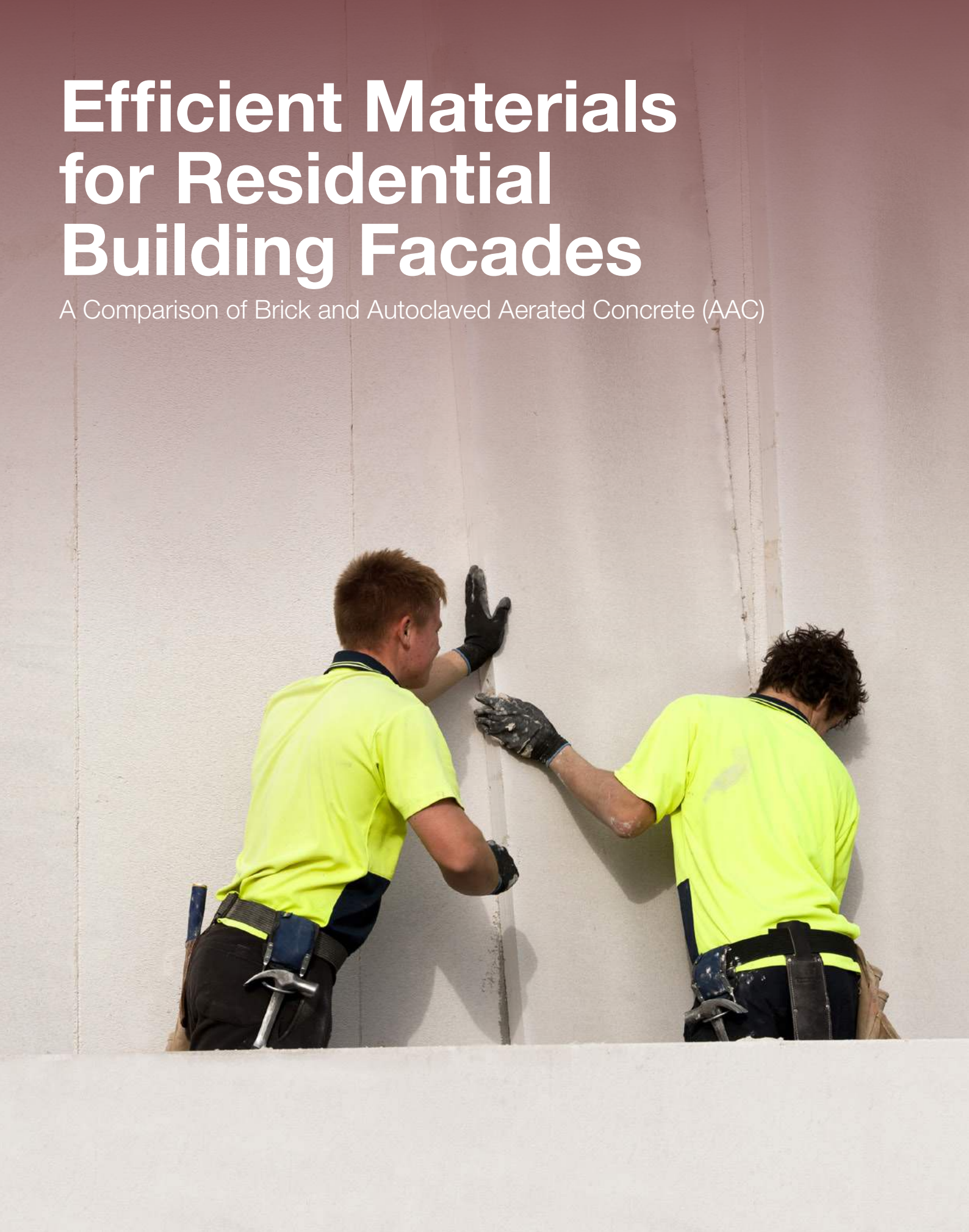
Efficient Materials for Residential Building Facades

A Comparison of Brick and Autoclaved Aerated Concrete (AAC)



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Introduction

External cladding, an architectural term that refers to the process of wrapping the exterior of a house or a building with some layering material, is a key component of any facade. The cladding's main purpose is to protect the building from weather elements, provide noise control and thermal insulation, and add visual appeal to the structure.

Over the years, we have seen a growth in the types of materials used for cladding applications, including aluminium, glass, timber, bricks, autoclaved aerated concrete (AAC) and steel. Whatever material you choose depends on the purpose of the cladding, the environmental conditions of the site, the material's architectural properties and project limitations (time and budget).

Architects and designers must give sufficient weight to the process of evaluating cladding materials. The use of efficient facade materials plays a critical role in optimising operational energy requirements and other functional characteristics desired in modern buildings. They also have a significant impact on the longevity and maintenance of the building.

This whitepaper discusses the use of brick and AAC – two of the most commonly used materials in residential construction. We identify the differentiating factors that are commonly misrepresented, and identify the advantages and disadvantages of each material for cladding applications.

Definitions

Autoclaved aerated concrete

Invented in the 1920s, autoclaved aerated concrete (AAC) is a lightweight concrete product that has been manufactured to contain closed air pockets. AAC is composed of quartz sand, calcined gypsum, lime, cement, water and aluminum powder. The manufacturing process is characterised by a foaming process that gives AAC its light weight and porous structure with the resulting product coming in at approximately 20% the weight of standard concrete.

When AAC is mixed, the aluminum powder reacts with calcium hydroxide and water to form hydrogen, which foams and doubles the volume of the raw mixture. Once this foaming process is complete, the resulting mixture is in a solid yet soft form. It is then cut into blocks or panels and placed in an autoclave under high heat and pressure. The combination of heat and pressure hardens the material, imbuing it with high strength and other unique properties. After autoclaving, the material is ready for use in construction applications.

Despite being made with concrete, AAC is *not* classified as a masonry product. It is categorised as a 'lightweight' building product and is required to comply with AS 5146 "Reinforced Autoclaved Aerated Concrete".

Bricks

One of the oldest building materials, bricks are uniformly sized blocks of baked clay or concrete. Bricks are made from minerals found in clay and shale, mixed with water and formed into the desired shape. They are then dried and fired, resulting in a durable ceramic product. Bricks are components of durable masonry construction, which is characterised by uniform individual units laid into courses using mortar as the bed and binding material.[1]

Bricks are among the most commonly used materials for residential construction due to their high strength, excellent fire resistance, durability and aesthetic versatility.[2] Bricks are categorised as a masonry product and are required to comply to AS 4455, AS 4456, AS 4773 and AS 3700.

What are the benefits of AAC vs brick?

AAC and brick are both popular building materials due to their exceptional architectural properties, longevity and ease of manufacturing. While both are designed to perform as external cladding products and have many common features, each material offers unique advantages for residential construction.

Architects and designers will need to identify the key differences of each material and select the right material based on the needs of their project. Below we compare the various benefits of AAC and brick in the context of cladding applications.

AAC

Thermal efficiency

Due to the material's closed aerated structure, AAC panels are highly effective insulators, which helps reduce a building's air-conditioning load in comparison to conventional construction. AAC has four times greater thermal resistance than standard house bricks. When incorporated into an energy-efficient design, this superior thermal performance reduces the amount of energy required to heat or cool the building, thus resulting in significant cost savings for homeowners.

Acoustic insulation

With its closed air pockets, AAC has superior soundproofing and acoustic insulation properties. An AAC wall without any gaps or unfilled joints, combined with an insulation asymmetric cavity system, provides exceptional sound insulation that can improve comfort within the indoor living environment.[3]

Fire resistance

The porous structure of AAC gives superior fire resistance. It is also inorganic, incombustible and does not explode, so it is well suited for fire-rated applications.[4] Depending on the application and the thickness of panels, fire ratings up to four hours can be achieved.[5]

Good strength and durability

While it is one-fifth the density of normal concrete, AAC still offers half the bearing strength and can be safely used to erect structures up to three storeys high.[6] When combined with a durable external finish, AAC panels are also suitable for Australia's harsh climate and will not degrade under normal conditions.

Speed of construction and reduced costs

The construction benefits of AAC derive primarily from its strong yet lightweight properties and its unique manufacturing process. The light weight of AAC panels make them easier to handle onsite with standard construction tools. Installation requires less labour and creates less onsite mess than brick. AAC panels are also produced to the exact sizes needed before leaving the factory, thus reducing the need for on-site trimming. These benefits contribute to faster, more efficient installation, enabling projects to save on costs, time and energy.

Environmental benefits

As it is comprised of 80% air, AAC contains far less raw materials than standard concrete. Weight for weight, the embodied energy and greenhouse gas emission impacts of AAC are similar to those of concrete. However, on a volume comparison, the environmental impact of AAC manufacturing and construction is significantly less than that of concrete and bricks.

Modern aesthetics

AAC panels are suited to a wide range of modern architectural styles, with rendered finishes that can create distinctive visual effects and contemporary aesthetics. Such finishes have the added advantage of hiding surface imperfections on the exterior facade.

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Brick

Buildability and availability

With a long history of use in Australia, brick buildings have stood the test of time. Today, clay and concrete bricks are manufactured throughout Australia and readily available at competitive prices. There is also a huge body of knowledge and experience on the optimal techniques and standards for brickwork construction.

Durability

Bricks offer high levels of durability and element resistance. They are also non-combustible. The longevity of bricks is second to none, and even after many decades they remain strong, reliable and relatively maintenance free. For reference, the required levels of durability are detailed in AS 3700:2018 “Masonry structures”.

Moisture resistance

Clay brickwork is not completely waterproof, but it does effectively resist the penetration of rainwater with the appropriate detailing. This quality contributes to minimising moisture-related issues within the structure of the building and the indoor living environment.

Low maintenance

Due to its strength and durability, some types of brick require little or no maintenance. Brick is also among the most effective material at minimising moisture issues, reducing the risk of costly mould and rot-related damage within the building structure.

Thermal mass

Brick has exceptional ‘thermal mass’ properties, which refers to the ability of a material to absorb, store and release heat. When used in conjunction with passive design features appropriate for the given climate, high thermal mass can improve the thermal performance of a building, and reduce heating and cooling costs. Note that clay and concrete brickwork have low resistance to heat flow,[7] which may need to be addressed with additional design features such as insulation.

Classic appearance

The classic style of brick construction is warm and inviting with a selection of earthy hues and textures. In recent years, advancements in manufacturing techniques have expanded the range of finishes available. There is also a large scope of shapes, textures

The verdict

During the cladding material selection process, the first priority is determining what material is best suited to the environmental conditions, and climate of the building. The key question is whether the cladding material has the appropriate levels of strength, durability and lifespan.

The thermal properties of the material should also be considered in context of the building's overall design. The cladding material will need to work in conjunction with other design features, such as insulation, to achieve the building's required level of thermal performance.

While functional aspects like stability, thermal insulation, acoustics, durability, and weathering resistance are important, cost and workability are often the difference when all other aspects of two different materials are relatively equal. In this regard, the use of AAC can help reduce project costs and timelines due to its ease of installation, and lower requirements for labour and equipment.

Some cladding systems require regular treatment to protect against weather elements. Brick is advantageous in this regard due to its high durability, moisture resistance and colour retention. While its maintenance requirements are still relatively low, AAC requires a durable finish to provide protection against moisture penetration and weathering.

AAC is clearly the superior option for environmentally-conscious homeowners. AAC's reduced environmental impact can be attributed to several factors:[8]

- resource efficient as it uses far less raw materials than brick or concrete;
- use of recycled waste in the manufacturing process;
- low energy consumption throughout its lifecycle compared to other building materials; and
- helps maintain indoor air quality as it does not promote the growth of mould or mildew.

This is not to say brick is without some environmental benefits. The longevity of bricks means they do not need to be replaced often, and the environmental cost of brick manufacturing is spread out over a longer period of time. Clay bricks are also recyclable and can be repurposed in another building or structure, or crushed into finer particles for use in road-base, landscaping material or new bricks.Brick and AAC are undoubtedly both strong options to consider using in a construction project, with AAC offering the added benefits of cost and time savings and sustainability. Ultimately, the decision to use either AAC or brick will depend on the specific requirements of the project, including the desired aesthetic. A useful step is to discuss your project with the relevant supplier or manufacturer to determine which option will work best for your required design objectives.

MaxiWall by Big River Group
The future of cladding

Big River Group's MaxiWall is a strong yet lightweight walling panel made from AAC and reinforced with corrosion-protected steel mesh. MaxiWall is easy to handle and quick to build with, and its contemporary rendered finish offers a more stylish and sustainable alternative to traditional brick and concrete. MaxiWall is designed for homes and buildings built with standard timber or steel framing and is available in a range of panel lengths.

MaxiWall provides Australian homeowners with a high-performing cladding material that is kinder to the environment. The manufacture of AAC requires less raw materials than other comparable building materials, resulting in 30% less environmental waste compared to traditional concrete and 50% fewer greenhouse gas emissions.

Combining excellent thermal performance, acoustic insulation, and fire resistance, MaxiWall offers an ideal option for all types of residential projects, from detached dwellings to multi-residential housing. It is suitable for low-rise external and party wall applications as well as high-rise external and internal wall systems. Beyond its functional benefits, the use of MaxiWall also leads to faster construction times and structural savings due to its light weight.

MaxiWall's rendered finish offers a stylish and sustainable alternative to traditional brick and concrete. The product can be finished in a multitude of different rendered finishes, ensuring any architectural style can be achieved.

AAC was invented in Sweden over 70 years ago and is widely used in building throughout Europe as well as other regions in the world. Its popularity among architects, builders and homeowners in Australia has been growing significantly over the past 20 years. This product is fully compliant with current Australian Standards.

MaxiWall is now available and supported in Australia through the established national sales and distribution network of the Big River Group.

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References

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5 Ibid.

6 Ibid.

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8 Chowdhury, Rajdeep. “AAC An Efficient Material for Building Façade.” WFM Media. https://wfmmedia.com/aac-an-efficient-material-for-building-facade (accessed 8 March 2022).

All information provided correct as of April 2022.

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