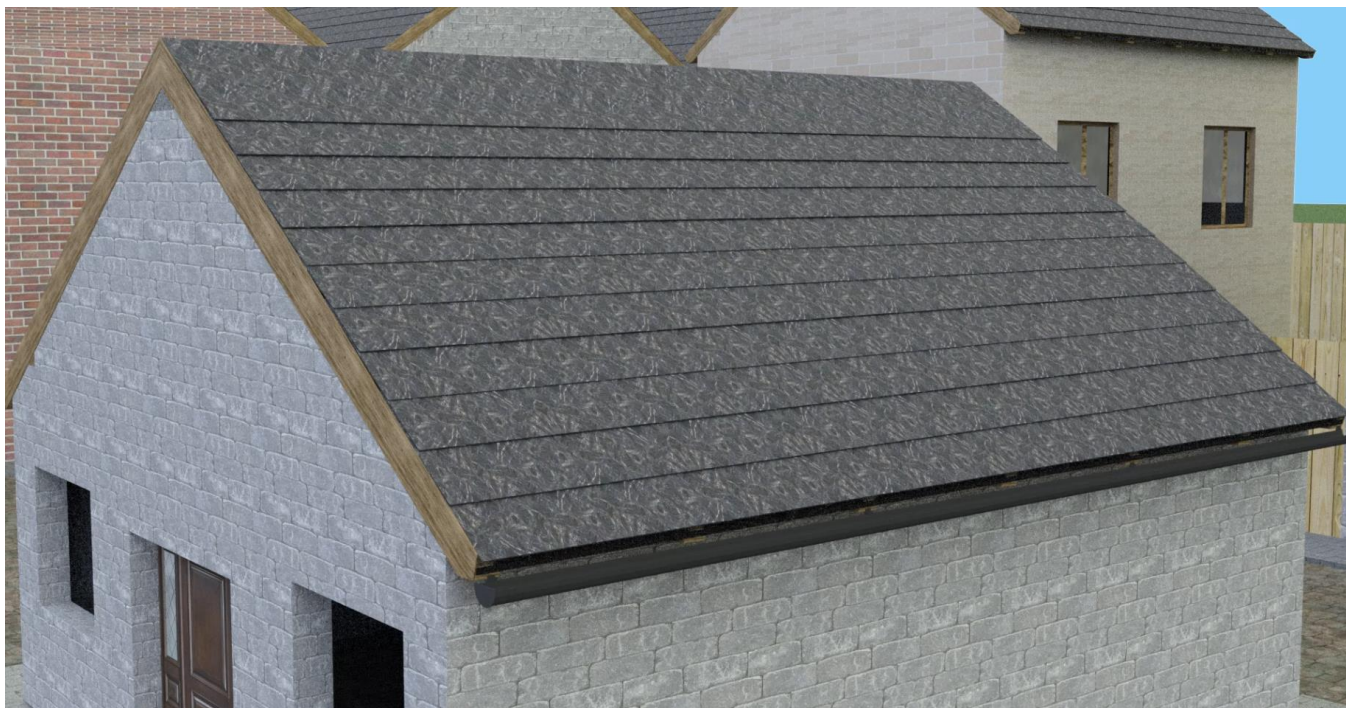


REPORT 1.2.1

BEST PRACTICE REPORT ON METHODS, SKILLS AND COMPETENCES IN RELATION TO STONE PRODUCTS

CONSTRUCTION PROCESS OF A VENTILATED SLATE ROOF



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1. INTRODUCTION

The BIMstone project was born from the fusion of three lines of action whose convergence is to consolidate a didactic material base for the training in the stone sector. These three lines of actions are:

- BIM (Building Information Modeling).
- LCA (Life Cycle Assessment).
- Digitisation of stone products placement methodologies.

The European Commission is focused on the construction sector on the criteria of smart growth (knowledge and innovation-based development and economy) and inclusive growth (ensuring social and territorial cohesion through employment).

According to the above context, the general aim of BIMstone project is to increase the skills of workers in the field of placing the stone products particularly in placing different type of floors and walls in buildings and urban environments, in order to increase the quality of the final work, the permanence of the work and the environmental sustainability, by using methods without non-recyclable and/or eco-friendly materials. For that reason, it is necessary to define and compile the most suitable execution systems and placement methods for stone products.

The first task of the BIMstone project "O1. *Establishment of common learning outcomes on stone placing methods, Life Cycle Analysis (LCA) and regulations*" encompasses a number of specific tasks among which we find the elaboration of this report.

This best practice report addresses the establishment of skills and competencies, as well as the definition of the most sustainable and environmentally friendly implementation processes.

Of all the natural stone construction elements selected in this project, this report focuses on the construction of a ventilated slate roof, describing in detail some of their characteristics, both constructive and environmental, and the construction process to be followed to achieve an optimum result.

2. ENVIRONMENTAL CONSIDERATIONS

The Environmental Product Declarations (EPDs) are the clearest, most rigorous and internationally accepted way to provide the environmental profile of a product throughout its life cycle.

The EPD “**Environmental Product Declaration according to ISO 14025 for Slate Rathscheck Slate and Roofing Systems**” (“*Umwelt-Produktdeklaration nach ISO 14025 für Schiefer Rathscheck Schiefer und Dach-Systeme*”) include natural stone products which main function is for ornamental use to cover exterior surfaces, such as walls and roofs. It has been verified and published by IBU (www.bau-umwelt.com).

This declaration is an environmental product declaration according to / ISO 14025 / and describes the environmental performance of roof and facade slate products from Rathscheck Schiefer. It is intended to promote the development of environmentally and health-friendly construction. All relevant environmental data is disclosed in this validated declaration. The declaration is based on the PCR document "Schiefer", 2009-11.



The life cycle assessment was carried out in accordance with / DIN EN ISO 14040 / and / DIN EN ISO 14044 / the requirements of the IBU guide to type III declarations and the specific rules for slate. Specific data of the examined products as well as data from the "GaBi 4" database were used as the database. The life cycle assessment encompasses the life cycle stages of raw material and energy extraction, production including transport, and the production and thermal recycling of packaging.

Slate is a weather-resistant and ideally fissile rock, the predominant components of which are leaf silicates. Leaf silicates, on the other hand, consist of minerals, which are in the form of platelets in a very fine grain size and arranged in layers. Slate has extensive slate formation, which is the result of a very weak to weak rock metamorphosis due to tectonic pressure.

3. CONSTRUCTIVE CONSIDERATIONS

Slate roofing has a very long tradition that goes back many centuries. Slate is a very easy to split natural stone, which is made available to us by nature and for the creation of which no energy is used. Energy is only required for quarrying and processing.

Slate is not flammable and contains no pollutants, making it a particularly good building material in terms of environmental protection. The excellent properties of the slate, in particular the impermeability to water and high resistance to weather influences. The long service life of the slate roofing and the environmentally friendly properties of the slate make it a preferred construction material

Prefabricated slate (standard formats) and raw slate (accessory formats) are available for the different roof coverings. Slate roof coverings are laid directly on wooden roof boarding or on roof battens. The required thermal insulation is usually installed between the rafters. In the case of roof areas that are not used for living rooms, the thermal insulation is alternatively laid on the top floor.

When planning and executing, the recognized rules of the technology are to be observed, which can be found in the regulations of the roofing slaters. Requirements for roof slate are regulated in the European product standards EN 12326-1 and -2. In addition, many suppliers of slate offer their own leaflets (e.g. the Slate-Bible from Rathscheck) for detailed planning and execution.

Slates for roof coverings are available in various forms, such as scale or rectangular formats. The standard roof inclinations of the rafters and the slip-ons on the eaves depend on the different types of covering.

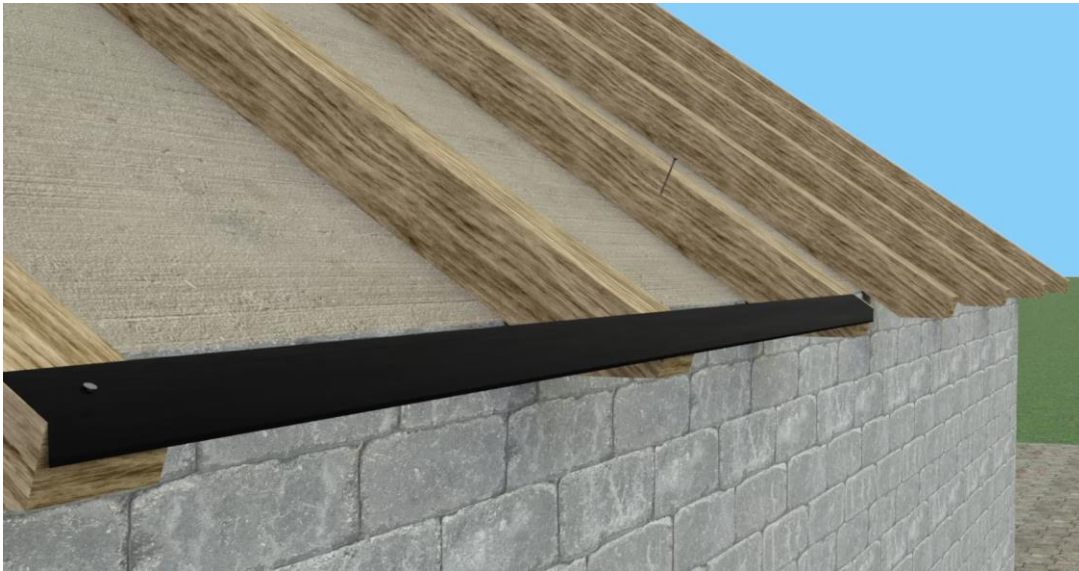


Installation of ventilated slate roof.
SOURCE: Primero/Sven-Erik Tornow.

4. CONSTRUCTION PROCESS

4.1 Waterproof blanket

A waterproof blanket is laid on the rafters from bottom to top with overlapping joints.
A first batten with waterproofing coating is placed at the lower end of the vertical battens.



Source: BIMstone project website.

The first waterproofing blanket is placed on the underside and is fitted to the initially laid waterproofing batten.



Source: BIMstone project website.



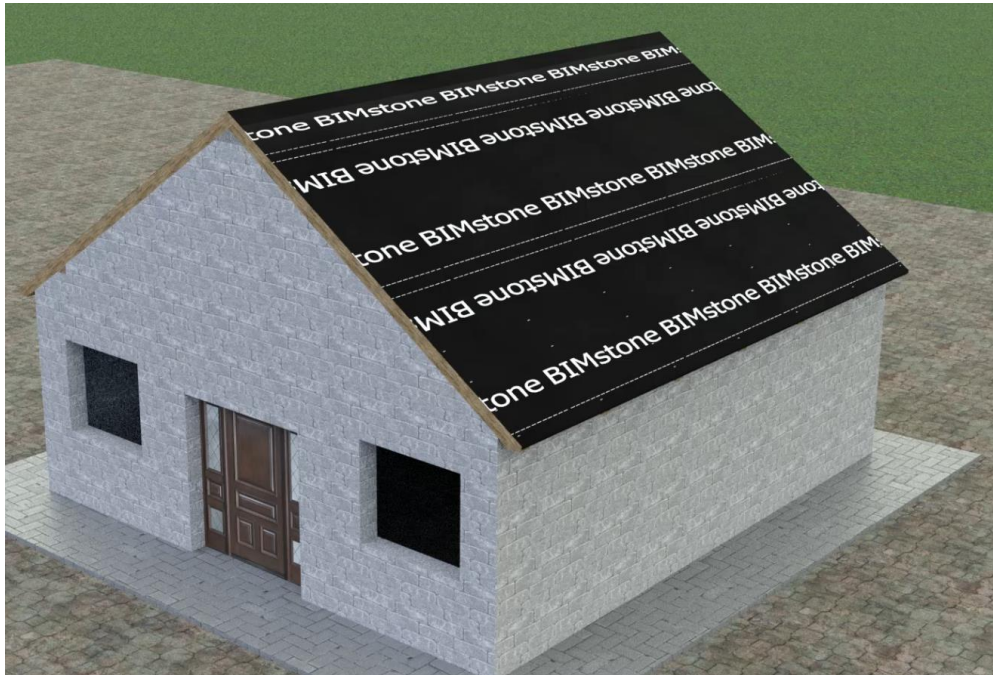
Source: BIMstone project website.

The waterproofing blanket is fixed at the upper and lower ends of the blanket.



Source: BIMstone project website.

Successive waterproofing blankets are laid over the beams from the first one laid to the top with overlapping joints.

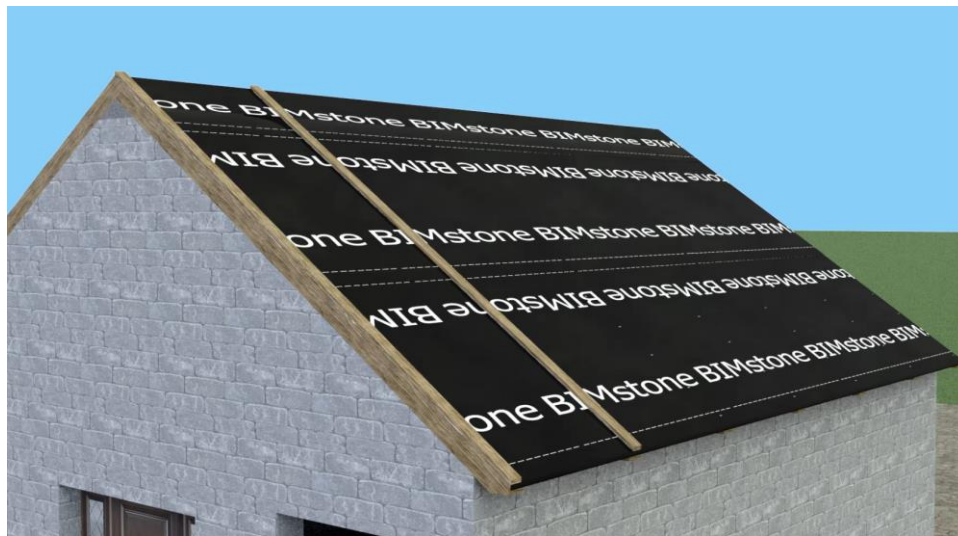


Source: BIMstone project website.

4.2 Vertical wooden battens

Wooden battens with a cross section of at least 20 mm x 40 mm are fastened to the roof savings with nails. The height of the batten with at least 20 mm is required for the air gap in favour of rear ventilation.

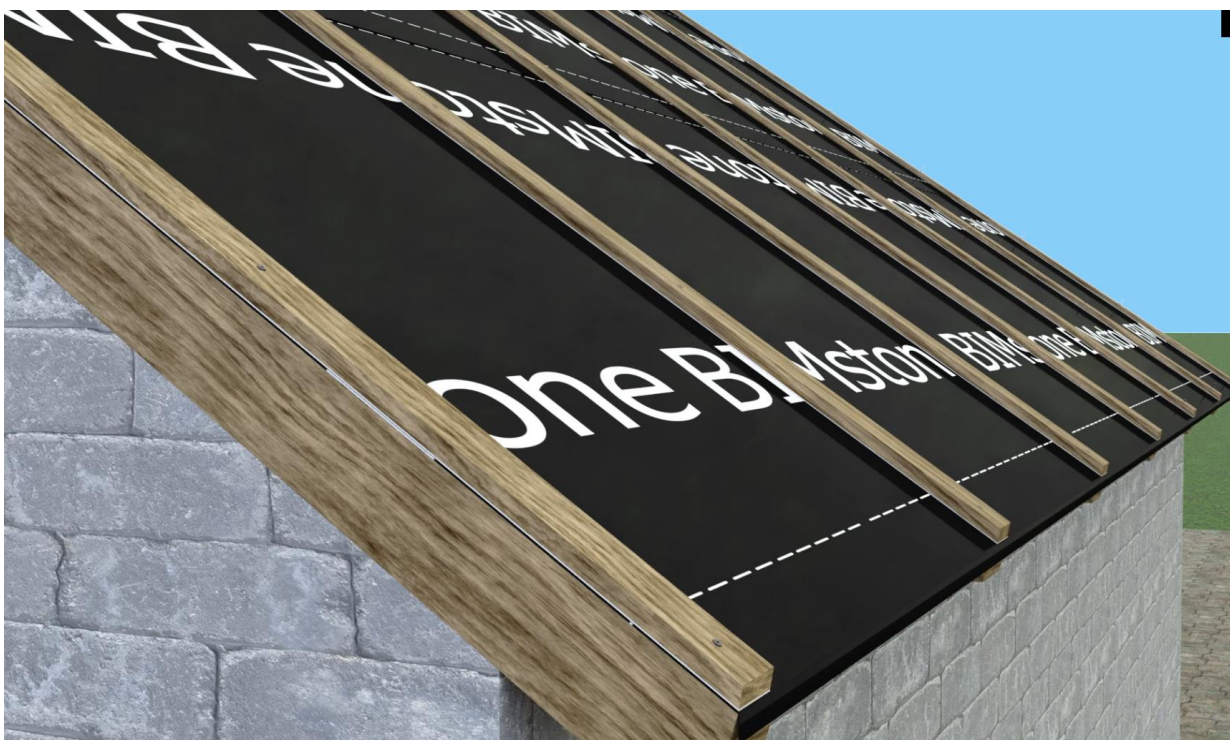
The vertical battens are successively screwed in place and fixed.



Source: BIMstone project website.



Source: BIMstone project website.



Source: BIMstone project website.

4.3 Horizontal wooden battens

Horizontal roof battens with a cross section of approx. 40 mm x 60 mm are attached to the vertical battens with nails. The position of the roof batten must be measured and marked so that it is guaranteed that they are installed correctly. The distance between the battens should be selected according to the formats of the slate elements.

The number of fasteners can be found in the static analysis.

The horizontal battens are installed from the bottom upwards. They are screwed to the vertical battens.



Source: BIMstone project website.

To lay each line of battens, the staking out is carried out depending on the size of the slabs.



Source: BIMstone project website.

Once the distances have been defined, each horizontal batten is staked out with a guide string.

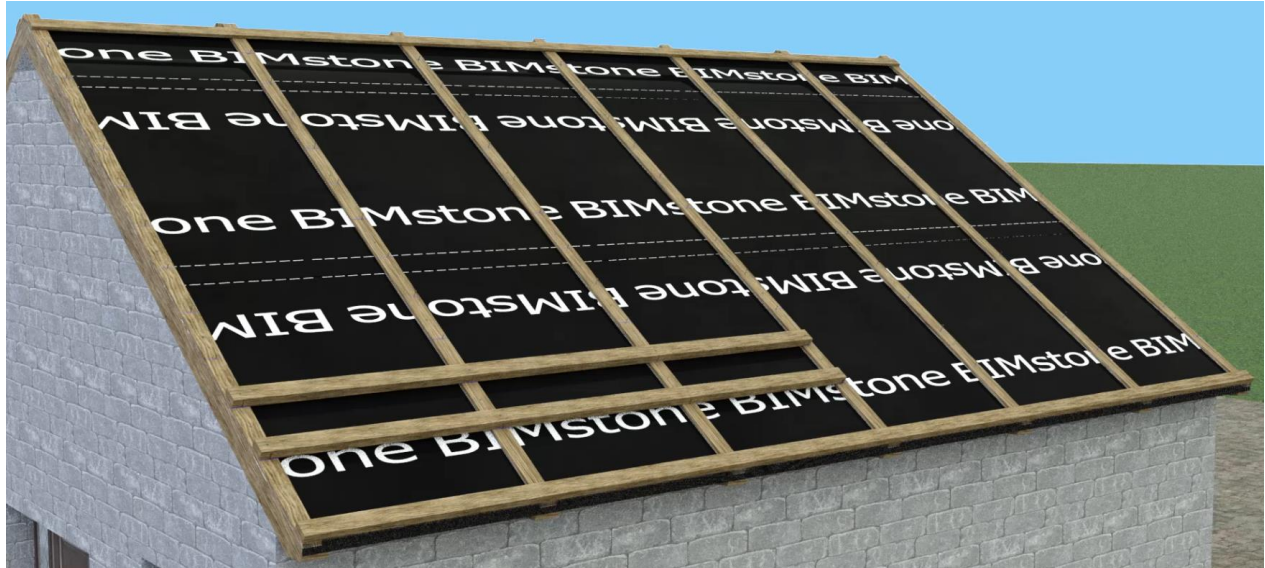


Source: BIMstone project website.



Source: BIMstone project website.

The horizontal battens are positioned and fixed in accordance with the bottom-up layout.



Source: BIMstone project website.



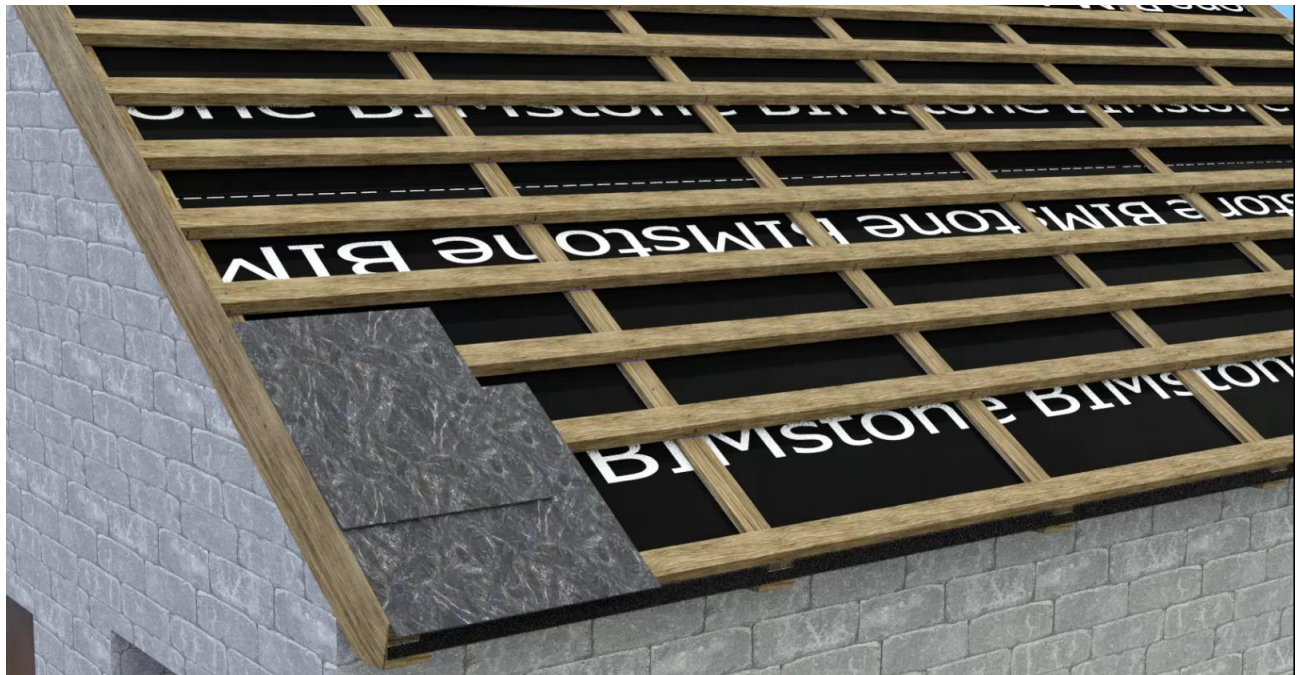
Source: BIMstone project website.

4.4 Slate covering

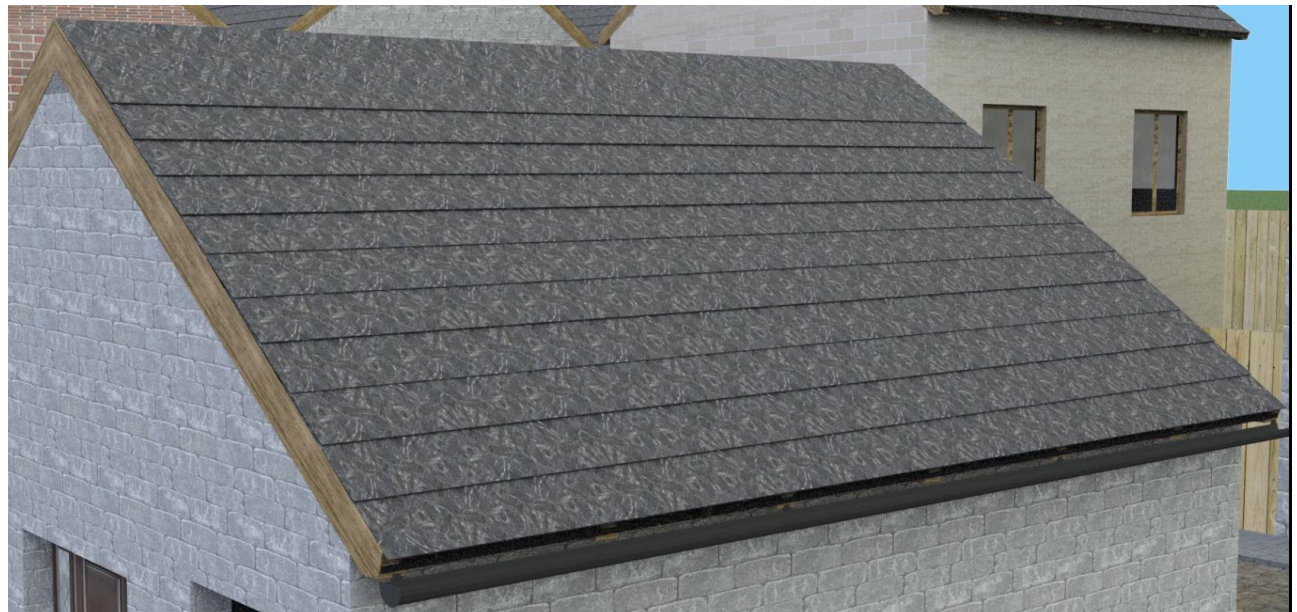
The covering is made with rectangular or square slate elements which are arranged in half a bond with a butt joint of approx. 3 - 6 mm. Each slate is to be attached to the battens with at least 2 slate nails or pins or screws or a clip hook / weft hook.



Source: BIMstone project website.



Source: BIMstone project website.



Source: BIMstone project website.

5. SUMMARY. STEPS TO FOLLOW IN THE CONSTRUCTIVE PROCESS

The construction processes of a ventilated slate roof are summarised below:

1. Installation and fixing of the insulation.
2. Fixing the vertical roof battens.
3. Fixing the horizontal roof battens.
4. Placing the slate covering.

6. REFERENCES

1. BIMStone project website. www.bimstoneproject.eu/bimstone-products
2. *Umwelt-Produktdeklaration nach ISO 14025 für Schiefer Rathschek Schiefer und Dach-Systeme. IBU – Institut Bauen und Umwelt e.V.*
3. Video “01. Ventilated slate roofs” of BIMStone project. <https://youtu.be/f-6kltG6Zuw>