

Clay Roof Tile

Leaving Minimal Impact to the Natural Environment as a Cradle to Cradle Building Envelope Solution

INTRODUCTION

A classic building material, clay roof tile has been utilized for centuries as an integral, substantial piece of the building envelope and has been found on ancient structures dating back as far as 5,000 years ago¹. These historical Greek structures are a testament to the durable and natural materials that comprise clay roofing tile.

Overview of Benefits

Clay tile is a premier roofing tile solution. Like its counterpart, concrete roofing tile, it offers a number of benefits as both an aesthetic and structural component of the building. Clay tile's numerous high-performance benefits to both commercial and residential property owners include lasting durability, temperature control, energy efficiency, energy savings, sustainability, "curb appeal," low maintenance, long life, and low cost repairs. Created using natural material from the earth, clay tile is manufactured in a number of profiles and colors, offering seamless compatibility with countless architectural styles and trends, while satisfying the personal preferences of the owner.



Sustainability, Manufacturing and Lifecycle

Clay tile provides a suite of positive qualities that have likely influenced its widespread adoption among builders, architects and remodelers. One of the most impressive aspects of the clay roofing tile is its overarching sustainability. Clay tile is known for its Cradle-to-Cradle² performance starting with the minimization of environmental impact from sourcing local materials and responsible manufacturing processes. Clay roof tile is a durable product for the roof and is easily recycled at the end of its service life.

1. TYPICAL APPLICATIONS

Clay tile is widely used in both residential and commercial property applications. Builders, architects, remodelers and owners are driving the widespread adoption with clay tile's exceptional curb appeal. Uses for clay tile roofs include single-family detached homes, townhomes, condominiums, apartment communities, mixed-use and office properties as well as other special use commercial types.

The wide variation in aesthetic profiles and colors available for clay tile provides a variety of roofing solutions to both residential and commercial owners. These extensive options allow for widespread use across multiple building types.

¹www.oldhouseweb.com

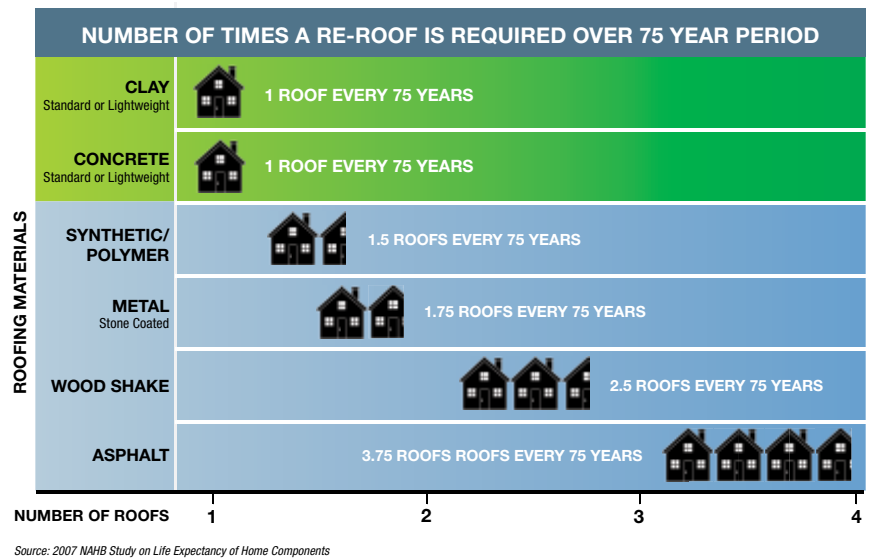
²www.c2ccertified.org



2. PERFORMANCE BENEFITS

The noteworthy performance benefits of clay tile are vast and varied, offering numerous benefits to property owners. A long-lasting solution, clay tile even outperforms alternative roofing materials. In a 2007 study on the Life Expectancy of Home Components, the National Association of Homebuilders (NAHB)³ found the average lifespan of a clay tile roof is 75 years, further highlighting its durability.

Low maintenance clay tile is easily repaired in rare cases of damage. Only the damaged portion requires repair instead of needing to replace the entire roof, thanks to clay tile's unique installation. Coupled with an impressive lifespan and superb durability, this type of roof proves ideal for owners interested in a product that requires little maintenance or expense over the course of its life.



3. COOL ROOF ENERGY EFFICIENCY/SUSTAINABILITY

Properly installed, clay tile is designed to protect the structure. Even better, clay roofing tile are also known as cool roof tile because they incorporate temperature-adjusting qualities with superb energy efficiency. These qualities equate to a comfortable interior environment as well as energy savings in both residential and commercial applications.

In addition, a cool roof helps control internal temperature with solar reflectance, thermal emittance, thermal mass and airflow, all of which support the building envelope's energy efficiency. Color reflectance reduces the amount of heat that absorbs into the structure. Clay tile, especially when installed in terracotta or light earth tone colors, boasts a high solar reflectance index (SRI) – a measurement for reduced heat transfer – which reduces the common need for energy consumption associated with air conditioning usage.

High thermal emittance is another benefit of clay tile. A high measure of thermal emittance indicates that the tile is successfully radiating absorbed solar heat away from the structure prior to it transferring inside the building envelope. The importance of this is demonstrated on a reduced load to the structure's HVAC system, providing further energy savings.

Clay tile also boasts thermal mass to reduce energy demands. Measuring the ability of a building material to store heat, a material with high thermal mass absorbs heat in times of peak temperature, rather than transferring it inside the structure to the living spaces. This keeps the interior of the structure comfortable for inhabitants and users, thus reducing peak cooling and energy demands. At night, the absorbed heat is released, helping the building maintain warmth, further decreasing the energy needed for heat.

Because clay roof tiles measure high in thermal mass, they can react to temperature fluctuations and delay heat flow through the envelope by as much as 10-12 hours.⁴ The end result of this is a structure that remains cooler by day in summer months, and warmer by night in the winter.

Airflow is the fourth integral component of a cool roof. Clay tile as a cool roof solution is engineered to encourage greater airflow between the tile and the roof deck. This capability enhances the insulating qualities of the roof. Increased airflow encourages the heat absorbed by the roof to be eliminated before it can be absorbed into the building envelope. Hot air is channeled above the deck and released through the ridge of the roof.

When combined, these four roof characteristics – solar reflectance⁵, thermal emittance⁵, thermal mass and airflow - complete the cool roof package and dramatically reduce the need to heat and air-condition the structure. This reduced energy consumption equates to significant energy savings throughout the lifespan of the clay tile roof.

³2007 NAHB Study of Life Expectancy of Home Components

⁴Australia Government <http://www.yourhome.gov.au>

⁵Cool Roof Rating Council (CRR) www.coolroofs.org

4. RAW MATERIALS

Clay tile is made of naturally occurring geologic materials prevalent throughout the United States, where the tile is manufactured. The clay material used to manufacture the tile is locally sourced and extracted close to the manufacturing plants, dramatically reducing the environmental impact of transportation and fuel needed to move materials from their original source to the facility. Additionally, up to 59 percent of the material used to manufacture clay tile is recycled, further minimizing environmental impact. The recycled material content originates from the waste by-products of mining processes.



5. ECO-FRIENDLY MANUFACTURING PROCESSES

Once all pre-manufacture materials are sourced – whether extracted or recycled – they will enter the manufacturing process or second lifecycle phase. All materials are mixed together. A variety of clays, sand and scrap are combined together and then placed inside a hopper to be ground.

The material is then pushed through sieves to achieve the correct and consistent particle sizing. Thoroughly sieved materials are then siloed and extruded into various profile shapes. US Tile® by Boral® provides one of the largest selection of styles and colors for clay roof tiles. These various aesthetic options are distributed to customers nationally with styles ranging from traditional mission style barrel to flat tiles, fulfilling a wide range of architectural aesthetic needs.

When cut, the tile profiles are prepped to be fired in a kiln, which requires the most energy during the manufacturing process. Boral utilizes a modern firing process that incorporates a cutting-edge roller hearth kiln system to reduce traditional firing times from as much as seven days to approximately 90 minutes. The innovative technique reduces the tiles' embodied energy.



Boral Roofing's US Tile® Corona, California manufacturing facility reuses some of the heat generated during the kiln firing process. A portion is re-routed and utilized to dry the product, which reduces the amount that typically ends up as simple exhaust. It also reduces the need for additional energy to be generated as heat for drying.

The processes and materials in the plant follow earth-friendly manufacturing methods. Pre-fired clay waste and manufacturing rejects – each comprising the manufacture green waste – as well as a selection of unused fired product is all re-introduced into the manufacturing process. Additionally, wash and clean-down water is captured and recycled back into the mix, never leaving the facility or polluting the environment.

Safety and best practices are also employed at the facility and throughout the manufacturing process. In addition to water reuse, US Tile® by Boral® protects the community from clay dust. This is achieved by keeping materials moist at all times. Additionally, the facility is thoroughly swept to limit material entering storm water run-off. An air filtration system vacuums all pre-extrusion clay dust byproduct, and captured dust is recycled back into the grinding process. All of these efforts minimize waste and limit dust for environmental protection and safety.

6. LIFECYCLE ANALYSIS AND PRESTIGIOUS CRADLE TO CRADLE PRODUCT CERTIFICATION

Boral clay roof tile is a premium, high-performance roofing product whose “lifecycle” may be broken into four core categories. These categories, or “life stages,” include:

- 1) pre-manufacture, raw materials and sourcing;
- 2) manufacturing – the process through which natural base materials are transformed into the final building product;
- 3) the clay tiles’ service life on the roof and 4) the end of the roof’s life, when the product is retired, or removed, from the structure.

Like living organisms with clear life phases, the life of building products is similarly defined – with a clear beginning, or birth at the cradle, and a clear end, or death at the grave. Where Boral clay tile differs is in its demonstrated minimal impact on the natural environment through all stages of its life and in the fact that the materials may be recycled and reutilized at the end of the roof’s life. Either way, the roof materials are not abandoned as waste.

This lifecycle analogy is defined best by the prestigious Cradle to Cradle Certification earned by the company’s Corona, California clay tile manufacturing plant. A third-party multi-attribute eco-label, the Cradle to Cradle designation focuses on the use of safe materials that may be disassembled after use as a product and recycled as technical nutrients or composted as biological nutrients.

Unlike single attribute eco-labels, the Cradle to Cradle certification takes a comprehensive approach to the assessment of a product and the practices employed in its manufacturing. Materials and manufacturing are measured in five categories: Material Health, Material Reutilization, Renewable Energy Use, Water Stewardship and Social Responsibility. All certified products meet a minimum requirement in each of these five categories.

Cradle to Cradle emphasizes the impact of the product on the natural environment throughout all life stages and, uniquely, that the product at the end of its life may be broken down to fuel a new product generation. In other words, the product does not become waste but is reformed and reused without harming the environment.

Demonstrating the Cradle to Cradle ideal, clay tile is 100 percent recyclable. Once it is reclaimed, tiles may be reused on a different roof, or crushed for re-introduction back into the manufacturing process or for use on baseball infields – to name just a few of its second-generation applications.

CONCLUSION

As a classic building material, clay tile has stood the test of time. With worldwide applications for a variety of property types and regions, clay tile offers both performance and popularity. The modern-day evolution of the product has expanded its appeal, improved sustainability measures and increased the lifespan of roofing.

When you add up the benefits of energy efficiency, cost savings, local sourcing, regional manufacturing, and environmental appeal, clay tile represents one of the finest roofing materials available on the market today.

