

REPORT 1.2.6

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

CONSTRUCTION PROCESS OF NATURAL STONE INTERIOR PAVEMENT (PLACEMENT WITHOUT MORTAR)



This work is licensed under a [Creative Commons Attribution-ShareAlike 4.0 International License](https://creativecommons.org/licenses/by-sa/4.0/).



ROMANIA
GREEN
BUILDING
COUNCIL

"The European Commission's support for the production of this publication does not constitute an endorsement of the contents, which reflect the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein".

Consortium members: Deutscher Naturwerkstein-Verband E.V (DNV), Asociatia Romania Green Building Council (RoGBC), Colegio Oficial de Arquitectos de la Región de Murcia (COAMU), Asociación Empresarial de Investigación Centro Tecnológico del Mármol, Piedra y Materiales (CTM), Klesarska Skola Pucisca (KLESARSKA)

Content

1. INTRODUCTION	3
2. ENVIRONMENTAL CONSIDERATIONS	4
3. CONSTRUCTIVE CONSIDERATIONS	5
4. CONSTRUCTION PROCESS	5
4.1. Preparation of the area	5
4.2. Placing of neoprenes	6
4.3. Placement of a waterproofing layer	7
4.4. Placement of the natural stone floor pavement	8
4.5. Layout of metal brackets and vertical wall profiles	13
4.6. Laying and fixing the natural stone slabs	14
SUMMARY. STEPS TO FOLLOW IN THE CONSTRUCTIVE PROCESS	15
6. REFERENCES	15

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 process of placement an interior natural stone paving without mortar, describing in detail some of its 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 “**Tablas de mármol y caliza (marble and limestone slabs)**” include natural stone products which main function is for ornamental use to cover interior and exterior surfaces, such as floors, walls, facades, stairs, etc. and has been verified and published in AENOR's GlobalEPD program.

The EPD of marble and limestone slabs has been carried out according to the LCA methodology with quantified environmental information of its entire life cycle. That is to say, the EPD of these materials is of the "cradle to door" type, as can be seen in the following table, which includes the life cycle stages considered.

Etapa de producto	A1	Suministro de materias primas	X
	A2	Transporte a fábrica	X
	A3	Fabricación	X
Construcción	A4	Transporte a obra	MNE
	A5	Instalación / construcción	MNE
Etapa de uso	B1	Uso	MNE
	B2	Mantenimiento	MNE
	B3	Reparación	MNE
	B4	Sustitución	MNE
	B5	Rehabilitación	MNE
	B6	Uso de energía en servicio	MNE
	B7	Uso de agua en servicio	MNE
Fin de vida	C1	Deconstrucción / demolición	MNE
	C2	Transporte	MNE
	C3	Tratamiento de los residuos	MNE
	C4	Eliminación	MNE
	D	Potencial de reutilización, recuperación y/o reciclaje	MNE
X = Módulo incluido en el ACV; NR = Módulo no relevante; MNE = Módulo no evaluado			

Tabla 1. Límites del sistema. Módulos de información considerados

This EPD has been developed and verified according to the UNE-EN 15804:2012+A1:2014 and UNE-EN ISO 14025:2010 standards and the Product Category Rules (PCR) for marble and limestone slabs used in the construction of AENOR's GlobalEPD programme.

The EPD functional unit is defined as 1 tonne of mass of natural stone. The scope of the study has been defined from the cradle to the door, covering only the manufacturing module (extraction and preparation of the raw materials, processing of the natural stone slabs and transport between these stages).

The EPD details the formulation to be used (conversion factor) to transform the functional unit from a tonne of mass of natural stone to a square meter of flooring.

3. CONSTRUCTIVE CONSIDERATIONS

The system of big format natural stone floor realization without mortar, starts from some premises that constitute determinant advantages from a sustainable point of view. These include:

- the reversibility of the system, by the fact that no mortar is used;
- the possibility to easily recover and reuse the component layers, especially the finished layer of natural stone.

This type of system is compatible with any function of the usual civil buildings such as residential, commercial, transport or industrial sectors.

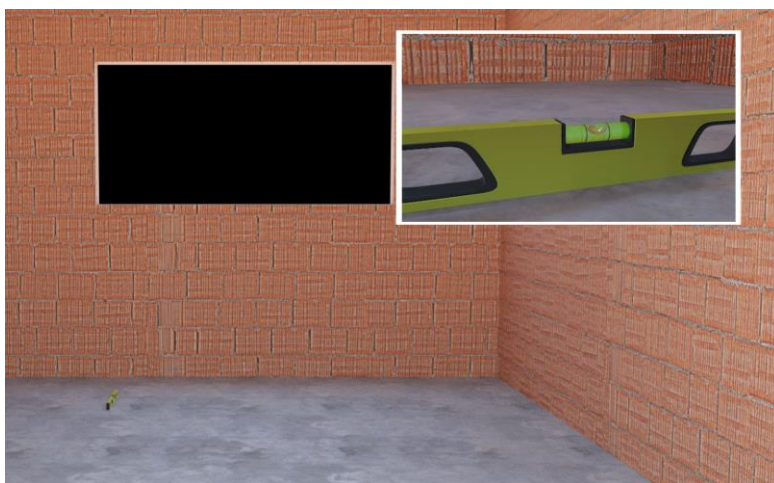
Given all of the above, this system for achieving interior floors is compatible with the requirements of international systems for certifying the sustainability of buildings.

4. CONSTRUCTION PROCESS

4.1. Preparation of the area

In order to begin the construction process of laying natural stone flooring and obtain a satisfactory result, it is essential to check that the substrate has matured and is perfectly dry and hardened, i.e., that all the shrinkage due to setting has taken place, in order to avoid the appearance of the pathologies associated with this phenomenon, such as tile lifting or cracking due to lack of stability.

Subsequently, it is necessary to check that the floor is level and clean the surface, leaving it free of dust and loose residues.



Source: BIMstone project website.

4.2. Placing of neoprenes

Neoprene pads are placed in the skirting board area.



Source: BIMstone project website.



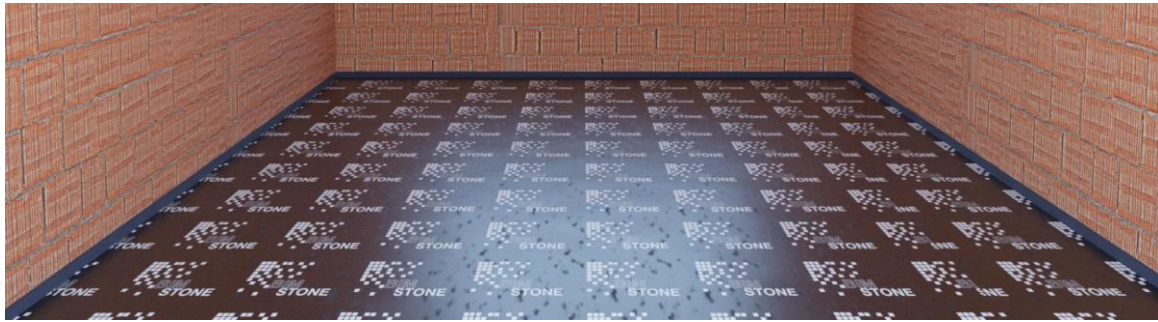
Source: BIMstone project website.

4.3. Placement of a waterproofing layer

A waterproofing layer is applied to the entire area where the natural stone slabs are to be laid.



Source: BIMstone project website.



Source: BIMstone project website.

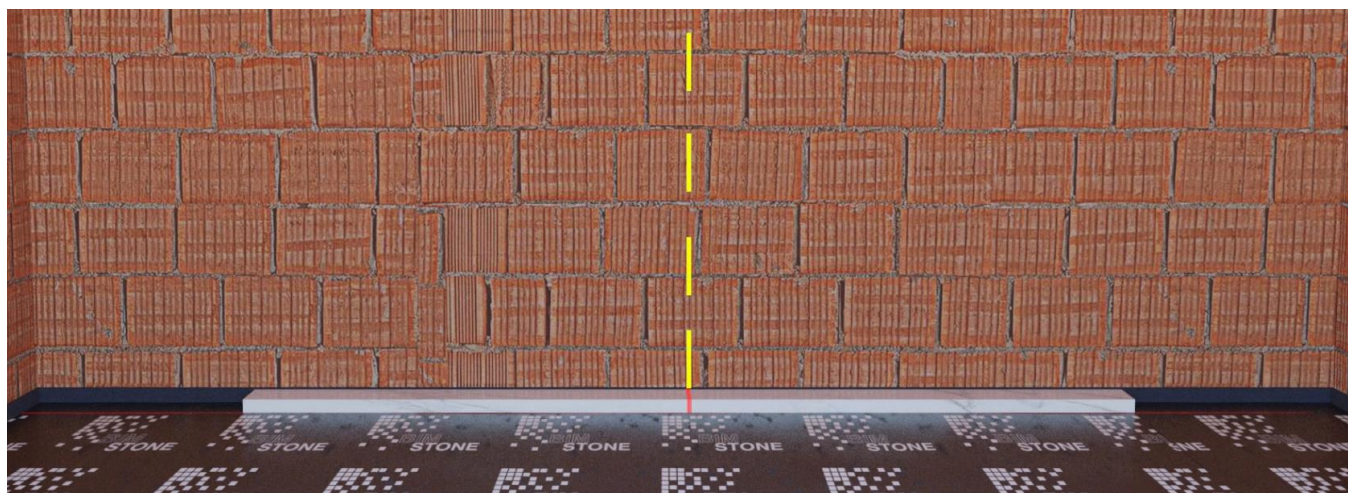
4.4. Placement of the natural stone floor pavement

To lay the natural stone elements, they are first laid out, starting with the area closest to the wall.



Source: BIMstone project website.

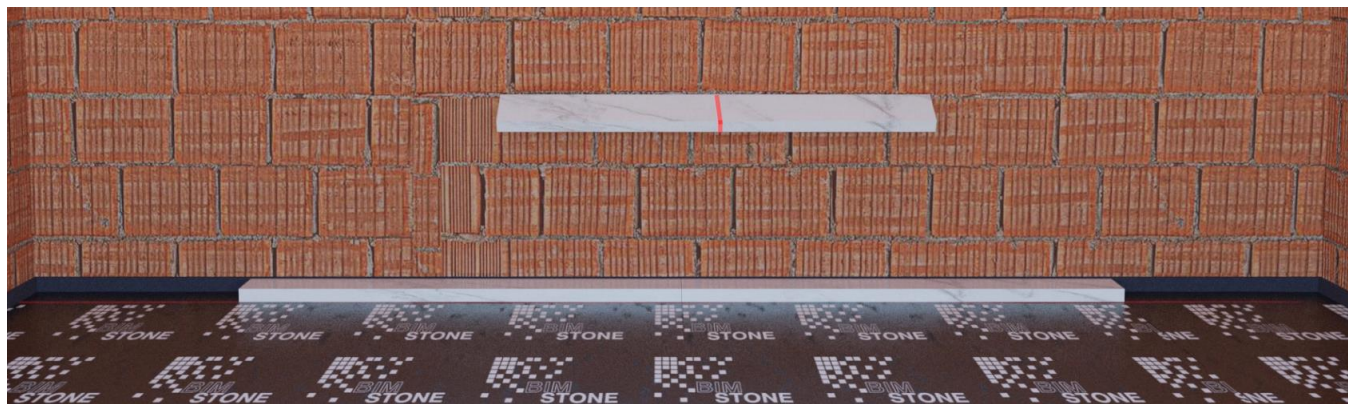
The natural stone slabs are laid symmetrically on the ground, starting with the marking of a central axis, to achieve optimum aesthetic quality.



Source: BIMstone project website.

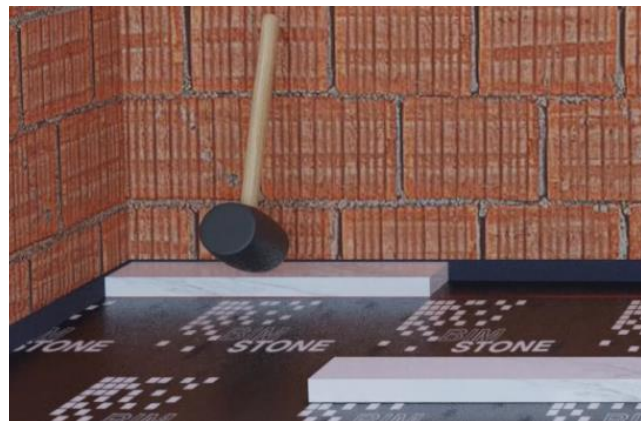
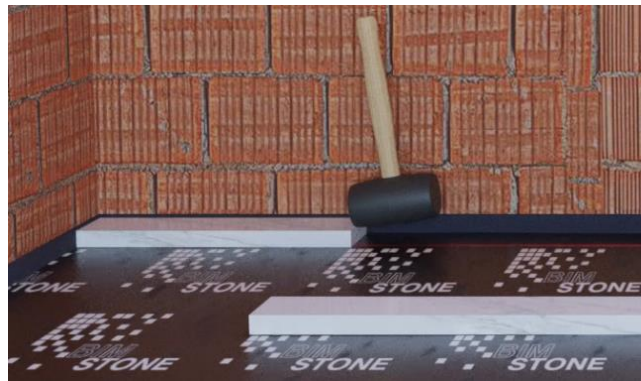
To ensure that the stone slabs fit and fit perfectly in the laying area, elements larger than the required size shall be marked and cut for correct placement.

An approved cutting tool suitable for the material to be cut shall be used for this purpose.



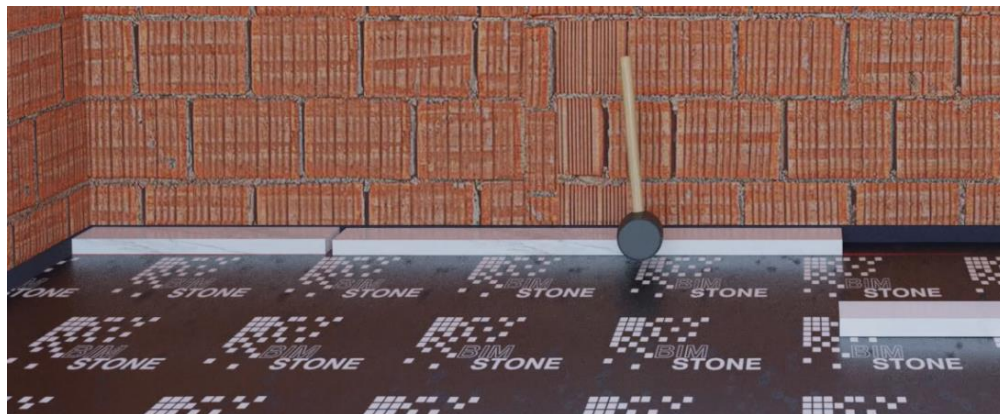
Source: BIMstone project website.

Once the pieces have the desired dimensions, they are placed, starting from the corner, with the help of a plastic hammer.

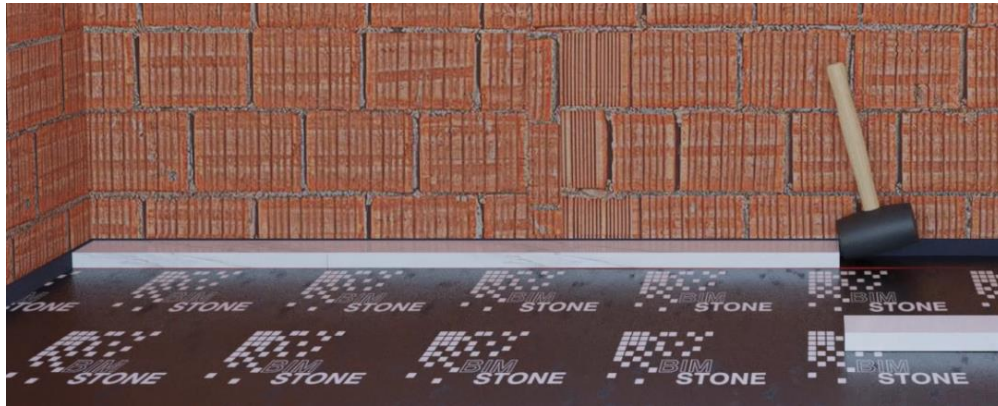


Source: BIMstone project website.

The next step is to place the stone element adjacent to the one initially placed, using the plastic hammer for its correct placement.

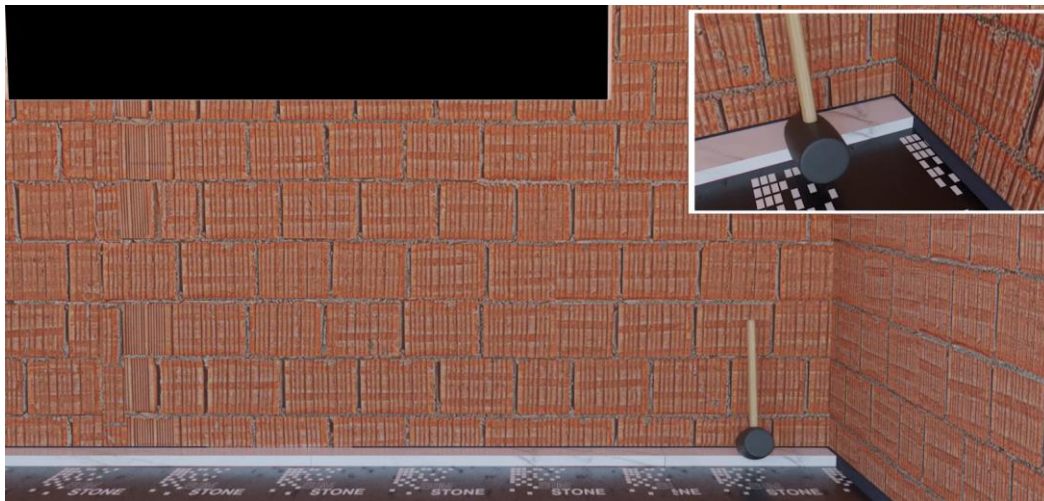


Source: BIMstone project website.



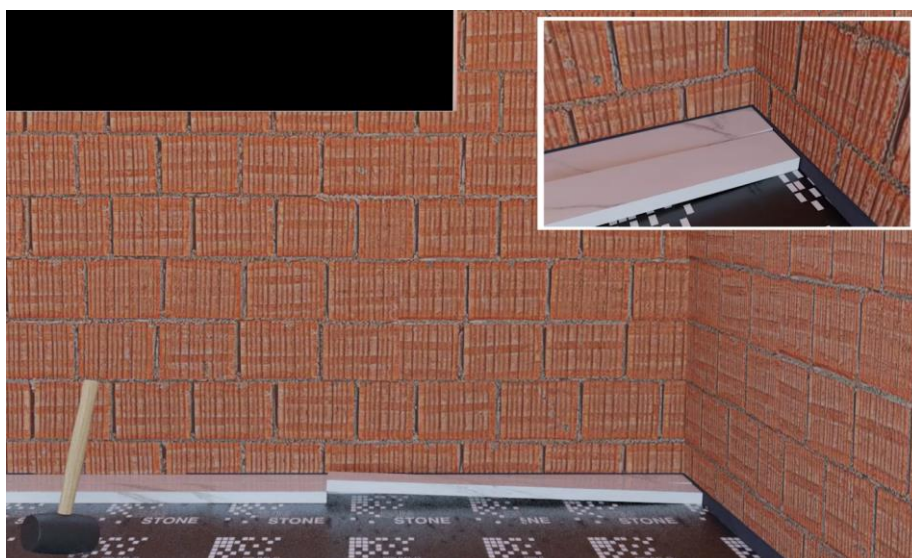
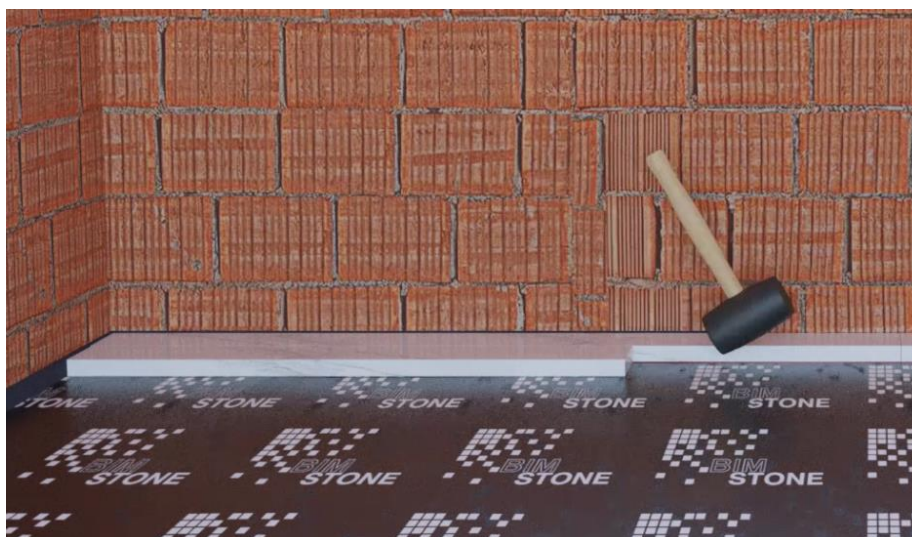
Source: BIMstone project website.

In the same way, all the stone tiles corresponding to the first line are laid and adjusted.



Source: BIMstone project website.

Once the first line of slabs has been laid, the rest of the lines are laid, starting with the one immediately adjacent, following the same procedure.



Source: BIMstone project website.



Source: BIMstone project website.

Once the natural stone paving has been laid, the elements corresponding to the vertical walls are installed.

4.5. Layout of metal brackets and vertical wall profiles

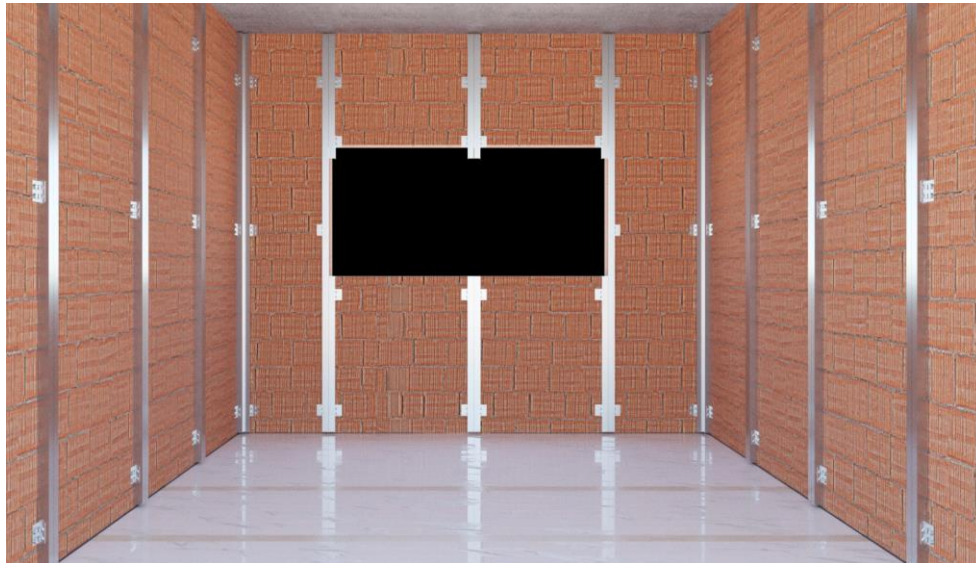
To begin the process of laying the stone cladding of the vertical wall, the metal supports will be placed. To do this, a laser level will be used, and the line strip will be used to make marks on the support on which the entire load-bearing structure of the cladding will be placed. The exact position of the pieces and the profile that will be necessary according to the plans will be determined with this line drawing.



Source: BIMstone project website.

The fixing of the metal brackets and guides is staggered on each side of the vertical profile, with the brackets being bolted together.

The same procedure is repeated until the entire dimensioned supporting structure has been installed.



Source: BIMstone project website.

4.6. Laying and fixing the natural stone slabs

Each natural stone slab is fixed with two screws at the bottom and two screws at the top. Once the first row has been laid, the same procedure shall be followed until the entire cladding has been completed.



Source: BIMstone project website.



Source: BIMstone project website.

SUMMARY. STEPS TO FOLLOW IN THE CONSTRUCTIVE PROCESS

The construction process of natural stone interior pavement without mortar are summarised below:

1. Preparing the area.
2. Placement of neoprenes.
3. Placement of waterproofing layer.
4. Placement of the natural stone floor pavement.
5. Layout of metal brackets and vertical wall profiles.
6. Laying and fixing the natural stone slabs.

6. REFERENCES

1. BIMstone project website. www.bimstoneproject.eu/bimstone-products
2. Tablas de mármol y caliza (marble and limestone slabs). Environmental Product Declaration. AENOR. https://www.aenor.com/Producto_DAP_pdf/GlobalEPD_EN15804_001_ESP.pdf
3. Video “06. Interior stone pavement without mortar” of BIMstone project. <https://www.youtube.com/watch?v=y4CyG1UL2UM>