the different loadings on the structure," said Mitton.

Another innovation that Austruss developed was to design and construct the roof trusses to allow a full 3m gap between the trusses. This allowed significant space for plant and equipment to be installed between trusses, not underneath as would occur traditionally. This also reduced the

overall height of the building as there were no ceiling voids under the trusses.

### STEEL CLADDING

According to Mitton, another important decision was the selection of the cladding to be used in the project.

"The finishes were to be clean, comfortable and thermally efficient. We knew that traditional cladding like plasterboard and cement sheeting were not an option due to the programming constraints of fixing, setting and painting while service trades were waiting to fit out," said Mitton.

"We had to come up with a product that was thermally and acoustically sound that didn't need painting but had a resilient finish to reduce infection control. Thermal cool room panels were the obvious choice, although consideration was given to other products like white rock."

"The thermal panels are constructed by placing an expanded polystyrene sheet between two layers of Colorbond cladding. Combining the Truecore framing and the thermal panel meant that we still had a cavity to run the services in, without surface mounting any of the cabling or pipework. This was an important factor for infection control principles," said Mitton.

### SUSTAINABILITY

While not part of the original brief, the team set a goal for the project to be able to be deconstructed and reconstructed elsewhere when no longer required.

"The best estimate is that 90% of the

materials used in the construction of the building can be reclaimed and nearly all of the building can be flat packed and re-established in a different location, either locally or internationally. This meant that no component could be no longer than what could fit into a 20 foot container. That goal was set for designers and suppliers," said Mitton.

"Locally sourcing materials and labour was another crucial aspect of ensuring that we were able to meet the project objectives. We were able to gain a commitment from regional and local contractors to do so. Austruss for one fabricated over Easter when most companies would have been shut down."

"There was minimal waste as a result of the build. We had very little left over on-site and what was left was de-assembled and sent back to Austruss," said Mitton.

### THE SPEED OF TRUST

This project was a success for both Austruss and Manteena who have worked on many projects together since Austruss opened their doors 17 years ago.

Fowler said, "The only way this project could be undertaken was due to the trust we'd developed with Manteena. We've had a longstanding relationship with Manteena. It comes down to the speed of trust. If you trust people you can get a lot done incredibly quickly."

The unique circumstances of this project just further cemented their working relationship. "It just adds a new level of trust between both parties," said Fowler.

Mitton praised Fowler and the Austruss team. "I want to acknowledge the relationship between Manteena and Austruss and the collaborative nature in which Austruss worked with us. This collaboration enabled the decision making process to proceed unimpeded, with the main objective being to open the facility as quickly as possible."

"Andrew's very inventive and if you have an idea or a need, he will come up with a solution. We knew that if Andrew committed to the project, then he would deliver," said Mitton.

ASI would like to thank prefabAUS for providing access to their recent webcast on the COVID-19 Surge Centre case study, which provided much of the content for this article. For further information about prefabAUS, visit: <https://www.prefabaus.org.au>.

### KEY BENEFITS OF TRUECORE® STEEL

**Design Flexibility:** With the floor plan for the structure still being finalised while frame fabrication was underway, design flexibility was key to the success of this project. According to Fowler, "Even as wall frames were being delivered, changes were being made to the floor plan. And Truecore steel was strong enough to fulfil these changes and adapt to different loadings on the structure."

The frames made from Truecore steel allowed for design flexibility. "The product allowed for flexibility – allowing changes to be made onsite," said Mitton. "You take out a few screws, make a few changes and then all of a sudden you've got an opening where you didn't have an opening before."

**Impressive strength-to-weight ratio:** "Framing made from Truecore steel is structurally very sound, which helped to allow for large spans of ceilings," said Mitton.

**Speed and efficiency:** "The frames that Austruss made from Truecore steel were produced quickly and designed in a way that they were fast to erect onsite and facilitated the running of services (water pipes, electric cabling, and so on) very easily," said Mitton.

**Consistent quality:** "Knowing that Truecore steel is a consistent quality product gave Austruss confidence with what they committed to deliver," said Fowler.

**Reliable supply chain:** "Vital to Austruss turning around the framing so quickly was knowing that enough Truecore steel product was readily available within such a short time frame," said Fowler.



Hospital triage.



Resuscitation bays.



Main corridor.

# MURRA WARRA II USHERS IN THE WINDS OF CHANGE



Delivering pre-assembled anchor cages.



Assembling the anchor cages.

THE MURRA WARRA WIND FARM WILL PLAY A KEY ROLE IN AUSTRALIA'S RENEWABLE ENERGY FUTURE. CONSTRUCTED ON A 4,250 HECTARE SITE SOME 25KM NORTH OF HORSHAM IN VICTORIA, MURRA WARRA IS THE FIRST LARGE-SCALE WIND FARM TO BE CONSTRUCTED IN THE WIMMERA. ONCE COMPLETE, IT WILL BE HOME TO 99 TURBINES, CAPABLE OF GENERATING 435MW. ALLTHREAD INDUSTRIES DELIVERED A WIND TOWER ANCHOR CAGE SOLUTION FOR THE 38 TURBINES INSTALLED DURING STAGE TWO OF THE PROJECT.

With its low environmental impact, Murra Warra is the ideal location for a wind farm. Situated on 4,250 hectares of farmland used for sheep grazing and broadacre cropping, the footprint of the wind farm accounts for less than two per cent of the area. In addition to its minimal effects on agricultural productivity, Murra Warra was chosen for its consistently strong wind resources, close transport links, and an on-site connection to the grid network.

The Murra Warra wind farm is being developed in two stages at an estimated cost of \$650 million and is expected to operate for 25 years. The construction of the \$247 million stage one commenced in April 2018, and has been in operation since February 2020. Construction of stage two commenced in late 2020, and is expected to be fully commissioned

and operational by mid-2022.

Featuring 38 General Electric (GE) Cypress 5.5-158 wind turbines, the Murra Warra II wind farm will generate enough renewable energy to power the equivalent of 150,000 homes in Victoria and offset around 500,000 tonnes of carbon emissions every year, playing a significant role in supporting the Victorian renewable energy target of 40 per cent by 2025. The power generated from stage two will be supplied to Australian electricity generation and retailing company Snowy Hydro under a power purchase agreement.

Murra Warra II will provide immense benefits for the regional economy, creating more than 400 full-time jobs during the two-year construction period and ongoing employment opportunities

in operations, maintenance and project support services throughout its lifetime.

The completed wind farm will feature an operations and maintenance building, four permanent meteorological masts and car parking facilities.

## THE TURBINES

Murra Warra II features 38 General Electric (GE) Cypress 5.5-158 wind turbines—one of the quietest systems in its class designed to operate at low to high wind speeds. The turbine blades are aerodynamically optimised and have serrations on the edges. Each blade is 70.5m long and weighs approximately 20 tonnes. The weight of the nacelle is approximately 130 tonnes.

The turbines feature the next electrical system (NES) gearbox-based concept,

including an asynchronous generator and a fully rated converter, which permits stable grid feed-in. Each turbine has a large rotor with a 144m diameter, delivering a nominal output of 3.7MW. The hub height of each turbine is 139m and the total height to tip is 211m.

## ROBUST ANCHOR CAGE SOLUTION

Given the size, scale and weight of the turbines, a robust anchor cage solution was required; the expertise of Allthread Industries was required.

Allthread Industries supplied the anchor cages, which included large plates and 176 M48 bolts, each of which was 3.8m long and weighed 50kg.

The principal contractor for the civil works was Australian-owned Zenviron in Newcastle. According to Simon Preston (Group General Manager, Allthread Industries and Precision Oxycut), Zenviron approached Allthread Industries to quote on the anchors, which were designed by icubed (a local engineering consulting firm). "Nick Canto, the Principal Consultant from icubed designed gravity anchors

for the project. So rather than being pierced onto any bedrock, the anchor is effectively an enormous mass of concrete and steel. The sheer weight of the anchor ensures that the tower remains stable, even under the force that the wind generates," said Preston.

"To begin with, we were given a design to quote on, which featured an 80mm plate at the bottom. We knew our quote would be compared to overseas suppliers—that is quite common for us. While the client was keen to work with a local Australian manufacturer, we knew we'd have to sharpen our pencils."

"On reviewing the scope, it became apparent that a key element was missing from the original tender request—the grout pocket forming ingots. These ingots form a trench that runs along the top of the foundation. When the tower is lowered into position, the trench is filled with grout so that the self-leveling material ensures that there is an even surface for a perfectly straight tower—it eradicates the danger of a Leaning Tower of Pisa," explained Preston.

“ We were able to provide an Australian-made solution. Our solution used all Australian steel and, on analysis, used 97 per cent Australian content.”

"Traditionally, the grout pocket trench is made using a set of rubberised foam ingots that is fitted around the bolts during assembly. They are quite significant in terms of size, very expensive and non-biodegradable. And they're almost always made overseas. As the grout pocket forming ingots had been overlooked, the client asked Allthread Industries to supply these as part of the anchor cages," said Preston.

Allthread Industries sourced prices for these rubberised foam ingots, and received quotes that were extremely expensive. In addition, Allthread Industries knew that the end result would be a significant volume of waste that simply could not be recycled and end up in land fill.

Instead, Allthread Industries investigated a more environmentally friendly alternative. This alternative called upon the expertise of their sister company, Precision Oxycut—the largest steel cutting and plate processing company in New South Wales.

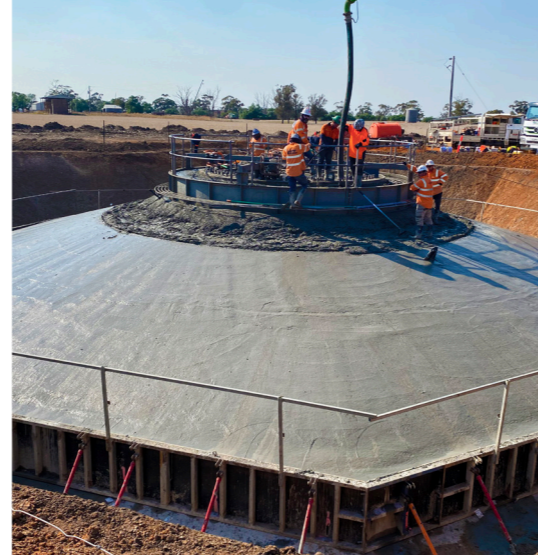
"With the rubberised foam ingots, we knew we'd have to use one set per tower. They cannot be reused. They either have to be sent to landfill or burnt in the hole. The environmental impacts just weren't right, particularly while constructing a renewable energy project like Murra Warra."

"So, we suggested that we opt for metal reusable rings. Not only did these eradicate the environmental impacts, they gave us the benefit of being able to assemble the anchor cages in our factory and then ship them to the site on the back of a truck."

## COMPETING ON VALUE AND INNOVATION, NOT COST

This unique solution enabled Allthread Industries to compete with cheaper overseas imports based





#### IMAGES

**Left:** Finished product showing grout pocket trench at the top of foundation, with bolts protruding.

**Above:** During the concrete pour.

**Below:** Anchor cage in reo-mesh ready for concrete pour.

#### PROJECT HIGHLIGHTS

- Non bio-degradable foam ingots were not used and thus did not have to go into land fill
- Grout pocket forming rings were recycled back to BlueScope at the end of the installation project
- Anchor cage supply chain was 97 per cent supplied and manufactured from raw materials in Australia
- During anchor cage installation, there were zero injuries and zero safety incidents for all 38 tower anchors
- Time to install anchor was 90 minutes using two site personnel plus crane, compared to conventional method which takes two days with six site personnel
- Zenviron regularly achieved five pours per week—a new company best for a project like this
- Project started two weeks late due to unrelated issues. Anchor cage installation still completed two weeks ahead of original scheduled date
- Total cost to buy and install anchor cage using Allthread Industries Australian made anchors, plus site labour, was more cost effective than imported anchor cages plus site labour costs

on the value delivered throughout the construction phase—not just on the cost of steel.

"Prior to this, we would supply the anchor cages as flat packs on the back of a truck—in exactly the same way as an overseas supplier. Because of this, we were always compared as a like for like option with international imports. The market perception was that we had an identical offering, with little differentiation. We were essentially competing based on the price of steel, and were often missing out on local contracts," said Preston.

"Instead of that, the cost comparison had to encompass not only the cost of the steel, but the cost of getting it to site, of destuffing the container, of assembling the parts, of having workers on-site for longer in hot weather or rain or wind. With the installation of 176 bolts required, all on uneven ground, the risk to worker safety was quite high. Manual handling is always the biggest cause of injury onsite."

"Allthread Industries was able to provide a quote that encompassed the cost of the steel plate and bolts finished and in the ground. When this was compared to the costs sighted by international suppliers, we were cost effective," said Preston.

The total cost to buy and install the anchor cages using Allthread Industries Australian-made anchors plus site labour costs was more cost effective than imported anchor cages plus site labour costs.

#### RAPID, SAFE CONSTRUCTION

All this was completed within a compressed timeframe, with just seven weeks between the signing of the contract and delivery of the first anchor cage to the site.

In fact, between September 2020 and March 2021, BlueScope supplied 380 tonne of XLERPLATE® steel in AS/NZS 3678 *Structural steel - Hot-rolled plates*, Grade 350, 80mm thickness to Precision Oxycut. This plate was cut, milled, drilled, and tapped, to fabricate the top and bottom steel plate rings that were used to build the Anchor Cages that were housed in reinforced concrete foundation.

In addition, InfraBuild supplied 334 tonnes of 4140 grade steel that was heat treated and peeled back to rolling size by Milltech Martin Bright so that Allthread Industries could create a 10.9 grade bolt. The result: anchor cages that featured all-Australian steel.

The construction process was rapid. The average time to build each anchor cage and check positional accuracy was just 90 minutes (once the cage had been unloaded from the truck). As a result, even though the project commenced two weeks late (due to unrelated issues), the anchor cage installation was still completed three weeks ahead of the original scheduled date.

Accuracy was not sacrificed for speed though. As Preston describes it, "We

#### ALLTHREAD INDUSTRIES: THE TRUSTED AUSTRALIAN BOLT MANUFACTURER

Established in Sydney in 1966, Sell & Parker's metal recycling services have evolved over the years, making strategic acquisitions such as precision profiling (to merge with the already established Oxycut), Allthread Industries and First Forge. Today, the group plays a role in the entire steel lifecycle, supplying the mill with scrap, buying plate from the mill, and supplying bolts, plate and—in the case of Allthread Industries—assembled anchor cages to their customers.

Manufacturing from 2,400m<sup>2</sup> premises in Regents Park, New South Wales, Allthread Industries boasts over 40 pieces of plant including 20 specialised threading machines for sizes ranging from M5 to M120 in grades 4.6, 8.8 and 10.9 grade, as well as stainless steels in lengths up to 6m or longer by special arrangement.

Some of the products manufactured by Allthread Industries include hold-down bolts or anchor (foundation) bolts, bolt cages, square and round bottom J bolts, U bolts, rock bolts, threaded rod, nuts, washers and chemical anchors. As a trusted choice of some of the world's largest brands such as Bechtel, CATCON, Downer and Thiess, Allthread Industries is proud to have remained at the top of its industry for more than five decades. While there is no re-inventing the bolt, technology is continuously evolving and improvements in steel, heat treatment, manufacturing and finishes have added a tremendous amount of customisation options. Allthread's engineers have the specialised knowledge and experience to manufacture custom designs for client needs.

"What sets us apart is our level of detail and engineering. We don't just have thread rolling machines, operators and a production manager. We also have a strong and robust engineering department which, at the height of major projects, can include as many as eight engineers from a workforce of 40 people," said Preston. "In addition to this, we deliver exceptional quality and adherence to ISO 9001. In fact, our engineering manager sits on the ISO standards committee for bolting and is currently reviewing a number of the latest standards for bolting. We're not just focused on making a bolt to specification, we provide full traceability, inspection and testing. This means that when people buy from us, they don't ever have to worry that what they're buying might not be right. There is no such thing as a short cut at Allthread Industries."

also achieved far greater accuracy. We designed the top plate so that it acted as a positioning device for the bolts. We machined nuts that had a taper on them, which made it easy to get them in and out. The positioning was perfect every single time."

"We clawed back such an enormous amount of time in the construction schedule because our process was so much faster than anything that had been done in the past," said Preston.

"Plus, during the construction of the anchor cages, there was not a single recorded safety incident. We solved a lot of problems regarding safety on site by using pre-slung loads. When our truck arrived on-site, it drove right up to the location of each tower. We designed a

method to remove all the components off the truck without anyone having to get on the truck. This removed the risk of falling from heights," said Preston.

#### AN AUSTRALIAN-MADE SOLUTION

"We were able to provide an Australian-made solution. Our solution used all Australian steel, and on analysis used 97 per cent Australian content. Even the plastic components were sourced from Allmould Plastics Group in Orange. The only components that weren't locally sourced were nuts and washers because there is no Australian manufacturer of those components. On our current project, the plastic components being manufactured by Allmould Plastics Group are now being made from plastic waste collected from the COVID-19

vaccination syringes."

"On further analysis, we also found that our anchor cage was made up of 50 per cent recycled material by mass. This meant that we not only had an Australian manufactured solution that was cheaper than the overseas equivalent, but also had a far higher recycled component of raw materials and therefore a lower carbon footprint."

"In the end, the steel grout pocket forming rings that we designed to replace the non-biodegradable foam ingots from overseas were recycled back to BlueScope, and have since found their way back into new steel products that are distributed across Australia," said Preston.



SCAN THE QR CODE TO LEARN MORE ABOUT ALLTHREAD INDUSTRIES & THEIR CAPABILITIES >>>



#### PROJECT TEAM

**Owner:** Renewable Energy Systems  
**Engineer:** icubed  
**Head Contractor:** Zenviron  
**Steel Processor:** Precision Oxycut and Milltech Martin Bright  
**Bolt Manufacturer:** Allthread Industries  
**Wind Turbine Supplier:** GE Renewable Energy  
**Plastic Components Supplier:** Allmould Plastics Group  
**Manufacturer:** BlueScope and InfraBuild