

ESD – ACHIEVING OUTCOMES THROUGH CAREFUL SPECIFICATION OF CONSTRUCTION MATERIALS





INTRODUCTION

Across the globe, extreme temperatures, increasing atmospheric pollution and the growing amount of waste amassing in landfills and waterways has brought light to the impact of human activity on the environment. This is particularly true for the design and construction industry, which is repeatedly among the highest contributing sectors of waste and emissions year after year.¹ In 2018, the built environment comprised 40% of Australia's total waste levels.² In the same year, the Green Building Council Australia reported that commercial buildings alone were responsible for 8.8% of Australian greenhouse gas emissions.³

Based on current trends, the negative environmental impact of the design and construction industry and the built environment in general is only set to worsen given the industry's sustained growth and expanding activity. The commercial construction sector expanded by 8% in 2018,⁴ while the Australian construction industry in general remains strong, amounting to 8% of gross domestic product.⁵ Against this backdrop, industry professionals must take immediate action to ensure they minimise their contribution to harmful emissions and waste without compromising design integrity and performance.

In this whitepaper, we provide an overview of Environmentally Sustainable Design (ESD), an approach to design and specification that enables this balance to be achieved. We also explain how this approach can be practically implemented through careful selection of construction materials.

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UNDERSTANDING ESD?

Sometimes referred to as “Ecologically Sustainable Development” or simply “Sustainable Design”, ESD is an approach to architectural design that is driven by an overarching goal to minimise negative environmental impacts at both the construction and use stages. ESD can be applied in residential and commercial contexts and typically results in buildings that exceed the relevant requirements for sustainability and efficiency contained in the National Construction Code (NCC) and the Local Environmental Plans of local councils.

JF McClennan noted that the intention of ESD is to “eliminate negative environmental impact completely through skillful, sensitive design”.⁶ To achieve this, ESD incorporates the use of renewable resources as well as approaches to enhance the connection between people and the natural environment. Accordingly, ESD not only improves the health and wellbeing of the environment but also that of building occupants.

PRINCIPLES OF ESD

The core principles of ESD are as follows:⁷

- responding directly to, and optimising, the site;
- minimising reliance on non-renewable energy;
- using environmentally friendly products and materials;
- using energy and water-efficient appliances;
- reducing potable water use for non-drinking purposes;
- enhancing indoor environmental quality (IEQ); and
- optimising operational and maintenance practices.

The best results in terms of sustainability are typically achieved when built environment practitioners, such as designers and specifiers, consider ESD principles early in the design phase.⁸ Building projects also benefit from a cost and schedule efficiency perspective if ESD decisions are made early in the project timeline.⁹ Given the benefits of this approach, the practice of incorporating ESD in the early stages of building projects is growing among design and construction professionals.

INCORPORATING ESD THROUGH CAREFUL SPECIFICATION OF BUILDING MATERIALS

Following ESD principles, designers and specifiers consider the entire building lifecycle – from construction to occupation, post-use and potential demolition – and plan for buildings that are feasible in both the long and short term. One of the primary ways of achieving this is to take an informed and carefully considered approach to building materials. Designers and specifiers cannot do this alone as material manufacturers and suppliers play a critical role in simplifying the product selection process by providing better access to information for education, accreditation and compliance.

The demand for better, up-to-date materials and product information is driven by legislative and policy requirements. One notable driver is the growing concern in the Australian construction industry regarding quality and confidence issues highlighted in the 2018 Shergold Weir Report, which was requested by and issued to the Building Ministers’ Forum. This Report, which observed compliance issues in the building industry and advocated for a national best practice model to improve compliance with the NCC, noted that there is “diminishing public confidence that the building and construction industry can deliver compliant, safe buildings which will perform to the expected standards over the long term.”¹⁰ Among the recommendations made in the Report was improving the training of practitioners as well as the sharing of building and product information.

There are also programs such as Declare,¹¹ an ingredients initiative for building products run by the International Living Future Institute, that aim to make the materials and product specification process easier. Initiatives such as Declare provide a platform for public disclosure that offers greater product transparency to assist designers select sustainable and environmentally-friendly products.

A Declare label provides the following information on a product:

- where the product comes from;
- what it is made of; and
- where it will go at the end of its life.

A PRACTICAL GUIDE TO IMPLEMENTATION

Incorporating ESD into the early design and specification stages of a building project is fortunately becoming more the norm. Design and construction professionals can deliver elevated sustainability outcomes by making the following considerations when specifying building materials:

Using existing (ie, “upcycled”), recycled or recyclable materials wherever possible. This practice significantly **minimises the embodied energy**, or total amount of resources required for production, of a building. It also extends the life span of construction materials and products. If materials found on-site cannot be reused, or no demolition is required, practitioners should consider materials such as fibre cement, metals incorporating post-consumer waste, and concrete blends that contain recycled content. During the specification process, designers and specifiers should consider whether new materials specified in their project can be disassembled and re-used post-use.

Identifying materials and products that require minimal processing to convert them from their natural to finished state. Choosing materials and products that are minimally processed reduces the impact of manufacturing and production of building products on the natural environment. To assess this, designers and specifiers can reference a product’s associated accreditations and green credentials such as a **Declare** label, a **Good Environment Choice Australia (GECA)** ecolabel or Forest Stewardship Council certification.

Selecting only locally-sourced materials. Locally-sourced materials are more sustainable than materials sourced internationally or from distant locations due to the reduced time and transportation requirements for getting the material from its original source to the building site. By choosing

only locally-sourced materials, designers and specifiers can drastically reduce the overall embodied energy of a project. Due to increased competition and demand, there is an **excellent, diverse selection of local building materials** from domestic manufacturers.

Selecting materials that are long-lasting with minimal maintenance requirements. As noted earlier, a core ESD principle is to ensure a building is sustainable in the both short and long term. Choosing **durable materials** contributes to stronger, longer-lasting buildings that perform to high standards for extended periods of time. The use of highly durable materials also reduces the need for ongoing repairs and replacement that require further energy and resource consumption. Materials with **low maintenance** requirements will also require less energy and cost in the long term to maintain acceptable levels of quality and performance.

Selecting materials that enhance the health and wellbeing of building occupants. As Australians spend most of their time indoors,¹² designers and specifiers should be particularly mindful to select materials and products that are free of **volatile organic compounds (VOCs)**. VOCs are carbon-based chemicals that can have health effects ranging from nausea and eye, nose and throat irritation to headaches and liver, kidney and nervous system damage.¹³ Concentrations of VOCs are often ten times higher indoors than outdoors due to the off-gassing from building materials and products that cannot then escape into the atmosphere. Indoor air quality (IAQ) can be significantly reduced due to off-gassing of VOCs.¹⁴ Technological advancements, like products with specialty plasterboard technology that make harmful compounds inert or prevent them from being released into the air, provide new ways to improve the quality of internal living and working environments.

CSR

For decades, CSR has been one of the most recognisable and trusted names in Australian commercial and residential construction. The industry powerhouse behind the nation’s leading brands, the CSR building project range spans a wide array of solutions from facades and cladding, formwork and internal linings, acoustic ceiling systems and energy to insulation, roofing products, bricks and pavers.

Sustainability is a central pillar of CSR’s operations, and the company is committed to minimising its own environmental impact. To date, CSR has invested \$20 million in dedicated energy improvement funds and reduced its waste production by 14% between 2013 and 2018.¹⁵

Within the CSR product portfolio, several businesses continue to develop products and systems that can contribute to building healthier environments. Some examples include:

- **Collaborating with suppliers to recycle plasterboard waste.** Recycling plasterboard waste can help the environment by reducing landfill. In New South Wales, the Gyprock manufacturing plant offers an on-site recycling service.

- **Drawing on the technologies developed by global partners.** For example, this includes utilising Saint-Gobain’s Activ’Air technology, which converts formaldehyde into non-harmful inert compounds. These compounds are then permanently locked in the board and cannot be released back into the air. This solution makes ambient air healthier by eliminating 70% of formaldehyde concentration.
- **Implementing water recycling programs within factories.** For example, CSR factories have utilised new technology to recycle water and steam as part of comprehensive “Zero Water Waste” policies.¹⁵
- **Offering products made with natural ingredients.** Fibre cement products such as Cemintel Barestone are made from cement, water and air, radiata pine and sand, all of which can be sustainably harvested.

Learn more about sustainability with CSR
csr.com.au/about-us/sustainability

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CSR CEMINTEL BARESTONE™

Part of the CSR family, Cemintel manufactures and supplies fibre cement panels and building systems for external façades, internal linings, ceilings and flooring which are suitable for use in commercial and residential applications. Cemintel products are covered by warranty to perform to the relevant Australian Standards and requirements in the NCC. This includes fire, acoustic and thermal performance requirements.

Available in external cladding (Barestone External) and internal walling systems (Barestone Internal), Cemintel Barestone compressed fibre cement panels provide a raw, contemporary concrete finish that enhances design aesthetics. Barestone offers unparalleled design flexibility as it can be used in many diverse ways and cut to different shapes and sizes. As external cladding, it weathers naturally and seamlessly blends into its environment. For internal applications, it comes with a stain resistant coating applied and can be installed by adhering to timber battens or, for a more industrial look, exposed fixing with either screws or rivets.

Reducing the environmental impact of the construction process, Barestone lightweight, prefinished panels speed up construction and reduce labour requirements. They also meet strict factory checks to ensure high customer satisfaction and reduced call backs. Barestone Internal is designed to be compatible with industry standard lightweight timber and steel stud wall construction and requires only simple components and construction techniques for assembly. Barestone External is similarly easy to install, enabling a clean, smooth and natural cementitious finish. Barestone has been used for shopping centres, office buildings, residential homes and apartment buildings.

Being prefinished fibre cement, Barestone offers a variety of benefits associated with the material, including:

- no need to be painted;
- durability and low maintenance;
- fire resistance;
- impact resistance;
- moisture resistance;
- termite resistance; and
- increased speed of construction and ease of installation.

Barestone has been tested under the relevant standards for strength and moisture-related properties, as well as for durability and weather resistance. It is manufactured to AS 2908.2:2000, the relevant standard for cellulose-cement products, specifically flat sheets.

Barestone minimises the environmental impact of the built environment while creating healthy buildings and living spaces. Made from sustainable, natural elements, this product has extremely low levels of VOC and formaldehyde emissions and contributes to improved IAQ by meeting the Green Building Council Office Design IEQ-14 Requirements for such emissions. It is also a product of Cemintel's sustainable approach to manufacturing which is committed to:

- water/solids management and recycling;
- low embodied energy; and
- minimal amounts of VOCs.

This product comes with a 10-year warranty, providing designers and specifiers with a long lasting solution that can stand the test of time while maintaining high levels of performance and the specified aesthetic.



Contains no harmful substances and can therefore be returned to the natural cycle as compost.



Certified wood from Danish forests.

CSR Himmel's Trolldtekt cement bonded wood panels are made of 100% natural materials.

REFERENCES

- 1 Yu, Man, Thomas Wiedmann, Robert Crawford and Catriona Tait. "The Carbon Footprint of Australia's Construction Sector." *Procedia Engineering*, Vol. 180 (2017): 211-220.
- 2 Diversified Communications Australia. "Zero to Hero: Waste in Our Construction and Demolition Industry." Australasian Waste & Recycling Expo. <https://awre.com.au/recycling/zero-hero-waste-construction-demolition-industry> (accessed 8 August 2019).
- 3 The Australian Industry Group. "Construction Outlook July 2018." AiGroup. https://cdn.aigroup.com.au/Economic_Indicators/Construction_Survey/2018/construction_outlook_June2018.pdf (accessed 8 August 2019).
- 4 Ibid.
- 5 Nelson, Kate. "What does the future hold for Australia's construction industry?" *lendlease*. <https://www.lendlease.com/better-places/20171219-what-does-the-future-hold-for-australias-construction-industry> (accessed 8 August 2019).
- 6 McLennan, JF. *The Philosophy of Sustainable Design: The Future of Architecture*. Houston: Ecotone Publishing, 2004.
- 7 WBDG Sustainable Committee. "Sustainable." *Whole Building Design Guide*. <https://www.wbdg.org/design-objectives/sustainable> (accessed 8 August 2019).
- 8 PennState College of Engineering. "Sustainability Analysis." *Architectural Engineering*. https://www.bim.psu.edu/sustainability_analysis (accessed 8 August 2019).
- 9 Ibid.
- 10 Shergold, Peter and Bronwyn Weir. "Building Confidence: Improving the effectiveness of compliance and enforcements systems for the building and construction industry across Australia." Department of Innovation, Industry and Science. https://www.industry.gov.au/sites/default/files/July%202018/document/pdf/building_ministers_forum_expert_assessment_-_building_confidence.pdf (accessed 8 August 2019).
- 11 International Living Future Institute. "About Declare." *Living Futures*. <https://living-future.org/declare/declare-about/#overview> (accessed 8 August 2019).
- 12 Australian Government. "Indoor air." Department of Environment and Energy. <https://www.environment.gov.au/protection/air-quality/indoor-air> (accessed 8 August 2019).
- 13 United States Environmental Protection Agency. "Volatile Organic Compounds' Impact on Indoor Air Quality." EPA. <https://www.epa.gov/indoor-air-quality-iaq/volatile-organic-compounds-impact-indoor-air-quality> (accessed 8 August 2019).
- 14 Ibid.
- 15 CSR Limited. "Annual Report 2019." CSR. https://www.csr.com.au/-/media/corporate/files/annual-reports/2019_csr_annual_report.pdf (accessed 12 August 2019).