Stone Coated Steel Roofs

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Stone Coated Steel:
Stepping Out of the Ordinary

Types of Roofing Materials

Introduction

Today's architects can choose from a wide variety of roofing materials. Deciding on the best option requires consideration of the materials' attributes with regards to performance and sustainability.

Stone coated steel roofing systems offer an alternative to traditional roofing materials such as clay and concrete tile, wood shakes, and asphalt shingles.

In this section, we discuss the life span, weatherability, installation versatility and safety—performance attributes. We will also discuss the sustainable attributes, namely durability, recyclability, energy efficiency, landfill impact, and water conservation.

Sustainable

It is difficult to find a product that does not claim to be sustainable. Many products have a single sustainable attribute, yet the makers claim the whole product is sustainable. One of the most widely quoted definitions of sustainability is "*meeting the needs of the present without compromising those of the future*." (Brundtland Commission, 1987)

Another is *"maximize quality, minimize negative impact*." This definition speaks to both the individual and the environment: give the inhabitant of the building a quality environment, inside and out, with little impact on the environment.

So, keep these in mind as we look at the various roofing materials in today's course.

Concrete/Clay

Made with an established manufacturing process, concrete/clay roofing systems have a life span of 25-50 years depending on climate and materials used in manufacturing. Absorbing up to 15% of their weight in water, concrete and clay tile can crack with freeze/thaw cycles. If using with a rain catch system, less water will be available because of this absorption rate.

Installation is both labor intensive and time-consuming. In a reroof situation, tear-off of the old material is required as concrete/clay roofing systems cannot be installed over existing materials; that torn off material can end up in the local landfill.

Concrete/Clay

Claims are made that concrete/clay tile are permanent roof systems. However, when the underlayment deteriorates and ages, the tile will have to be removed for the underlayment to be replaced, or else leaks will ensue requiring continuous maintenance.

Both concrete and clay are heavyweight materials (around 8 lbs./sq.ft.) which put extra pressure on the structure, an important consideration in seismically zoned regions. Furthermore, in high wind storms, loose clay or concrete pieces can cause serious harm to both people and property.

Concrete and clay tile contain high embodied energy. Additionally, they are not easily recycled at the end of useful life because of the lack of facilities.

Broken Clay Tile

16 Year Old Underlayment

Wood Shake

Wood shake has a life span of roughly 20-30 years. Age and environmental conditions can lead to rotting and splitting of wood shakes.

A great profile with limited use, wood shake is combustible and not suitable for areas that tend to be dry. In fact, it's not allowed in some regions due to building codes or neighborhood association requirements. Although treated when first installed, repeated fire-proofing maintenance is required to maintain the Class B fire rating.

Because of this fire-proofing and other preservatives added to the wood in the manufacturing process, the water from a wood roof is not potable because the preservatives can leach heavy metals, in particular arsenic.

Tear-off of existing materials is required when installing wood shake, again increasing the chance that the old material will be sent to the local landfill.

As a renewable resource, wood shake has the lowest embodied energy of all the roofing materials and can be recycled/composted at end of service life.

Asphalt Shingles

Architectural asphalt shingles have a life span of approximately 18 years, depending on the climatic conditions of the installation, product weight and quality.

Even though asphalt shingles have the lowest first cost of all roofing systems, they require more frequent replacement than other options, resulting in higher lifetime costs and a larger impact on local landfills. While there are some facilities that will recycle asphalt shingles, they are few and far between.

Weight is the name of the game for asphalt shingles—the heavier the product, the less susceptible it is to blow-offs. However, most do not have an extended wind warranty beyond 15 years.

Even though some asphalt shingles are impact resistant, hail can still penetrate the asphalt/fiberglass backing, causing it to “break.”

Asphalt Shingles

Although asphalt shingles are freeze/thaw resistant, the asphalt can become brittle and break down if exposed to extreme cold weather conditions. When the asphalt and fiberglass break down, the shingles can curl, split, and crack.

Granules provide protection for the asphalt. Foot traffic can knock off the granules, which will expose the asphalt to weathering.

An asphalt shingle contains petroleum products. The water from an asphalt shingle roof is not potable and is harmful to the groundwater.

Steel Roofing

In Section 3 of this course, stone coated steel roofing systems will be discussed in detail. In order to contrast the various types of roofing materials, a brief summary of the attributes of stone coated steel roofs follows:

Performance Attributes

- 50+ year life span
- Freeze/thaw resistant
- Weather-tight
- Wind speed warranty – 120 mph
- Class 4 hail resistance rating
- Class A fire rating
- Lightweight (1.25 – 1.6 lbs./sq.ft.)
- Various installation methods

Steel Roofing

Sustainable Attributes

- Contains recycled content
- Recyclable
- Low maintenance
- Metal is energy efficient
- Low life cycle cost
- Diverts materials from landfill
- Does not harm groundwater

Material Comparison Chart

Protection/Benefits	Steel Roofing Products	Concrete & Clay Tile	Architectural Shingles	Wood Shake
Weight	• 1.25-1.5 lbs./sq.ft	• 6-15 lbs./sq.ft.	• 2.5-4 lbs./sq.ft.	• 1.5-2 lbs./sq.ft.
Fire	• Class A Rated Material	• Class A Rated Material	• Class A Rated Material With Fiberglass Mat, Otherwise Class B	• Class A, B, or C – Treated & Underlayment Specific
Wind Warranty	• 110-120 mph Warranty	• Wind Damage Not Covered	• 60-110 mph Warranty – Special Restrictions; Warranty Period May Vary	• Wind Damage Not Covered
Impact (Hail) Resistant UL2218*	• Class 4	• Cracks Very Easily – Hail Can Cause Severe Damage	• Class 1 to 4	• Class 3 or 4
Snow/Ice	• Freeze/Thaw Resistant	• Not Waterproof – When Wet Will Absorb 15% Of Weight In Water	• Freeze/Thaw Resistant	• Limited Freeze/Thaw Cycles – Will Absorb Water
Warranty	• Lifetime Limited Warranty	• 25-Year To Lifetime Limited Warranty	• 25-Year To Lifetime Limited Warranty	• 25-Year To Lifetime Limited Warranty
Environmental Impact	• Upward Of 35% Post-Consumer Recycled Material • Diverts Old Material From Land Fill If Tear-Off Not Needed • Long Use Cycle • Closed Loop Production Cycle • End-Of-Life Recyclability	• High Embodied Energy • High Pollutant Generation In Production • Tear-Off Is Required In Reroof • Long Use Cycle • Limited Recycling Use	• High Embodied Energy In Relation To Life Cycle • Petroleum Based – High Pollutant Generation In Production • Tear-Off Usually Required In Reroof • Lowest Use Cycle • Very Limited Recycling Use	• Embodied Energy – Renewable Resource • Tear-Off Required In Reroof • Medium Use Cycle • End-Of-Life Recycling – Compost

* Hail Damage and Penetration May Not Be Covered

~Metal Roofing

Types of Metal Roofing Systems

Metal roofing is available in two system types: standing seam and panels.

1. A standing seam metal roof system consists of an overlapping or interlocking seam that occurs at an upturned rib. The standing seam is made by turning up the edges of two adjacent metal panels and overlapping them, then folding or interlocking them.

Standing seam

Types of Metal Roofing Systems

2. Panel systems come in two different types: long span, through-fastened vertical panels and smaller, interlocking, horizontally installed panels. The vertical panels are generally painted metal available in flat or formed profiles. These panels have exposed fasteners, fastened vertically through the panels, requiring a screw with a neoprene-type washer. The horizontal panels are available in various coatings such as paint or stone chip. Manufactured to standard width and height, the panels are installed horizontally across the roof. Panels fit together in an interlocking fashion and overlap at the sides and the back shelf. Fasteners are either exposed or hidden, and most are fastened horizontally through the nose, rather than vertically through the face.

Long span

Paint Finishes

Kynar and Hylar are the most common types of paint finishes used on metal roofing products.

Care must be taken during installation, as painted surfaces can be slippery when wet. As well, coated finishes are unforgiving: the paint can scratch easily, touch-ups and impact “dimples” can be noticeable.

Paint is susceptible to chalk and fade which negatively impacts the product’s aesthetics.

The warranty on paint finishes is limited and varies by manufacturer; plus, the coating may require maintenance after a period of time to preserve its appearance and performance.

Stone Coated Finishes

Stone coated steel roofs have a ceramic coated granular finish that is typically warranted for 50 years.

Not only is this type of finish easier to install and touch up, but the finish is more forgiving than paint since the stone coating and texture help to hide impact “dimples.”

Other advantages of stone coated finishes: They are low maintenance, granules have minimal fading, stone coated panels permit foot traffic, and unlike a solid color paint, granules provide rich, deep hues to the roof.

Panel Stone coated steel

Case Study: Lawrence Township Fire Department

Lawrence Township Fire Department had a twenty-year-old standing seam roof with a defective coating and hail damage. Aside from the aesthetic problems, the roof leaked.

Firemen wanted to replace the standing seam roof with a cost-effective, durable, long-lasting product that would be attractive and low maintenance.

After considering an asphalt shingle, the firemen decided to replace the standing seam with a stone coated steel product in a shingle profile. The stone coated steel provided the durability of steel with an attractive stone chip finish.

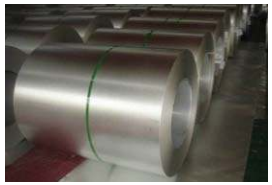
Before

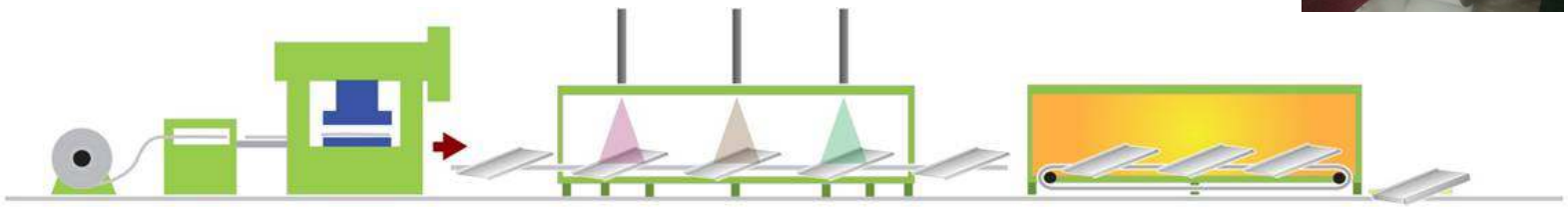
After

Stone Coated Steel Roofs

Introduction

The manufacturing process of stone coating steel begins with the shaping of aluminum-zinc coated steel coils into various sized panels using a mechanical hydraulic press.





Aluminum-zinc alloy coating is different from galvanized (G90) or aluminized coated steel panels. Galvanized panels are coated with zinc, and aluminized panels are aluminum coated.

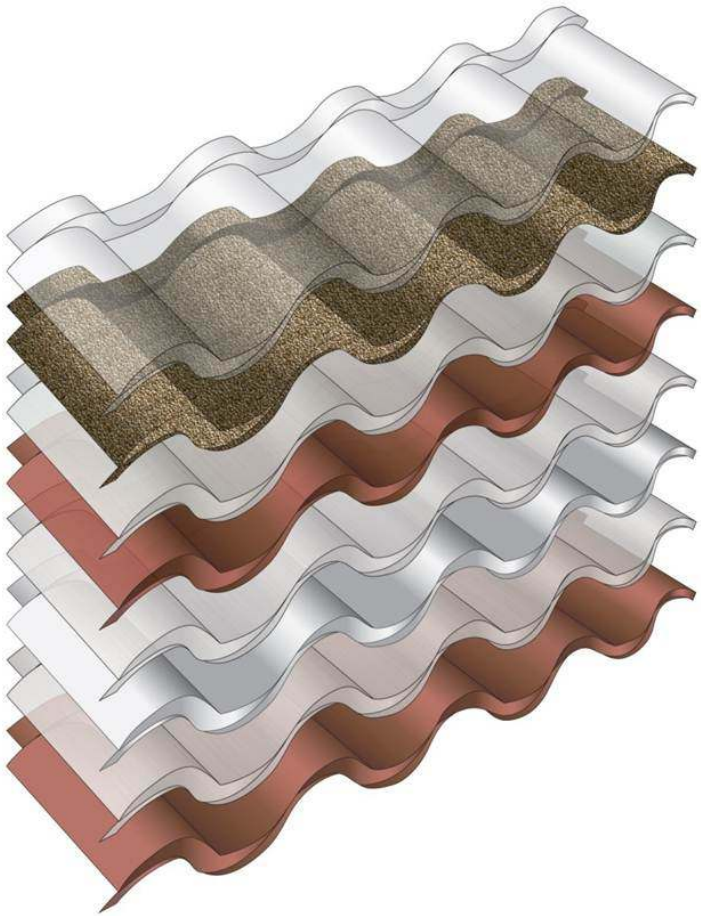
The dual coating of aluminum and zinc provides added protection to the steel; the aluminum provides corrosion resistance, while the self-healing properties of zinc protect the cut edges.

Aluminum-zinc alloy coated steel is known by the trade names Galvalume® and Zincalume®.

After protective coatings and granules are applied, the completed panel is coated with an overglaze before curing in an oven. This next section discusses the panel components and available panel profiles.

Panel Components

Stone coated steel roofing panels contain several protective layers; each of these layers serves the dual function of protection and adhesion for the next processing step.



Overglaze – semi-gloss finish; added protection

Stone Granules – color; UV resistance; coverage

Basecoat – adhesion; UV protection; color blended

Acrylic Primer – priming system; enhances adhesion

Aluminum-Zinc Alloy Coating – prevents corrosion; protection

Steel – 26-gauge; load-bearing; flexible

Aluminum-Zinc Alloy Coating – prevents corrosion; protection

Acrylic Primer – priming system; enhances adhesion

Panel Components

- **Steel**: The panels are made of 26-gauge structural grade steel with a minimum tensile strength of 37 ksi. Although they allow profile design without the risks of cracking, they are rigid enough to tolerate reasonable loads.

- **Aluminum-Zinc Alloy Coating:** Corrosion protection for the steel panels is achieved when, during the manufacturing process, the steel passes through a bath of molten aluminum-zinc alloy. By combining the protection and strength of both aluminum and zinc, exposed areas such as cut edges, drilled holes, and scratches are protected.

- **Acrylic Primer**: Immediately after the application of the aluminum-zinc coating, an acrylic primer is applied to both sides of the panel to enhance adhesion of the subsequent coatings.

Panel Components

- **Basecoat**: Formed with an acrylic resin binder, the basecoat is blended to match the color of the granules and serves two functions: 1) bonds the stone granules to the base steel, and 2) protects the underlying materials against water and harmful UV rays.

- **Stone Granules**: Providing a colorful finish, ceramic coated stone granules are applied in a way to guarantee maximum coverage of the basecoat, resulting in another layer of protection against water erosion. Additionally, they enhance the panel's resistance to UV light.

- **Overglaze**: An acrylic overglaze is applied as a final coating which not only enhances the panel's resistance to physical damage, but also provides the granules with a semi-gloss appearance.

Panel Profiles: Mediterranean Tile

Offered in a myriad of colors, this type of stone coated steel roof offers a lightweight alternative to traditional Mediterranean tile.

Panels are easily installed over a batten system using either 2x2 wood or steel hat section purlins.

Panel size, installed exposure, manufacturing techniques and installation methods vary by manufacturer. Make sure the product meets the criteria of the project.

Installation of stone coated steel roofs will be covered in more detail in Section 6, Installation Methods.

Panel Profiles: Barrel Tile or Italianate

While the Mediterranean tile is concave, this profile is convex with old-world Italian styling.

Products are available for use with either a direct-to-deck installation or a batten installation.

Panel size, installed exposure, manufacturing techniques and installation methods vary by manufacturer. Make sure the product meets the criteria of the project.

A product with a higher barrel profile will allow for better airflow, pulling more hot air away from the roof.

Panel Profiles: Shake

The shake profile has the beauty and richness of cedar shake combined with the durability and longevity of stone coated steel.

There are a variety of shake styles with different installed exposures, panel size, manufacturing techniques, and installation methods.

A product with a 12-⅝" installed exposure will more closely mimic the look of traditional wood shake.

One way to add strength is to corrugate the steel before the profile is stamped. Additionally, products are available for either a direct-to-deck installation or a batten installation.

Panel Profiles: Staggered Nose Shake

The newest profile to the market doesn't appear to be new at first glance. This profile takes detailing one step further and has a staggered nose that emulates handsplit wood shake.

The product is installed direct-to-deck and employs a unique clip at the back shelf and nose of the panel. The unique clip hides the fasteners so they are not outwardly visible.

Panel size, installed exposure, manufacturing techniques and installation methods vary by manufacturer, and not all offer a hidden fastening system.

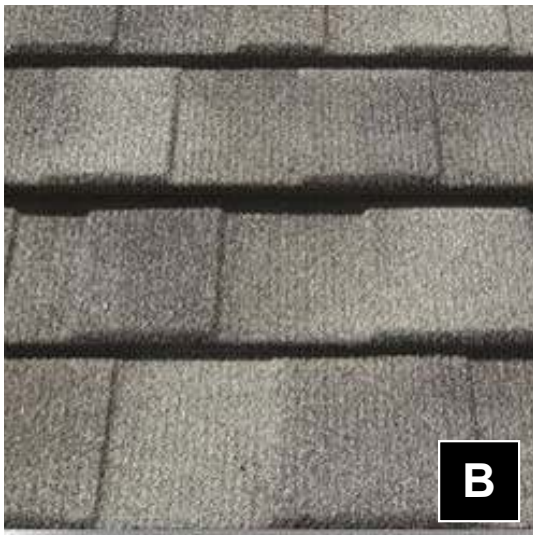
Panel Profiles: Shingle

The shingle profile is available in a traditional architectural shingle profile, but with two distinct color patterns emulating currently available asphalt shingle color patterns.

There is the more frequently seen shadow line (Image A) and the newer drop blends (Image B).

However, most of the shingle-style stone coated steel products are installed directly to the deck to more closely match the installation methods of asphalt shingles.

Panel size, installed exposure, manufacturing techniques and installation methods vary by manufacturer. Make sure the product meets the criteria of the project.



Panel Profiles: Shingle

Shingle-style, stone coated steel roofs are more lightweight and durable than traditional asphalt shingles and are available in a variety of colors.

Features and Benefits

Performance Benefits of Stone Coated Steel Roofing

Stone coated steel roofing panels are non-porous; with 0% water absorption, they can be specified for applications in freeze/thaw conditions. Furthermore, the design of the interlocking panels provides a watertight barrier, when designed with a minimum slope, that prevents water from leaking through the building envelope.

Available in a variety of profiles and colors, stone coated steel roofs are aesthetically appealing and require little maintenance; also, the panels are lightweight (125–150 lbs./sq.) and place no additional stress on the structure. The interlocking design helps to prevent leaks, and provides further stability during severe weather events and earthquakes.

With a lightweight, diverse product line and installation options, stone coated steel can be installed over most existing materials.

Durable, stone coated steel roofing products are Class A fire resistant, corrosion and Class 4 impact resistant.

Sustainable Benefits of Stone Coated Steel Roofing

Let's look at the sustainable characteristics of stone coated steel roofing.

As previously mentioned, stone coated steel roofing products have many sustainable attributes: the panels boast a clean manufacturing process, contain upwards of 30% recycled content, and are recyclable at end-of-life.

In most cases, tear-off of old roof material is not required, thereby diverting old materials from valuable landfill space.

Sustainable Benefits of Stone Coated Steel Roofing

Buildings create upwards of 136M tons of waste a year; using stone coated steel can reduce the amount of building waste going into landfills when used over the existing product.

Using stone coated steel reduces the number of new roof applications because of its long life cycle, thereby reducing use of raw materials to make new products.

No asphalt is used in the product so there is no harmful residue leaching into the groundwater; the water from the roof is potable.

Made of steel, the panels contain between 25-30% recycled material and are 100% recyclable at the end of useful life.

Natural Solution: Canada Summit Centre

The Canada Summit Centre was the site of the 36th annual Group of Eight (G-8) Summit.

The Canada Summit Centre is located in the pristine vacation area of Muskoka, which boasts clean and well-monitored freshwater.

Building styling and material selection were highly scrutinized in an effort to harmonize with the surrounding picturesque environment.

The architect chose stone coated steel for its clean lines, long life cycle and low environmental impact.

Unlike painted steel, the product will not have to be repainted to maintain its appearance, and there is no petroleum in the product so there is no harm to the surrounding groundwater.

Warranty

The warranty is exceptional when compared to most products. Due to the resiliency of stone coated steel roofs, they have a long life cycle backed by a Lifetime Limited Warranty, covering winds up to 120 mph and hail penetration.

Most manufacturers' warranties are non-prorated for the first 20 years, are transferrable, and cover manufacturing defects, including excessive granule loss.

Before specifying, review the manufacturer's warranty. Most do not warrant the work performed by contractors, and some require certified contractors for installation and repair for the warranty to be maintained.

In order for the wind warranty to be in effect, the roof must be installed in accordance with the manufacturer's instructions and specifications.

Case Study: St. Anthony's Retreat Center

What do you do with a failing fiber cement asbestos roof, knowing that its removal, handling, and dumping is not only time-intensive and expensive, but also poses serious health hazards?

This was the problem facing the Friars at St. Anthony's Retreat Center, built in 1919.

Once it was discovered that the price of removing the asbestos shingles negated the cost savings of installing traditional asphalt shingles, it became apparent that the asbestos roof would need to stay.

Case Study: St. Anthony's Retreat Center

Since the fiber cement tiles were heavy (500 lbs. per square), any additional weight added to the roof structure would need to be minimal.

For a successful installation, the new roofing material would have to be installed as a roof-over, be lightweight, and cost less to install than the asphalt shingle.

A stone coated steel roof (shingle profile), weighing only 125 lbs. per square, was chosen since the added weight of the product was minor and did not compromise the roof structure. By using a metal shingle, the asbestos would be completely encapsulated, making the roof-over more acceptable to the Environmental Protection Agency (EPA).

Although not required, an ice and water shield was applied over the cement tile for the safety of the installers. Screws were used to secure the stone coated steel roof panels to the deck through the cement tiles. Stone coated roofing provided an affordable and safe solution to what could have been a very expensive, but necessary, undertaking.

Standards and Testing

Overview: LEED® Certification

The U.S. Green Building Council (USGBC) is a 501(c)(3) non-profit organization composed of leaders from every sector of the building industry working to promote buildings and communities that are environmentally responsible, profitable and healthy places to live and work. USGBC developed the LEED (Leadership in Energy and Environmental Design) green building certification program, the nationally accepted benchmark for the design, construction, and operation of high performance green buildings.

LEED credit requirements cover the performance of materials in aggregate, not the performance of individual products or brands. Therefore, products that meet the LEED performance criteria can only contribute toward earning points needed for LEED certification; they cannot earn points individually toward LEED certification.

For detailed information about the council, their principles and programs, please visit www.usgbc.org.

Areas of Contribution for LEED

Specifying stone coated steel roofing systems can contribute to LEED (Leadership in Energy and Environmental Design) certification for your project:

- **Sustainable Sites - Heat Island:**
  Some manufacturers offer stone coated steel roofing systems and help reduce the heat island effect. The heat island effect is the term used to describe the phenomenon of urban regions that experience warmer temperatures compared to adjacent rural areas.

  As well, these products tend to meet the thermal emittance value of .8 to .9 under American Society for Testing and Materials (ASTM) E408. The emittance of a surface or material refers to its ability to release absorbed heat; the higher the number, the better the performance of the material.

  There were some updates to this credit in the 2009 version. A new formula has been introduced as an option for this credit which can allow materials with an SRI below 29 to qualify when the product is used on 75% or more of the roof. There will be further updates as LEED moves toward Version 4.

Areas of Contribution for LEED

- **Water Efficiency:**

  Stone coated steel roofing systems work well with captured rain systems for reduction in potable (municipally supplied) water waste. As well, water run-off meets or exceeds World Health Organization (WHO) standards.

- **Energy & Atmosphere:**

  Most colors and profiles of stone coated steel roofs could contribute to Energy & Atmosphere credits that address optimizing energy performance through the design of the building envelope. Results of a noteworthy study, conducted by Oak Ridge National Labs, suggest increased energy efficiency can be obtained with batten-installed roofing systems. Details of the study are found in Section 6 Installation Methods.

Areas of Contribution for LEED

- **Materials & Resources:**

  According to the Steel Recycling Institute, products that are manufactured using the basic oxygen furnace (BOF) have a total recycled content between 25-30%. Check with the manufacturer to ensure the product can contribute to this category.

  Packaging materials are typically recyclable and can contribute to the amount of construction waste that is recycled.

Possible qualification for regional materials credit could be available depending on the project location and its proximity to the manufacturing facility.

ENERGY STAR®

ENERGY STAR is a joint program of the U.S. Environmental Protection Agency (EPA) and the U.S. Department of Energy that is dedicated to decreasing energy use through energy efficient products and practices.

To meet ENERGY STAR compliance, reflective roof products must have equal or superior warranty to comparable non-reflective roof products.

Currently, the initial solar reflectance must be greater than or equal to .25, and third-year solar reflectance greater than or equal to .15. It's recommended you refer to the ENERGY STAR website for up-to-date standard information.

LEED and ENERGY STAR Testing

LEED and ENERGY STAR use ASTM standards to test the following characteristics of stone coated steel roofing systems:

- **Emittance**:
  ASTM E408
- **Absorptance, Reflectance & Transmittance**:
  ASTM E903
- **Solar Reflectance**:
  ASTM E1980

Performance Testing

Other performance characteristics of stone coated steel roofing systems are tested using Underwriters Laboratories Inc. (UL) and ASTM standards:

- **Fire Rated (A, B, and C):**
  UL 790 and ASTM E108
- **Hail (Class 4):**
  UL 2218
- **Uplift (Class 90):**
  UL 580 and UL 1897
- **Accelerated Weathering**:
  ASTM G26 and ASTM G90
- **Salt/Fog:**
  ASTM B117

Fire rating test

Impact resistance standards

Installation Methods

Introduction

In this section of the course, the three installation methods of stone coated steel roofing systems will be presented:

- Batten System
- Counter Batten System
- Direct-to-Deck System

Other topics include deck preparation, installation accessories, and the benefits of above-sheathing ventilation for energy efficiency.

Underlayment and Fasteners

An underlayment is always recommended to be consistent with local building code requirements. Please review manufacturer's instructions for product-specific details.

An ice and water shield is recommended for applications in cold climates to address freeze/thaw conditions, or as required by local code.

In most cases, roof slopes less than 3:12 are deemed decorative, and the steel panels must be installed over a roof system complying with local codes.

Underlayment and Fasteners

While steel is a non-combustible material, certain underlayments are required to achieve a Class A, B or C rating for the roof system. See manufacturer's ICC Report for specific information.

In most instances, either screws or nails can be used to fasten panels.

In high wind areas, additional fasteners might be needed to meet local building codes.

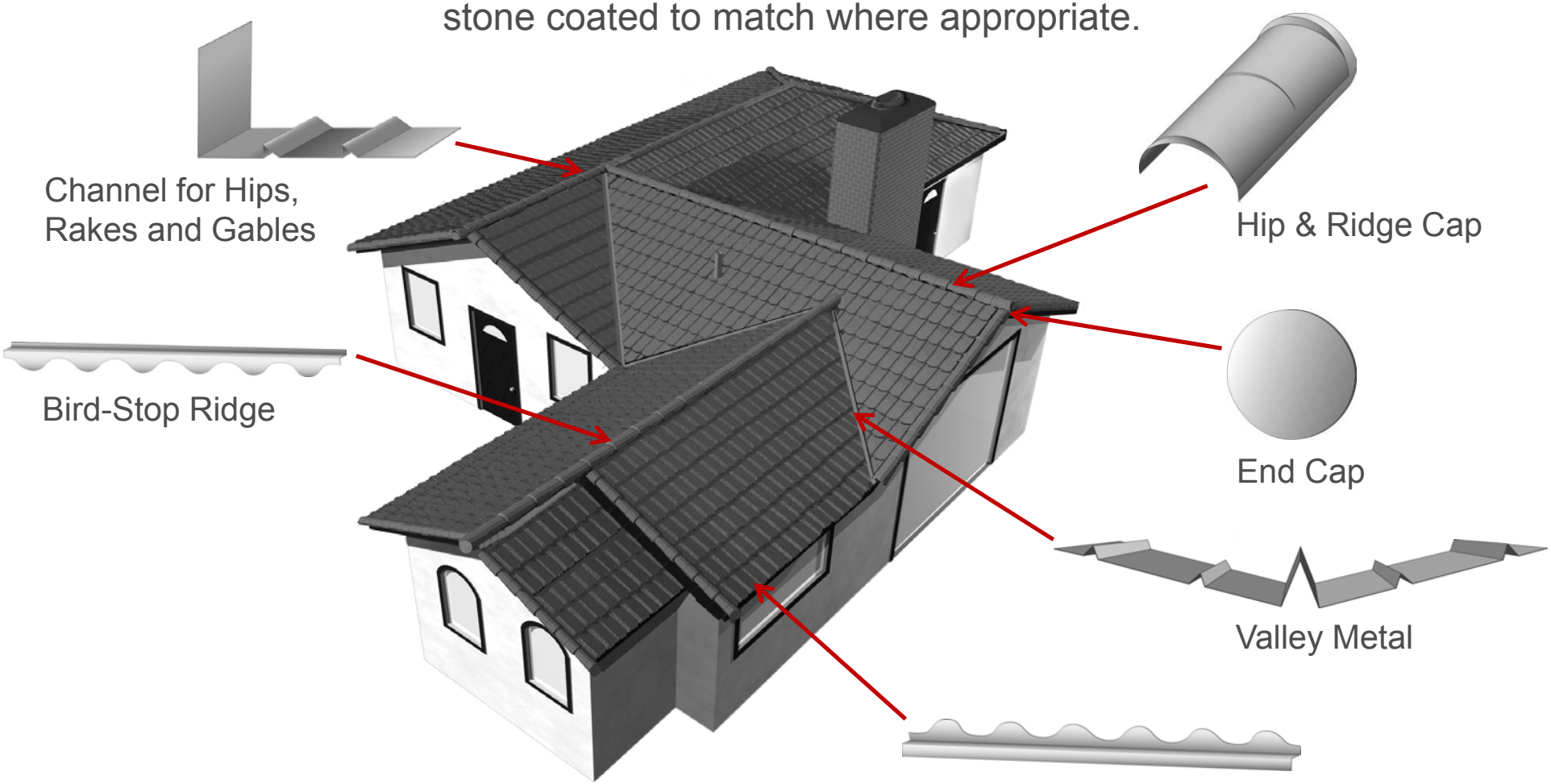
Dissimilar Materials

A galvanic breakdown will occur if copper or lead is used with an aluminum-zinc alloy coated steel roofing system.

A galvanic breakdown occurs when two dissimilar metals, in contact with one another, come in contact with an electrolyte, such as water. For example, the run-off from this copper turret could cause the aluminum-zinc coated steel to corrode.

Available Accessories

This is an example of the pieces that are available for use with a barrel tile system, stone coated to match where appropriate.



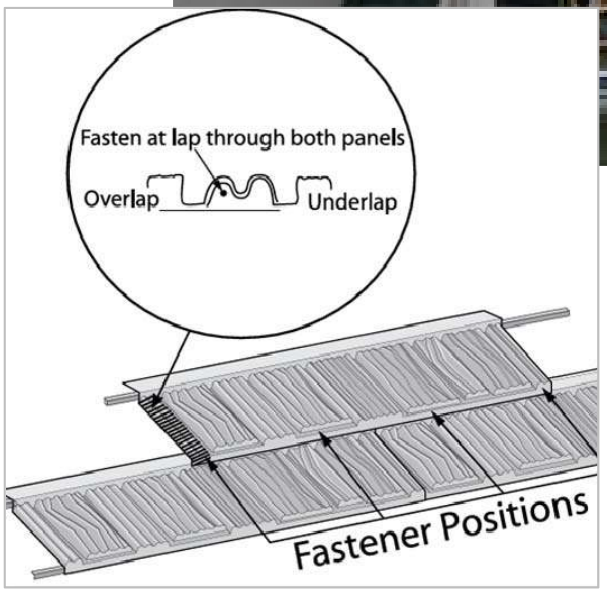
Batten System

As previously mentioned, some stone coated steel roofs can be installed over a batten system using either 2x2 wood or steel hat section purlins.

Wood battens need to be attached to supports spaced a maximum of 24" on center.

Steel purlin sections should be a minimum height of 1-½" and formed from minimum .017" thick galvanized steel, designed to resist the design loads.

Batten spacing will be determined by the profile and product chosen.



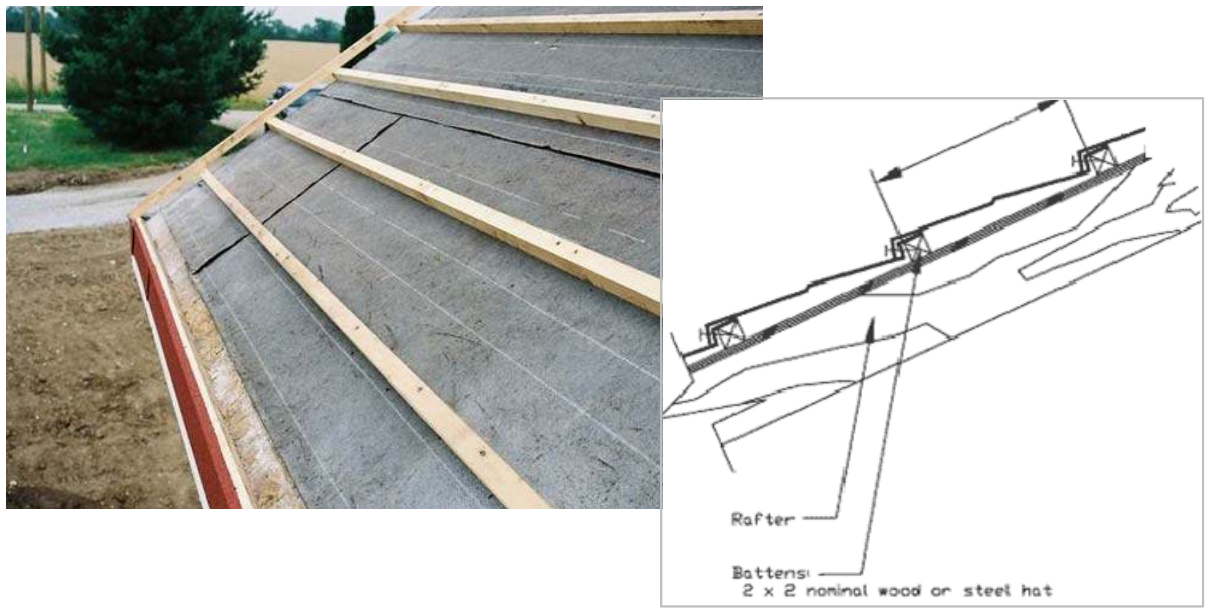
Benefits of a Batten System

When roofing over existing materials, a batten system offers ease of installation. Panels are installed from the top down; battens act as a ladder, providing added safety for the installers and resulting in less foot traffic on the face of the panels.

Panels are nose-fastened rather than top-fastened, providing added strength for high wind areas. Furthermore, fewer fasteners are required for a batten system versus a direct-to-deck installation, resulting in savings of time and labor.

As well, insulation can be added between the battens to increase thermal insulation and reduce energy use.

Battens permit airflow under the panels and, as a result, provide better ventilation. The air space resulting from a batten system works well for a cold roof design and for heat dissipation.



Counter Batten System

Counter battens are used to level the surface of the deck when installing over an existing roof, irregular surface, or skip/spaced sheathing.

Since a counter batten system offers many of the same benefits as a batten system, choosing to use one system versus another is dictated by the project requirements.

The use of counter battens in conjunction with battens can increase the airflow more than battens alone and can contribute additional energy savings.

Case Study: Integrated Solar System with a Batten System

This is an historical house in Providence, RI built in 1879 by Pardon Bosworth. The owners wanted to maintain the historical appeal, but also wanted to address rising energy costs.

An alternative to solar panels is a solar thermal collector system that installs under the roofing material horizontally between the battens. The system requires the roofing product to be offset from the deck so the system is integrated into the roof under the material. This system, by Dawn Solar, is a solar hot water system that uses heat from the sun to heat the water in the home. In addition, as the water is pumped through the system, the cooler water flowing within the tubing on the roof aids in cooling the attic.

The battens not only provided a casing for the solar product, they also solved another problem: the stability of the roof frame and the uneven deck. The battens leveled the roof and provided structural integrity and shear strength.

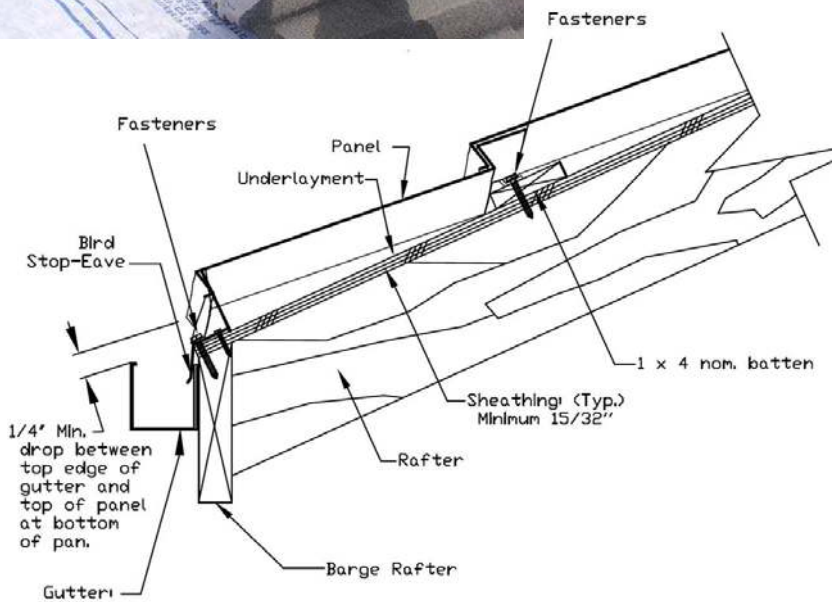
Direct-to-Deck System Without Battens

Some stone coated steel roofing panels can be installed direct-to-deck without battens.

With this method of installation, panels are laid out and fastened as you go along, starting at the fascia and working up to the ridge.

While a battenless system reduces the number of installation steps, this installation method might not be appropriate for every project. And, it might not be a choice depending on the product chosen.

While it depends on the product chosen, additional fasteners could be required in a direct-to-deck application.



Benefits of Above-Sheathing Ventilation

Oak Ridge National Labs conducted a study (commissioned by the Department of Energy's Buildings Technologies Program) on infrared-blocking color pigments. The DOE was interested in the possible benefits of using "cool" pigment in roofing materials, especially stone coated steel roofs, since IR-blocking granules are highly emissive and reflective.

Ten decks were tested for one year to include both summer and winter conditions:

- The control deck was covered in dark grey asphalt shingles applied direct-to-deck.
- One deck was painted metal and fastened direct-to-deck.
- Two decks were stone coated with dark grey conventional (no IR-blocking) granules on counter batten and/or batten systems.
- Six decks were stone coated with light grey IR-pigment granules and applied on counter batten and/or batten systems.

Venting was achieved with mesh-covered openings at the eave and at the ridge.

Benefits of Above-Sheathing Ventilation

Here are the results of the study:

- IR-pigments returned expected results. Heat transfer was reduced by approximately 45% when compared to the control deck (asphalt shingles); however, only 15% could be attributed to the IR-pigment granules—30% was attributed to batten/counter batten installation (above-sheathing ventilation).

- When the decks coated with conventional dark grey granules (similar in reflectance and emittance to the asphalt shingles) were compared to the control deck (asphalt shingles), heat transfer was still reduced by the venting created with the batten/ counter batten installation.

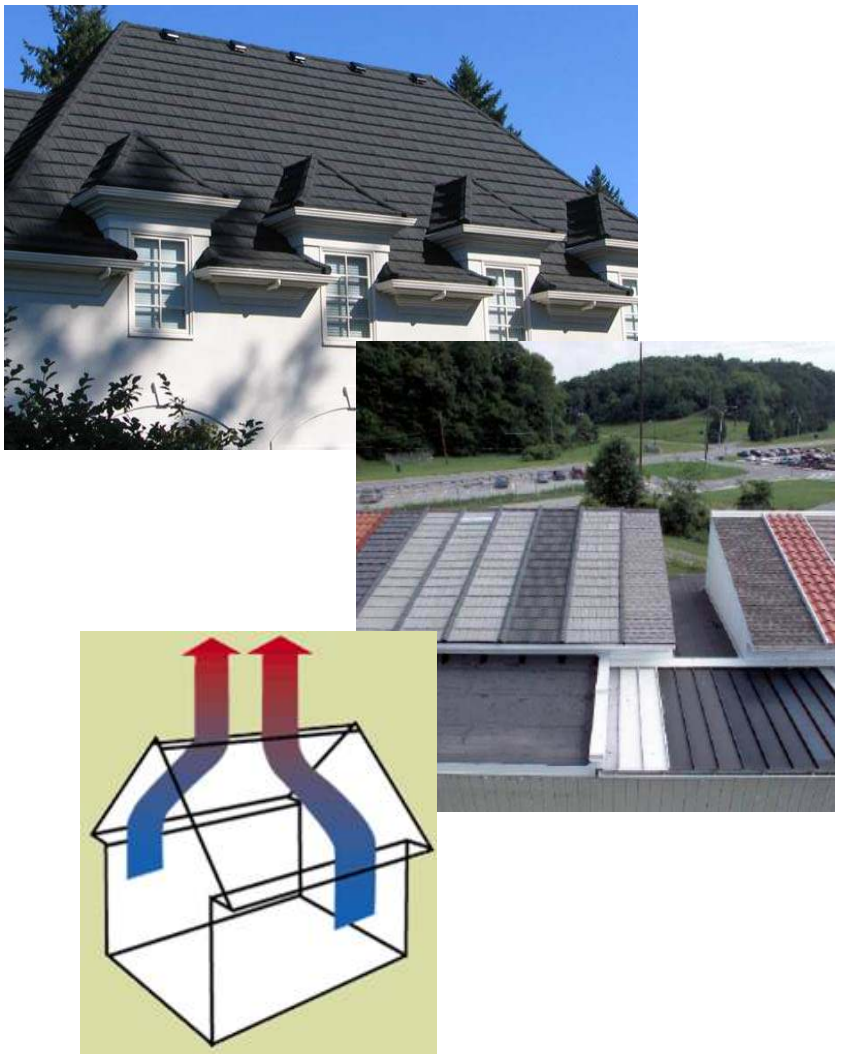
- When the light grey IR-pigment stone coated panels were compared to the dark grey conventional stone coated panels (both installed on a batten/counter batten system), it was noted that the panels with the dark grey conventional granules swept away more than twice the amount of heat flow than the IR-pigment granular coated panels; the heat produced by the darker pigment granules increased the amount of hot air swept away from the deck, preventing it from entering the attic.

Benefits of Above-Sheathing Ventilation

- In winter conditions, all of the test decks installed on battens/counter battens reduced heat loss that takes place on a cold night better than the asphalt shingles applied directly to the deck, thereby negating the winter heating penalty associated with cool roof constructions.

- As indicated by the results of this study, there is a potential tradeoff between solar reflectance and above-sheathing ventilation when modeling for energy efficiency.

- The test concluded that “venting of the stone coated metal roofs is just as important as the boost in solar reflectance for reducing the heat gain into the attic and conditioned space.”



Benefits of Above-Sheathing Ventilation

Based on the findings from the previous study, Oak Ridge National Labs conducted an additional study to determine the solar reflective value of the air space.

- The control deck was a metal roof with a solar reflective value of .40 fastened directly to the deck.
- AtticSim/EnergyPlus was used to compare the data across climates.
- Nine climates were studied: Miami, Austin, Atlanta, Baltimore, Chicago, Minneapolis, Fargo, Fairbanks, and Sacramento.

Benefits of Above-Sheathing Ventilation

Here are the results of the study with regards to stone coated steel:

- With an air space greater than or equal to ¾", the stone coated steel granule can be black and still have a seasonal cooling load that is less than the cool metal roof with an SR of .25.
- With an air space of 1-½" the stone coated steel needs a solar reflectance of about .10 to match the cooling load of a .40-SR cool roof fastened directly to the deck.
- Therefore, the 1-½" air space can account for as much as .30 SR value, meaning the SR value of the panel can be lower than a .10.
- Factors other than color can contribute to the energy efficiency of a roof design.

Case Studies

Presbyterian Camp & Conference Center – Big Bear Lake, California

When the Main Lodge Building of the Presbyterian Camp & Conference Center required a major renovation and reroof of its existing aluminum panel roof, the architect faced several challenges:

1. The replacement roof would have to withstand high winds, heavy snow loads, and extreme freeze/thaw conditions common to the area. The building—built in 1914, on the shoreline of a 6,200-acre lake, at an elevation of 6,700 feet—required a durable new roof that could endure the harsh mountain weather.

2. Due to the construction practices of the early 1900's, the architect concluded that any disruption of the underlayers of redwood shingle and composition shingle could cause expensive or even irreparable damage to the building substrate.

3. To decrease the stress on the roof's truss system and structure, the new roof would need to be lightweight.

Presbyterian Camp & Conference Center – Big Bear Lake, California

After careful analysis, it was decided that the best solution was to tear off the aluminum roofing material, leave the redwood and composition layers, and install a stone coated steel roofing system.

Specifying the shake profile not only maintained but enhanced the rustic appearance of the lodge and provided the necessary performance requirements for the application.

Cesar Chavez Middle School – Oceanside, California

A $34 million campus with 38 classrooms was built to eliminate crowding at another local school.

Located in a residential area, the architect wanted a roofing product that blended with the surrounding neighborhood, yet offered the performance of a steel roof.

The shake profile chosen complemented the clean look of the Craftsman-style school. In addition to the visual appeal, the school required a low maintenance product with a long life cycle.

By choosing a stone coated steel roof over a typical asphalt shingle, the school was not placed in a short-term reroof situation in the coming years.

Condominium Project – Ottawa, Ontario

This case study exemplifies the performance and longevity of stone coated steel roofing systems.

In 1978, the 3,000-square-foot composition shingled roof on this building was replaced with a stone coated steel roofing system (Mediterranean tile profile).

Installed on a batten system, the panels were fastened into the battens horizontally through the nose of the panel, rather than vertically through the face like other roofing materials.

This method provides greater wind resistance because the nail would have to be sheared apart in order for the panel to lift up.

Condominium Project – Ottawa, Ontario

The flexible and lightweight characteristics of steel enabled this roofing system to be used for this mansard and turret application.

The garnet-hued tiles covering the building's turrets and mansard contribute to the classic architectural aesthetics of the building.

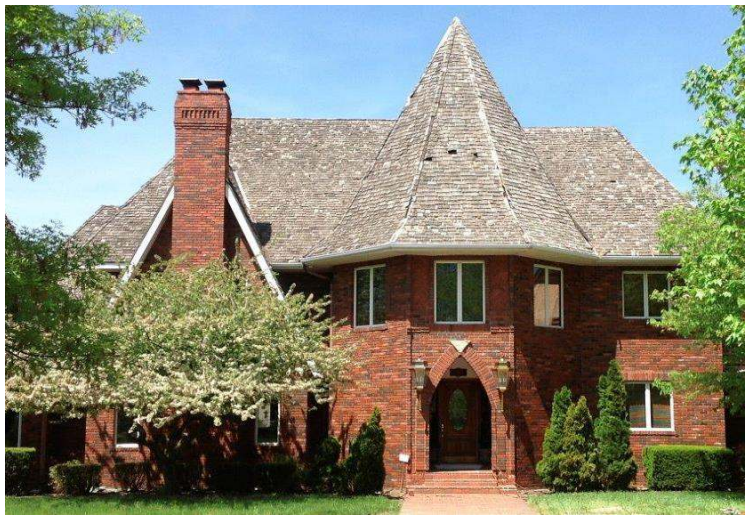
More than thirty years later, the ceramic coated granules have not faded or degraded even though they are subjected to Canada's harsh weather conditions.

Summary

Important Points: Performance

Stone coated steel roofing installs easily over most existing materials and offers several advantages over traditional roofing materials:

- 50+ Year Life Span/Low Life Cycle Costs
- Fire Rated Material (Class A): UL 790 and ASTM E108
- Freeze/Thaw Resistant - does not absorb water
- Wind Warranted up to 120 mph
- Product is made of steel and is Hail Resistant (Class 4): UL 2218
- Interlocking Design Prevents Leaks
- Durable and Lightweight
- Foot Traffic Permitted



Important Points: Sustainable

Sustainability is at the forefront right now. Stone coated steel can contribute to the sustainability of a home or building:

- Contains recycled content and can be recycled at end-of-life.
- When installed over current roofing, old material is diverted from the landfill.
- Stone coated steel is durable and requires little to no maintenance.
- Reduction in heat gain into the conditioned spaces is possible using a batten and/or counter batten system.
- There are no petroleum products used in the product, so there is no harm to the groundwater and the water run-off is potable.

Important Points

Stone coated steel roofing products are also tested for:

- Uplift (Class 90): UL 580 and UL 1897
- Accelerated Weathering: ASTM G26 and ASTM G90
- Salt/Fog: ASTM B117

Stone coated steel roofing is available in a variety of profiles simulating the traditional looks of asphalt, wood shake, Mediterranean and Roman tile.

Specifying some types of stone coated steel roofing systems can contribute LEED certification points to your project and meet ENERGY STAR requirements.

Depending on the application and profile type, stone coated steel roofing panels can be installed using either a batten, counter batten, or direct-to-deck system without battens.

As indicated by the results of the Oak Ridge National Laboratory study, there is a potential tradeoff between solar reflectance and above-sheathing ventilation when modeling for energy efficiency.

Additional Information

Other sources of information pertaining to sustainability and stone coated roofing systems include:

- Leadership in Energy and Environmental Design (LEED) - www.usgbc.org
- ENERGY STAR - www.energystar.gov