



An Introduction to Slate Roofing

Presented by

 **GREENSTONE SLATE**®

Vermont Architectural Roofing Slate

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The background of the slide is a close-up photograph of a stone wall. The stones are light-colored and have a rough, textured surface. Several dark, weathered wooden beams or logs are laid across the wall, creating a grid-like pattern. In the center-right area, there is a small wooden wheel with a handle, possibly a part of a traditional tool or mechanism. The lighting is somewhat dim, giving the scene a rustic and historical feel.

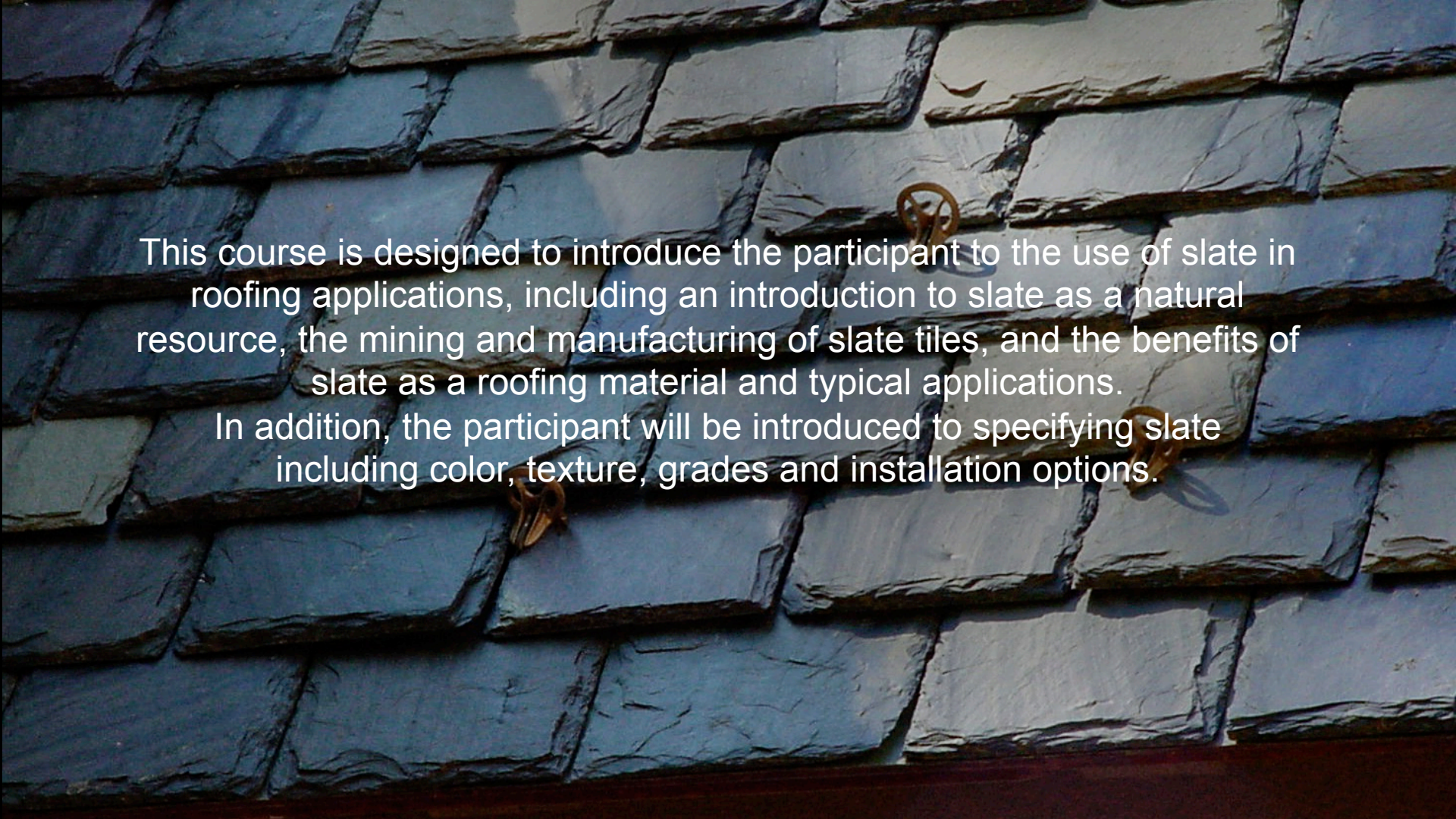
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This course is designed to introduce the participant to the use of slate in roofing applications, including an introduction to slate as a natural resource, the mining and manufacturing of slate tiles, and the benefits of slate as a roofing material and typical applications.

In addition, the participant will be introduced to specifying slate including color, texture, grades and installation options.

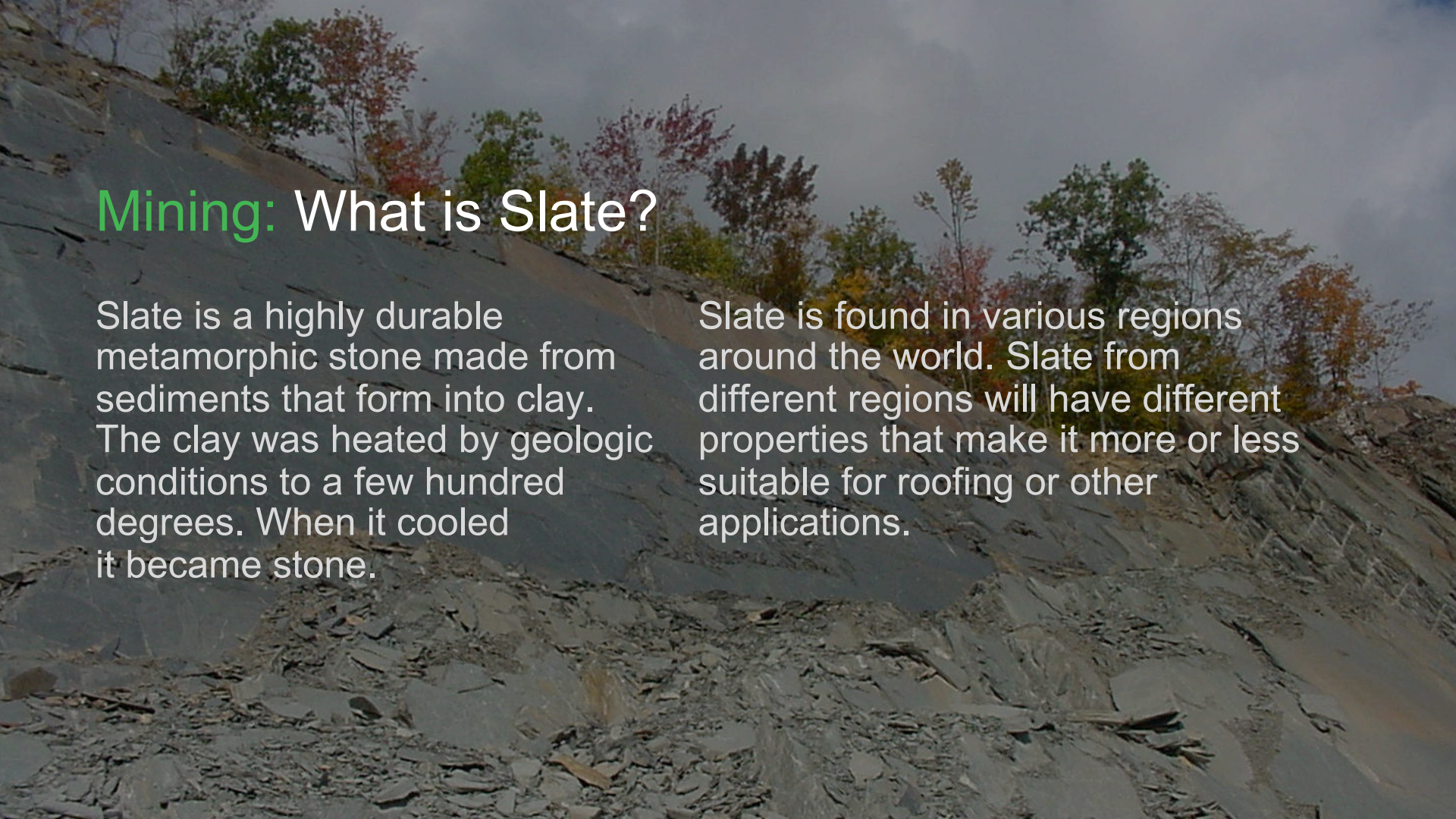


Learning objectives

1. At the end of this course participants will be able to discuss slate fundamentals: slate as a resource, slate manufacturing and as a building material, and the environmental implications of using slate as a roofing material.
2. Participants will also be able to recognize when the use of slate is appropriate in building design or renovation.
3. Course participants will be able to identify slate characteristics, and key information needed for the purpose of specifying slate
4. Participants will gain an introductory knowledge of slate roof installation.



Slate as a Roofing Material



Mining: What is Slate?

Slate is a highly durable metamorphic stone made from sediments that form into clay. The clay was heated by geologic conditions to a few hundred degrees. When it cooled it became stone.

Slate is found in various regions around the world. Slate from different regions will have different properties that make it more or less suitable for roofing or other applications.

Mining: Slate is a natural raw material

Slate is mined and removed from the slate quarry in slabs.



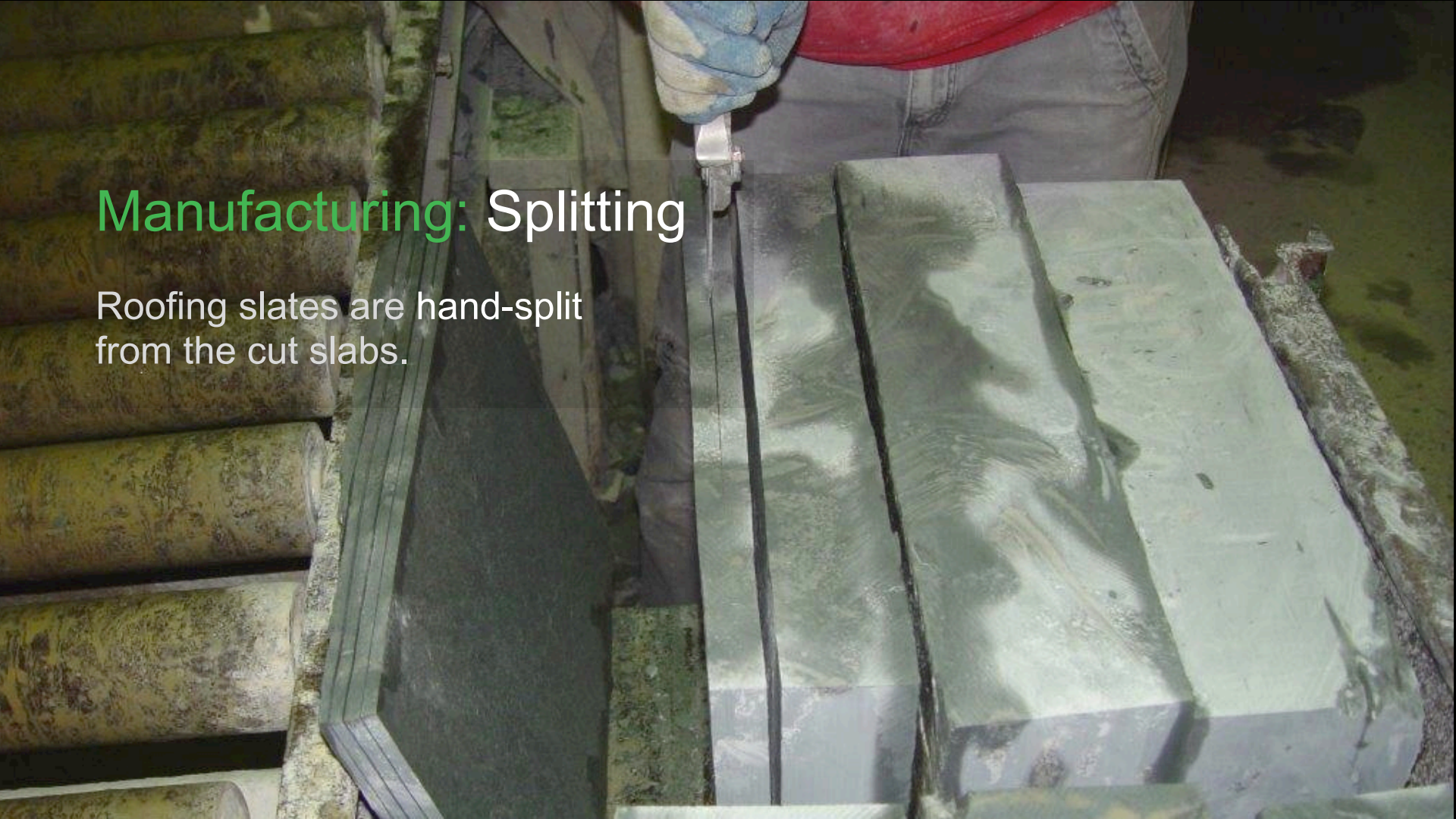


Manufacturing: Slate slabs are cut

Using diamond tipped blades, the slabs of slate are cut down to manageable pieces.

Manufacturing: Splitting

Roofing slates are hand-split from the cut slabs.



Manufacturing: Trimming

And then precision trimmed either by hand or by machine.





Manufacturing: Inventory

Slates are loaded on pallets and stored, ready to ship.



Manufacturing: Shipping

Slate is shipped on pallets via truck.

Slate Characteristics:

Slate has strong physical attributes

- Longevity – A slate roof can easily last a century and usually much longer



An S-1 slate roof has at least a 75-year lifespan.
Photo courtesy of Hathaway Farm, Rutland, Vermont

Slate Characteristics:

Slate has strong physical attributes

- Slate is unaffected by weather extremes
- Tolerates temperature fluctuations and severe weather events
- Some slate is Miami-Dade accepted for hurricane zones
- Slate is very dense and does not absorb water



High tolerance to weather extremes

Slate Characteristics:

Slate has strong physical attributes

- 100% fire proof: exceeds all standards for fire resistance
- Since slate is stone, it simply doesn't burn



Slate is fireproof

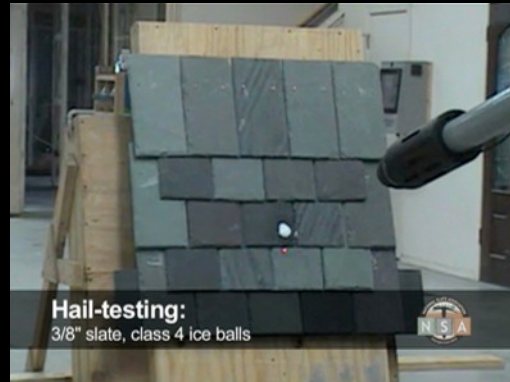
Slate Characteristics:

Slate has strong physical attributes

- Hail is a major cause of roof damage each year.
- Slate offers excellent hail resistance
- S-1 slate has been tested to withstand class 4 ice balls in simulated severe storm conditions.



Damaged ceramic tile roof



Hail-testing:
3/8" slate, class 4 ice balls

Independent slate strength testing using an ice ball cannon

Slate Characteristics:

Slate has strong physical attributes

- Slate is impervious to mold, mildew and insects
- Lightweight genuine slate roof systems can weigh less than 6 lbs per sq/ft — making them well suited to replace most cedar shake roofs.



Infested Cedar Shake Roof

Slate Characteristics:

ASTM Engineering Standards

Slate is rated for performance through independent testing for water absorption, weather resistance and flexure, resulting in three primary slate grades

- S-1 – more than 75 years
- S-2 – 40 to 75 years
- S-3 – 20 to 40 years



Standards Worldwide - Home

astm.org

Sustainability

Slate does not require chemicals in manufacturing

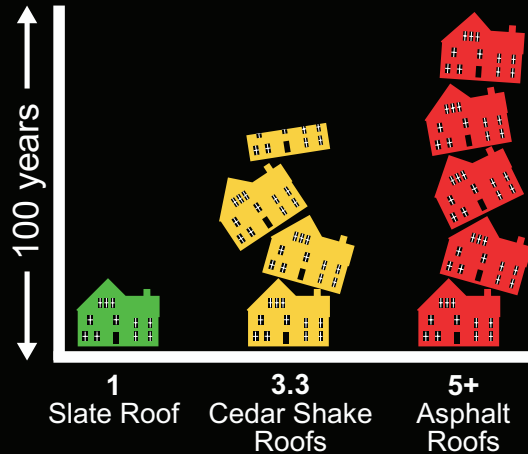
- Slate is natural stone
- More durable than any man-made roofing material



Sustainability

Easy on landfills

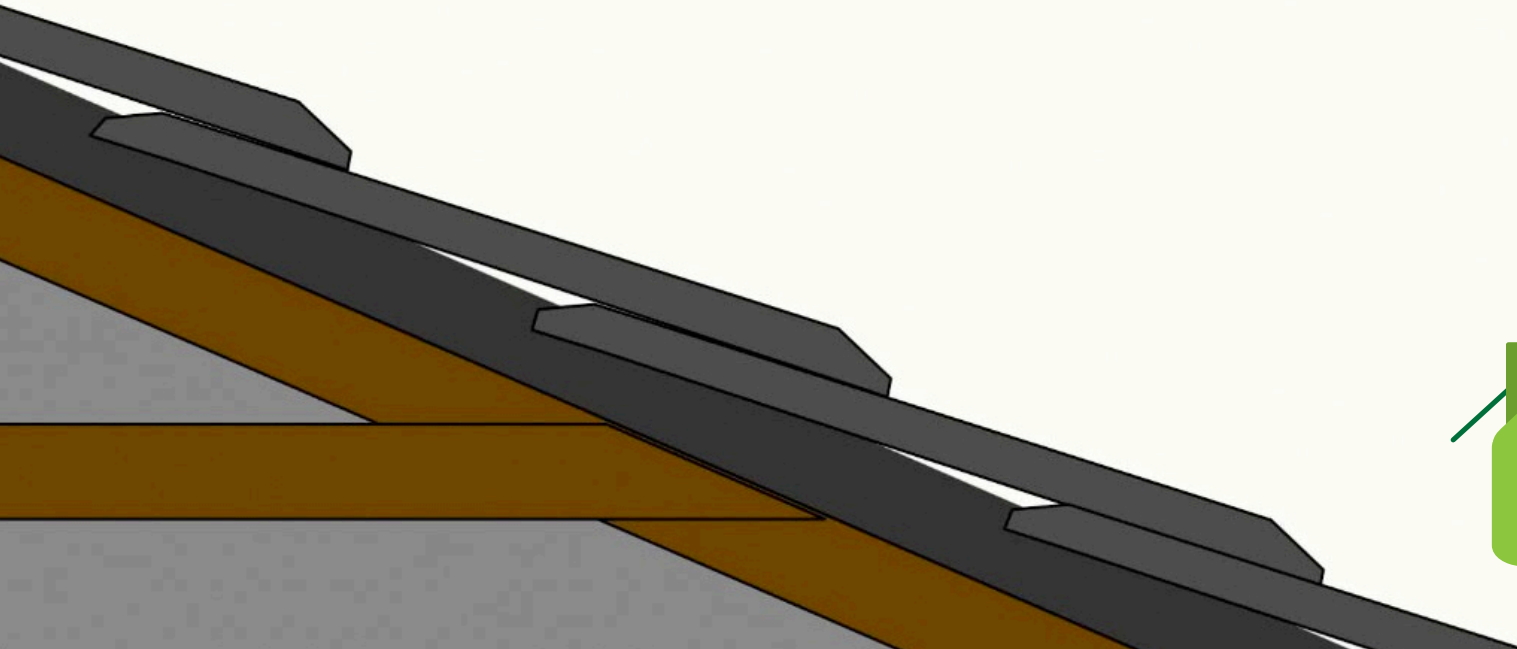
- A slate roof can still be in service after **FIVE** or more asphalt roofs have worn out and been thrown away



Sustainability

Thermal stability

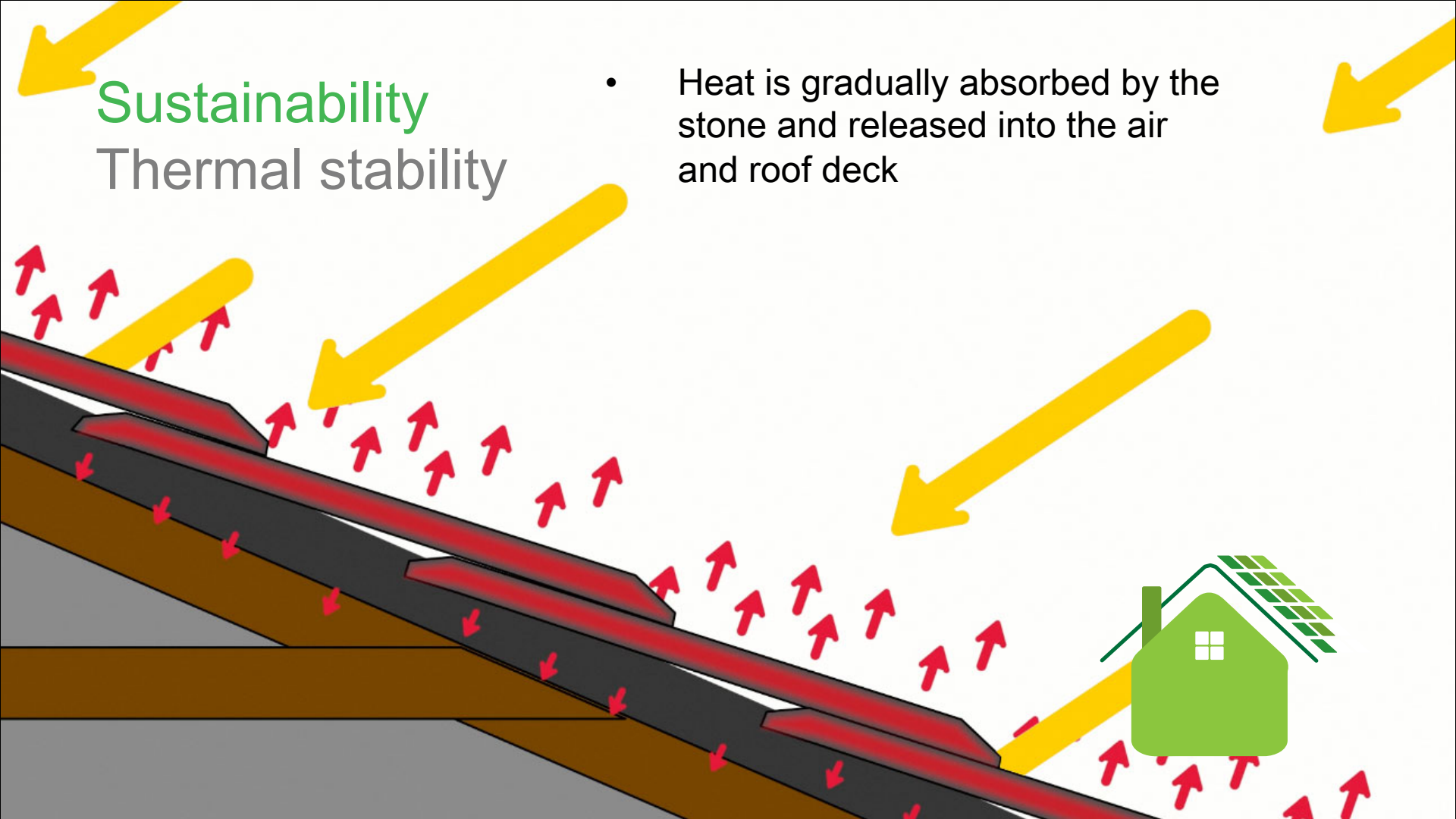
- Slate's density helps stabilize temperature inside the building



Sustainability

Thermal stability

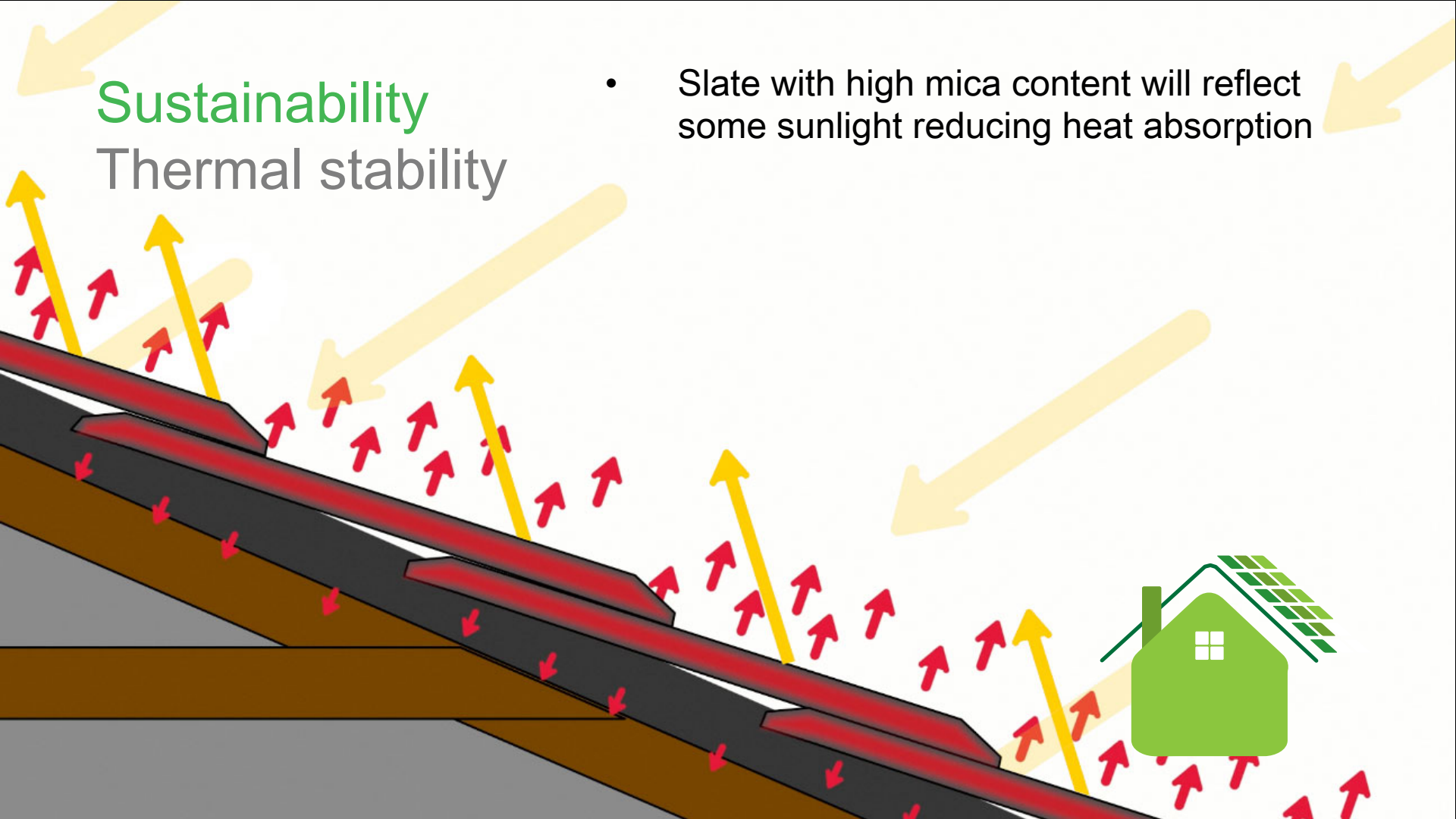
- Heat is gradually absorbed by the stone and released into the air and roof deck



Sustainability

Thermal stability

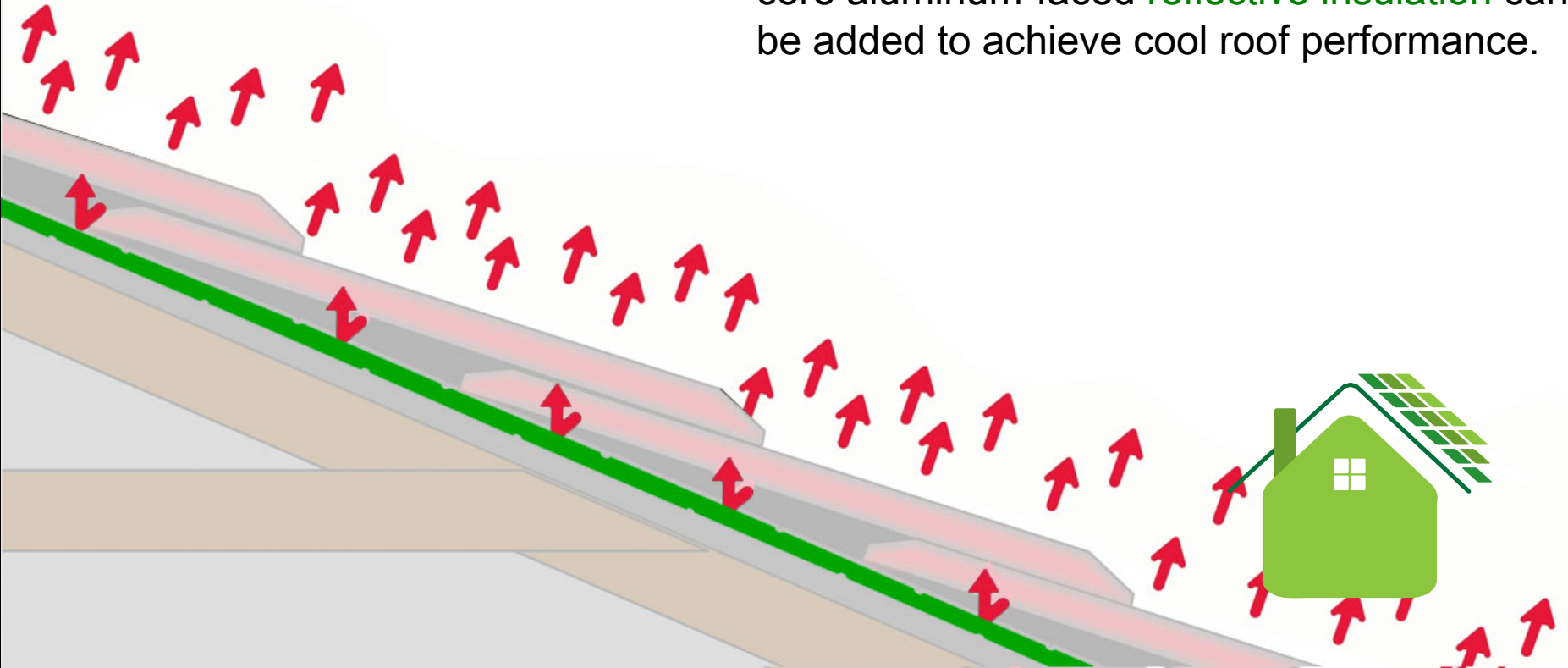
- Slate with high mica content will reflect some sunlight reducing heat absorption



Sustainability

Thermal stability

- In zones where heat conduction into the building interior must be minimized or a “cool roof” is specified, a layer of polyethylene core aluminum-faced **reflective insulation** can be added to achieve cool roof performance.





Applications:

Slate is particularly appropriate for large institutional projects where the aesthetic appeal of slate is desired and the budget exists to take advantage of the low cost of ownership that is attained through longevity and enhanced property value.




Applications:

Slate is also often the material of choice for upscale residences where the aesthetic appeal is also desired. These property owners can also take advantage of the low cost of ownership that is attained through slates's longevity and enhanced property value.



Applications:

Thanks to new installation technologies, genuine slate is being used more widely in new construction and renovation / re-roofing projects. These new installation systems use approximately 40% less slate (final weight less than 6 lbs/sqft) — reducing material cost and costs related to structural support. This allows projects that were traditionally limited to utilizing asphalt or cedar shakes the opportunity to take advantage of slate roofing.

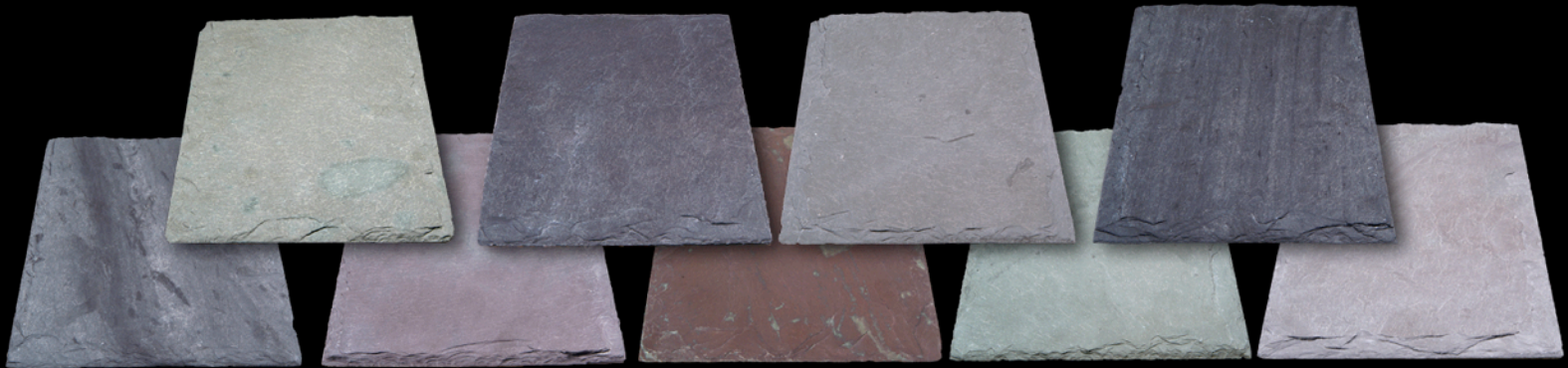


Specifying slate

Slate options

Color Selection

Slate is never artificially colored. Its color is determined naturally by geological conditions at its formation. Just as slate from different regions vary in durability, it will also vary in color. Slate also varies in its color retention. Some slate is very consistent or “non-weathering” while some exhibit new shades of color over time and are known as “semi-weathering”. Shown here are colors found in Vermont quarries.



Slate options

Color Selection

Slate's natural colors can be mixed in endless combinations to create a particular hue to match a design or environment. There are computer simulations for slate color selection. Depending on the intention of the designer, the positioning of the building to viewpoints, and surrounding geography, the roof can become an important visual element.



Slate options

Grades of slate

Slate is graded by the thickness, uniformity in thickness, and texture

- Standard Grade “Selects” are a very uniform 1/4" thick and have a fine texture.
- Rough Texture Grade slates exhibit unique natural texture and vary from 1/4" to 3/8" with prominent grain definition.
- Architectural Grade slates have the same characteristics as rough texture with more dynamic grain and texture with thicknesses from 3/8" to 1/2".
- Heavy Grade slates are similar in character to architectural grade and offer more overall roof texture with thickness variation from 1/2" to 3/4".
- Estate Grade slates exhibit the greatest dynamic range in texture and aesthetic appeal in a stone roof as well as extended longevity, with all slates at least 3/4" thick.

Slate options

Slate Width: Random vs Uniform

A uniform slate roof:

- Comprised of slates of one length and width, with square cut butts. Thickness may vary slightly due to the fact that slate is hand split into slate tiles.
- Uniformly spaced horizontal courses with carefully aligned alternating vertical joints.

A random width slate roof:

- Comprised of slates of one length and thickness but vary in width.
- They are laid in horizontal courses with randomly spaced vertical joints.
- The random width roof may use as few as two widths or as many as eight widths to create the desired appearance.

Random width slate installations are often favored for aesthetic appeal. While the material layout for these installations will require more forethought and preparation, in most cases the actual application of slates is less taxing.

Slate options

Slate Width: Random vs Uniform



Random width slate roof



Uniform width slate roof

Estimating Slate: Nails / Fasteners

- Copper wire slating nails are the most widely used fastener for slate roofs.
- They are available in several lengths, shank diameter sizes, and with smooth or annular ring shanks.
- Slating nails should be long enough to accommodate the thickness of two layers of slate shingles, the underlayment system and a minimum of 3/4" into the wood deck.

Other fastening methods include: slate hooks, clips, wire and wire ties



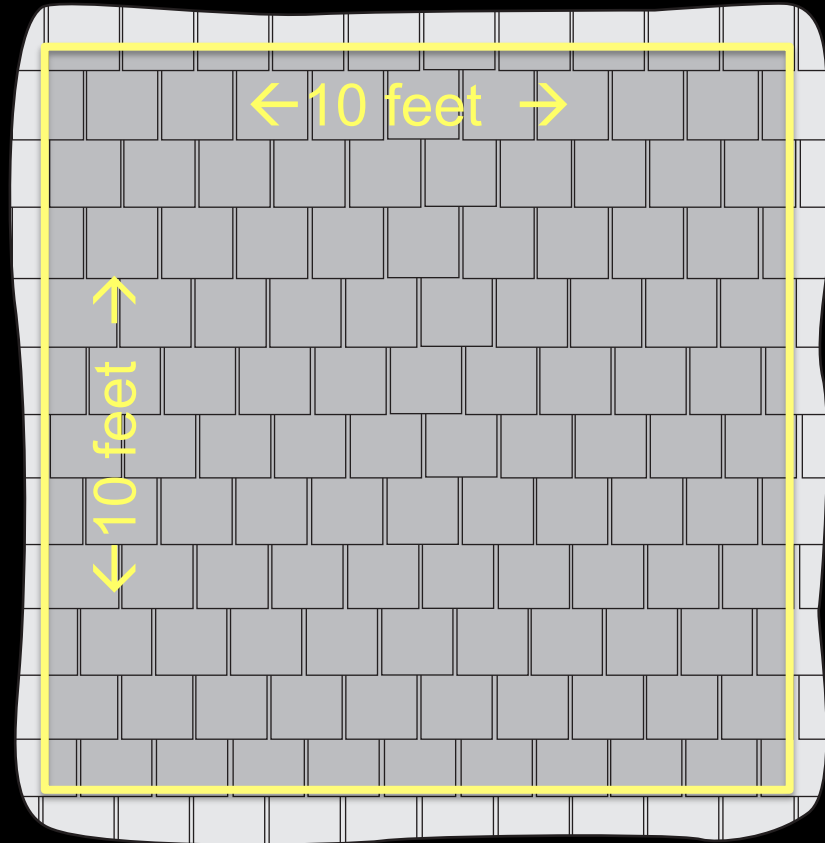
Estimating Slate

Determining a SQUARE of slate

Like any other roof, the surface area must be determined. Once this is known, the number of “squares” of slate needed is determined as follows:

1 square of slate = 100 square feet

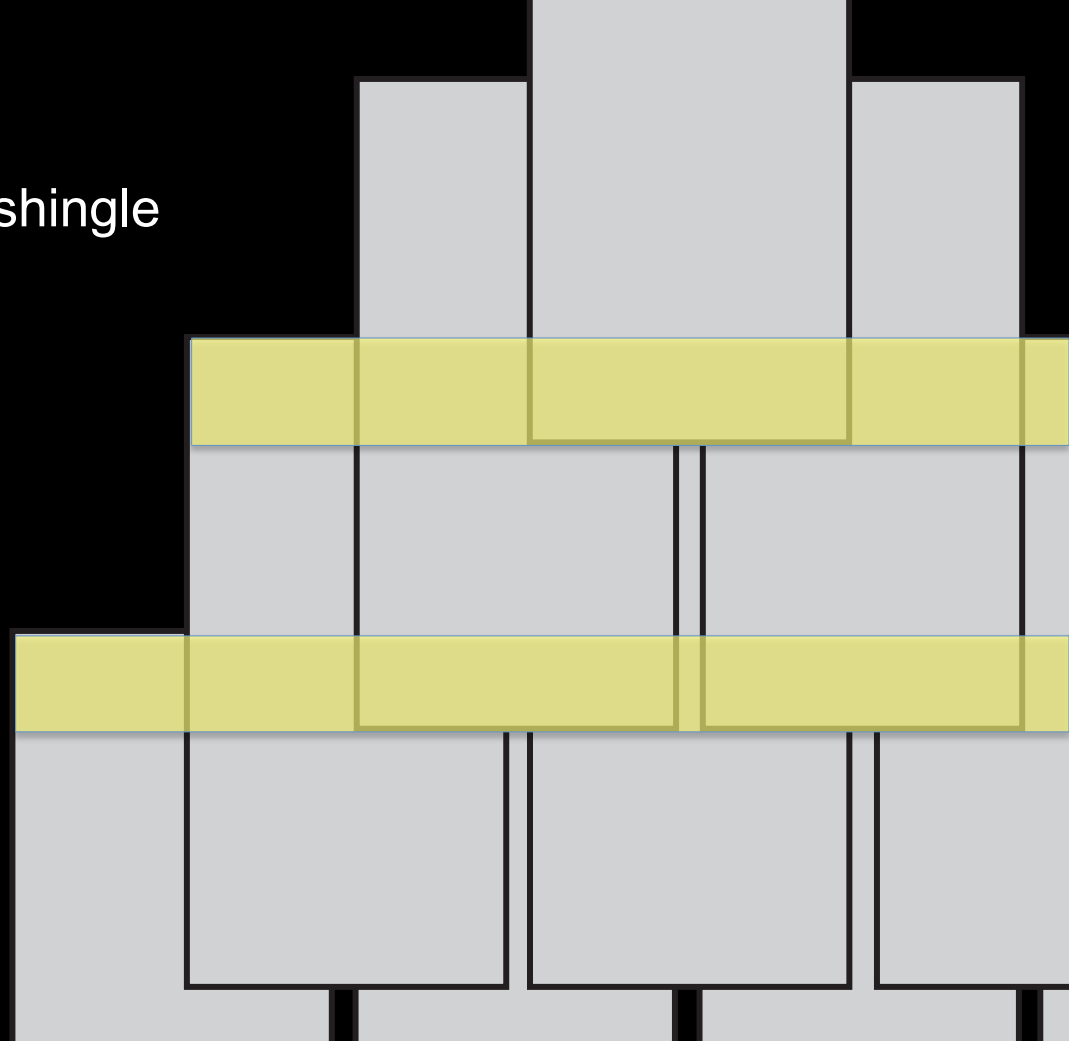
This *includes* allowance for the standard 3 inch double HEADLAP.



Estimating Slate

HEADLAP is the area of slate shingle overlap.

A 3" inch headlap is the North American standard



Estimating Slate

Appropriate headlap is essential

- A slate roof depends on proper overlap of the slates, both at the top and on the sides, to effectively shed water.
- Headlap is the amount of overlap at the top portion of slate that is covered by the two successive courses. There is a triple thickness of slates at these locations.
- Proper headlap prevents moisture from migrating in over the top of the slates.
- Standard North American headlap is 3 inches for roofs with a slope between 8:12 and 20:12. Less than 8:12 = 4 inch headlap, more than 20:12 = 2 inch headlap.
- Headlap can be adjusted to suit conditions, but the quarrier/distributor needs to be notified so they can drill the nail-holes accordingly.

Estimating Slate

Slate Weight

The density of slate contributes to indoor temperature stabilization. Its density makes it heavier than most other roofing materials, particularly in traditional-style slate roof installations. Therefore the overall roof weight must be considered. Each “square” of slate covers 100 square feet.

Slate Grade	Pounds (LBS) per square	LBS per sq ft
Standard Grade “Selects”	680 — 780	6.8 — 7.8
Rough Texture Grade	800 — 1000	8.0 — 10.0
Architectural Grade	1200 — 1600	12.0 — 16.0
Heavy Grade	1800 — 2200	18.0 — 22.0
Estate Grade	2500 — 3000	25.0 — 30.0

Estimating Slate: Slate Sizing Chart

It is useful to know the number of slates per square when determining an installation estimate. The following chart is a reference when using a 3-inch double headlap.

slate size pcs/sq	slate size pcs/sq	slate size pcs/sq	slate size pcs/sq
12 x 6 533.3	14 x 7 374.0	16 x 8 276.9	18 x 9 213.3
12 x 7 457.1	14 x 8 327.3	16 x 9 246.2	18 x 10 192.0
12 x 8 400.0	14 x 9 290.0	16 x 10 221.5	18 x 11 174.5
12 x 9 355.6	14 x 10 261.8	16 x 11 201.4	18 x 12 160.0
12 x 10 320.0	14 x 11 238.0	16 x 12 184.6	18 x 14 137.1
12 x 11 290.9	14 x 12 218.2	16 x 14 158.2	
12 x 12 266.7	14 x 14 187.0		
slate size pcs/sq	slate size pcs/sq	slate size pcs/sq	
10 x 10 169.4	22 x 11 137.8	24 x 12 114.3	
20 x 11 154.0	22 x 12 126.3	24 x 14 98.0	
20 x 12 141.2	22 x 14 108.3		
20 x 14 121.0			

Estimating Slate: Hips and Ridges

Measurements are taken to determine the lengths of ridges, hips and other areas that require placing cut slates .

In general, allow:

1 square of slate for each 100 linear feet of cut work

Breakage

Be sure to include an allowance for breakage that may occur in moving or cutting slate. General rule of thumb:

Add 5% over the project total.

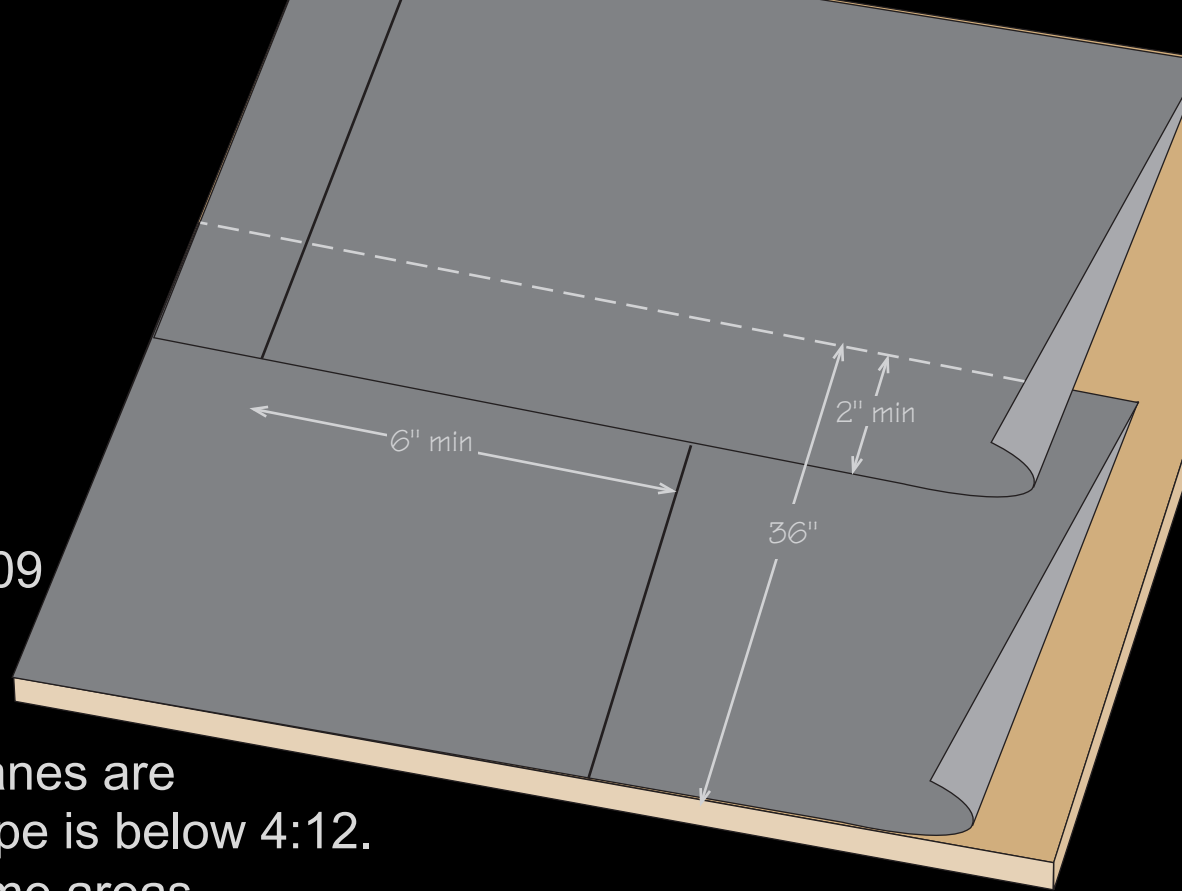


Estimating Slate: Underlayment

The most common underlayment used is non-perforated asphalt felt.

The underlayment should meet ASTM D226/D226M-09 designation which is the equivalent of #30 felt.

Ice dam protection membranes are an alternative when the slope is below 4:12. It is required by code in some areas.



Application of felt underlayment

Estimating Slate: Flashing

When flashing a slate roof the lifespan of the roof is an important consideration.

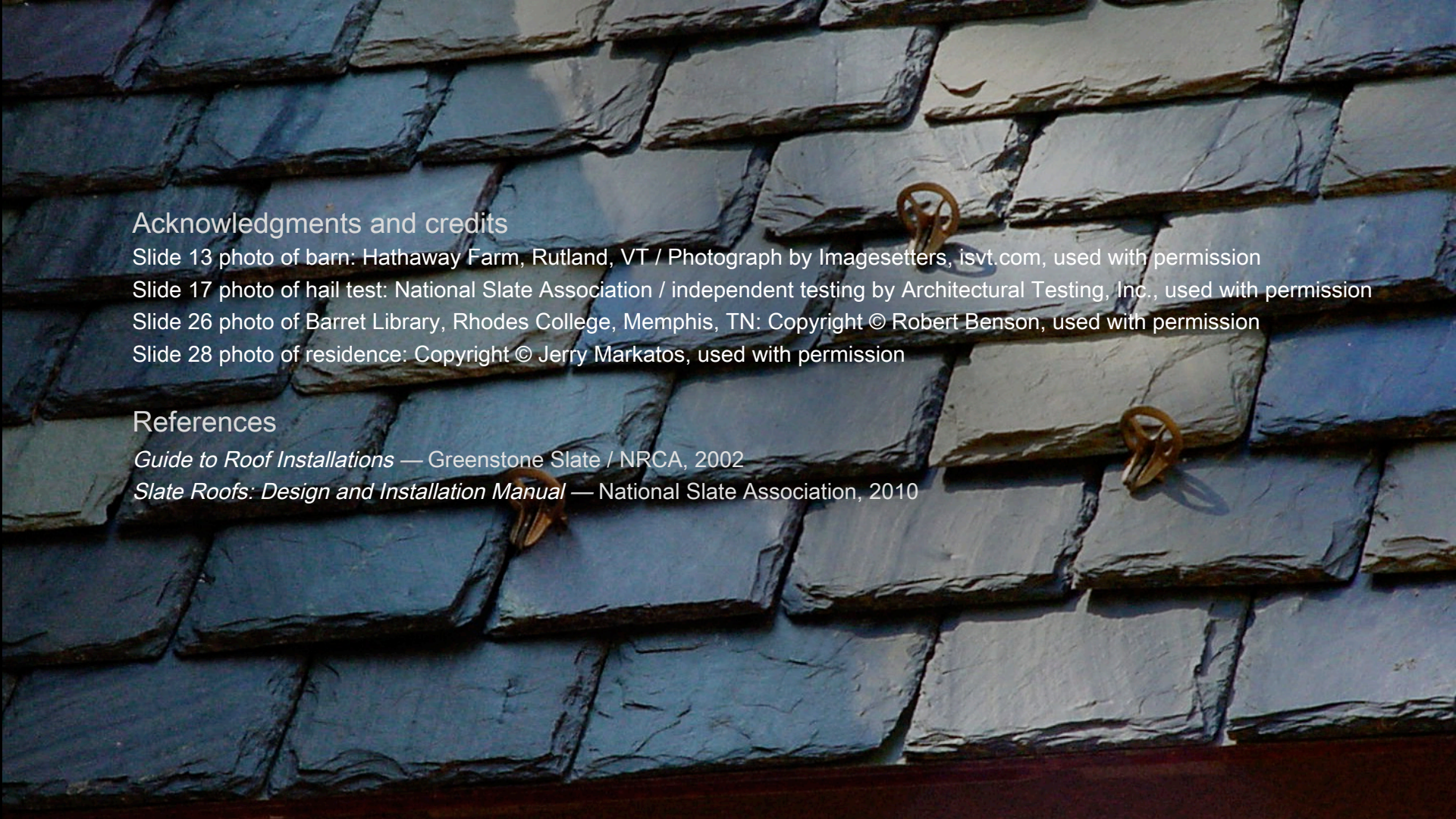
- The location on a roof determines its exposure to weather and sunlight. Greater exposure and wear (such as valleys) will require greater flashing thickness.
- Copper is widely used for its ease of fabrication, solder-ability, longevity, and appearance.



Estimating Slate: Flashing

- Stainless steel and tin-zinc alloy coated stainless steel (TCS II) have a longer service life, but are more difficult to apply.
- Terne metal and galvanized steel are a minimum standard but will require more maintenance (paint, etc).
- Lead has long history of use, but will fatigue and creep.
- Aluminum is rarely used.



A close-up photograph of a slate roof. The image shows several rows of dark grey, rectangular slate tiles. Between the rows, there are horizontal wooden batten strips. Three copper-colored metal fasteners, which look like small rings or clips, are visible, securing the batten strips to the roof structure. The lighting is bright, creating shadows and highlights on the textured surfaces of the slate and wood.

Acknowledgments and credits

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Slide 28 photo of residence: Copyright © Jerry Markatos, used with permission

References

Guide to Roof Installations — Greenstone Slate / NRCA, 2002

Slate Roofs: Design and Installation Manual — National Slate Association, 2010



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