

# WHERE DESIGN MEETS FUNCTIONALITY

The Benefits of Steel Cladding in Long-Span Building Applications



Cover Image: St Andrews Beach House

Below Image: St Bede's Catholic School Stage 2 - ARAMAX® roofing and walling





## INTRODUCTION

The roof is one of the most critical components of the building. It protects the building from weather elements and contributes to meeting the functional requirements of the build – thermal efficiency, acoustics, structural integrity and more. The choice of roof design and materials also greatly impacts the speed and economy of construction.

The span of the roof is a major design consideration that has flow-on effect across any building project. Long-span roofing systems were developed to satisfy the functional requirements of specific types of buildings, but have evolved to deliver striking aesthetic effects and are a feature of many of the most iconic designs in modern architecture.

Long-span roofing creates unobstructed, column-free interior environments. This capability is ideal for spaces where visibility is a high priority, where flexibility is required to support a range of activities, and for structures built to house large objects. There are numerous examples of long-span roofs in auditoriums, sport stadiums, gymnasiums, manufacturing facilities, public halls, large shading structures, agricultural buildings, and airplane hangars.

Long-span building applications – whether roofs, walls or otherwise – present a unique design and construction challenge. The ability to achieve long spans is greatly influenced by the materials used and the available technology. Steel cladding is the ideal option due to its ability to achieve great spans in a cost-effective manner while providing strength, weather resistance and a contemporary aesthetic.

In this whitepaper, we consider the design potential of steel cladding in long-span building applications and highlight the advantages of techniques such as roll-forming in improving construction efficiency.

# USE OF STEEL CLADDING IN LONG-SPAN APPLICATIONS

Long-span roofs are generally defined as those that exceed 12 metres in span. Similar to a traditional roof, the primary function of a long-span roof is to protect the interior environment from the effects of weather, and provide fire resistance, soundproofing and thermal padding. As they are the primary structural system (in addition to boundary walls), they also often must support building services, access routes, lifting equipment and lighting.

The challenges of designing a long-span roof relate to the strength and integrity of the entire roofing structure as opposed to individual components. As the desired span increases, so do issues with delivery

and installation as there are logistical and practical challenges associated with large sheet sizes of any building material and achieving a seamless outcome.

Long-span roofing can be fabricated from a number of materials but steel cladding is an effective option due to its high performance and workability. In addition, advancements in continuous roll-forming technology have given companies the capability to produce sheet sizes long enough for end-lapping to be unnecessary. Roll-forming is the process that converts sheet metal into an engineered shape using a continuously fed strip of metal, and enables a seamless, precise outcome when used for long-span building applications.

## Benefits of Long-Span Steel Cladding

### DESIGN FLEXIBILITY

Long-span steel cladding can accommodate a wide variety of roof designs, whether applied to conventional buildings or unique architectural statements. This includes classic roof designs, irregular geometry or long-span arches that are entirely self-supporting. Some real-life examples of the variety of designs possible with steel cladding are highlighted below:

- The Netball Central Sydney facility in Sydney Olympic Park features a distinctive geometric roof design with an expressive V-shaped aesthetic and integrated roof and ceiling system. The long-spanning capabilities of steel cladding (over 140 metres) are highlighted in this structure.
- St Bede's Catholic School Stage 2 showcases the remarkable versatility of long span ARAMAX®. Large cantilever roof areas and design limitations on structural steel were addressed by using ARAMAX®

roofing. Additionally the product was also used in a perforated form as a attractive and functional wall cladding element.

- Cairns Adventist College is a private co-educational primary school located on the southern side of Cairns in Queensland. At the school's Gordonvale site, a shaded play area for children was created utilising 1,444m<sup>2</sup> of 1.2mm single-sided steel as the roofing material. The product was affixed to beams to provide a modern finish to the recreational area, while still complementing the school's surroundings. This was paired with a curved segmented gutter, which was selected to match the radius of the structure.

Steel cladding also lends itself to integrated roof and ceiling systems. It can be used as a feature material for both the interior and exterior and provides a consistent finish. Perforated sheeting can be specified to provide acoustic attenuation.



Cairns Adventist College

## INTERIOR VOLUME

Given its ability to support long-spans while providing excellent weather protection, steel cladding can be relied upon to create flexible, column-free internal spaces that are sheltered from the elements. Two examples of this type of application are described below:

- Carlton Primary School were looking to build a structure to create an all-weather playground. The structure needed to provide a generous, light-filled play area that was protected from sun and rain, while delivering an architectural look. The total roof area was 850m<sup>2</sup> so long-span steel cladding was the obvious choice to meet the design, structural and functional criteria. The sheets were roll-formed onsite to ensure a quick project turnaround.
- The Hangar museum in Cessnock incorporates long-span steel cladding as the cantilevered roofing and walling profile, providing sufficient volume within the interior space to allow for the movement of aircraft.
- The refurbishment of the Singleton Regional Livestock Market included a brand-new roof, which sits over the selling yards. The brief was to reduce the amount of structure including frame and columns over the existing saleyard footprint. The project featured 4700m<sup>2</sup> of long-span steel cladding used to cover the expansive roof area with sheets spanning almost 70m long. While providing uninterrupted shade for the livestock, the new roof can also catch an impressive amount of water, creating a sustainable advantage for the saleyard.



Carlton Primary School Learning Precinct

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Singleton Livestock Market

## STRENGTH AND STABILITY

Steel's unique combination of performance properties makes it an ideal option for long-span building applications. High tensile steel has the requisite strength and stability to support long spans. When specifying long-span steel cladding, it is important to consider the yield strength, grade and temper of the material and ensure it is appropriate for the proposed application.

Note that the chosen product should be compliant with AS 1397:2011 "Continuous hot-dip metallic coated steel sheet and strip - Coatings of zinc and zinc alloyed with aluminium and magnesium" and AS/NZS 2728:2007 "Prefinished/prepainted sheet metal products for interior/exterior building applications - Performance requirements".

## WEATHER AND CORROSION RESISTANCE

Steel is a highly resistant material that is suitable for exterior applications. It provides a solid surface that can withstand the impact of flying objects or a harsh climate. A properly installed and detailed roof also protects the building structure from the effects of water penetration. Long, clean spans enable a joint and seam-free cover that has fewer points in which water can enter in comparison to a traditional roof or cladding material. In addition, most high-grade steel roofing materials are coated with alloys that provide high levels of corrosion resistance.

## FIRE RESISTANCE

Steel is a non-combustible material that does not burn, provide an ignition source or add fuel that contributes to the spread of fire. The material's inherent fire-resistance is important to meeting the stringent requirements in the National Construction Code for standard fire-resisting construction as well as protecting buildings in bushfire prone areas. Long-span roofing is particularly advantageous for the latter as it has fewer points of entry for embers and sparks.

## CONSTRUCTION BENEFITS

As they are cost-efficient and require less time to construct, long-span steel cladding is ideal for structures that require lengthy roofing systems. Much of these time and cost savings come from eliminating the complexity of the building's secondary structure. The secondary structure refers to components that hold a building element up, but are not

critical to the building's structural integrity. Long-span steel roofing allows massive spans without the need for purlins or girts. This can reduce the number of structural steel and secondary steel members by up to 30%. Building complexity is further reduced with very low roof pitches and a joint-free covering that minimises the risk of defects.

Leading suppliers offer onsite roll-forming using a mobile roll-former, which can help projects realise even greater savings. A mobile roll-former provides the unique ability to roll sheeting onsite anywhere in the world, eliminating any complications arising from product transport and delivery. Project efficiency can be improved as onsite roll-forming can accommodate last-minute changes without needing to wait for new product to be manufactured offsite and delivered. Fewer seams in the final product also contribute to a more weather-tight roof and better project outcomes.

## AESTHETICS

The unique capabilities of long-span steel roofing give designers freedom in their expression of architectural forms. A variety of roof shapes can be achieved, including geometric designs with striking linearity or curved forms that add a 'romantic' quality to contemporary structures. Leading suppliers also provide wide range of steel colours and finishes, all of which accentuate the modern appeal of its clean lines.

Structures are also elevated by the modern aesthetic associated with steel. Long-span steel cladding works well with other common building materials, such as wood and concrete, to achieve a variety of on-trend styles, including rustic, industrial and minimalist aesthetics.

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# ARAMAX® STEEL CLADDING

Delivering a distinct, signature aesthetic to your next project, Fielders ARAMAX® is the visual and functional choice for engineers, architects and builders alike.

The ARAMAX® structural cladding system is unlike any other, with a product that is bigger, bolder and deeper than conventional steel cladding profiles. The ARAMAX® roof sheeting allows for huge roofing spans of up to 20 metres with no purlins or girts. This enables the designer to eliminate the cost and complexity of the building's secondary structure.

The ARAMAX® cladding serves as a visually stunning and structural component of the structure, reducing cost without compromising performance. ARAMAX® is manufactured in a standard 800mm cover width but 700mm to 900mm cover width may be available subject to request. The profile can accommodate individual project requirements by tapering the sheeting along its length to produce spectacular curves and designs.

Specialist engineering assistance is available for design of ARAMAX® structures. Minimum order quantities may apply for ARAMAX® however, the Fielders team will be pleased to speak with you regarding your specific project requirements.

## ADVANTAGES

- Clear spans up to 20 metres
- Can reduce number of structural steel and secondary steel members by up to 30%
- Significantly reduces construction time
- Aesthetically appealing
- Accommodates irregular geometry
- Waterproof and vermin free
- Accommodates cantilever overhangs up to 5 metres



## About Fielders

Fielders are manufacturers of rollformed steel building products. Fielders building products include steel roofing and cladding in a range of profiles and gauges, fencing systems, Gutters, fascia and rainwater goods, purlins and structural members, KingFlor® structural decking, sheds, patios and carports.



St Bedes College

All information provided correct as of March 2022

