IMPROVE TECHNIFICATION AND LCA QUALIFICATION OF WORKERS IN CERAMIC SECTOR WITH THE SUPPORT OF BIM APPLICATIONS

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REPORT 1.2.8

REPORT ON BEST PRACTICES ON METHODS, SKILLS AND COMPETENCES IN RELATION TO CLAY PRODUCTS

INSTALLATION PROCESS OF CERAMIC FLOOR OVER EXISTING FLOOR

Consortium members: Associação Portuguesa da Indústria de Cerâmica (APICER), Centro Tecnologico da Cerâmica e do Vidro (CTCV), Asociación Empresarial de Investigación Centro Tecnológico del Mármol, Piedra y Materiales (CTM), Asociación Española de Fabricantes (Hispalyt), Institute of Entrepreneurship Development (iED).

Content

1. INTRODUCTION

1. Background

The BIMclay project was born with the purpose of producing and developing didactic materials based on the BIM methodology, which address the challenges related to Life Cycle Analysis (LCA) of clay products, to serve as a training base for professionals in the ceramic sector. To this end, it is necessary to define and compile the most suitable execution systems and tile installation methods for clay and ceramic products.

The first task of the BIMclay project "O1. Establishment of common learning outcomes on clay placement methods, Life Cycle Analysis (LCA) and regulations" encompasses a series of specific tasks among which we find the elaboration of this report.

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

This report "Process of installation of ceramic flooring over existing flooring" deals with the constructive process of laying ceramic flooring over existing flooring without the need to remove it.

2. Definition and type of grouting of ceramic tiles

The tile installation by direct adhesion is conditioned by two characteristics:

The water absorption capacity (E in % according to EN14411) since the anchorage of cement hydrates in cement mortars or cement and lime, as well as cementitious adhesives with a low polymer resin content, depend on it and the surface microroughness. In very porous tiles, the adhesion may also be compromised by incomplete hydration of the cement, as the ceramic body absorbs the water necessary for maturing the mortar or the cementitious adhesive without water retainers (the so-called "adhesive cements" or cementitious adhesives suitable only for interiors).

The surface of the tile, deducted from the format, due to shear stresses that may be generated after the hardening of the bonding material, due to thermal and/or humidity oscillations in the tiles or due to dimensional instability of the substrate. In cement mortars and adhesives with a low content of polymer resins, these shear stresses can lead to the breakage of the adhesive bond. The larger the surface, the greater the stresses on the perimeter of the tile. In addition, in thin-bed tile installation with dispersion resin adhesives (D1 and D2 of EN 12004 standard), large-surface tiles make it difficult for water and/or solvent to evaporate, making it impossible for the adhesive to fully mature in the time foreseen by the manufacturer.

The selection of the tile installation technique depends on these two characteristics: thick layer with cement mortar and/or lime or thin layer with adhesive, in the latter case conditioning the selection of the type of adhesive.

Other characteristics of the tile must also be taken into account, in relation to its intended use, in order to ensure its durability and avoid the loss of appearance through the correct selection of materials and tile installation techniques:

The coefficient of moisture expansion, especially in very porous and glazed tiles (BIII GL or AIII GL according to EN 14411), with respect to the appearance of deferred cracking if the glaze is subjected to tensile stress by compression of the substrate due to the overlapping shrinkage of the cement conglomerates and the increase in the volume of the tile due to water and humidity. In this situation, the use of deformable cementitious adhesives can be a good preventive measure.

The formation of efflorescence by the addition of soluble salts to the surface of the unglazed porous tile or the destruction of the support/glazing interface if these salts crystallise on it, in tiles that are also porous and glazed, in coatings subjected to the action of water and humidity from the substrates. In this case, waterproofing the fixing surface and fixing with adhesive are preventive solutions.

On the other hand, depending on the size of the tile, the tile installation system may be:

Thin-bed tile installation, with a toothed trowel and adhesive cements of at least type C1, for small formats, i.e. tiles with a side greater than 40 cm).

Tile installation with double grouting, with application both on the support and on the back of the ceramic tile, in tiles with a surface area greater than 1000 cm2.

In the case of wanting to remodel or renovate a room, there is the possibility of placing the new floor over the existing one, being the most recommendable option when the existing floor is a terrazzo or natural stone, having the following benefits:

Minimizes the work time, not having to chop the existing floors, saving hours of work in the tasks of demolition, cleaning and levelling of the support.

Economic savings, both for labour and for not having to transport the waste generated in the demolition of the existing floor.

Easy installation, cleaning and maintenance.

2. ENVIRONMENTAL CONSIDERATIONS

Ceramic tiles, like other ceramic products, respect the environment, as 96% of them are composed of supporting raw materials (clay, waste from ceramic pieces and other minority materials such as kaolin, sands and feldspars) and 4% of raw materials for enamel (feldspars, carbonaros, quartz, borates, silicates, kaolin, zirconium oxides, clays, alumina, zinc oxide...).

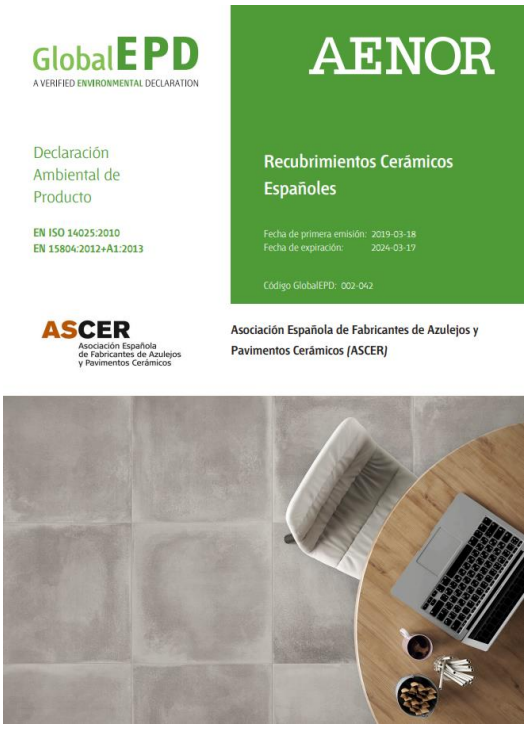
For this type of product, a useful life of equal reference to that of the building where they are installed is considered, provided that it is installed correctly, since it is a long-lasting product that does not require replacement. Therefore, the environmental product declarations (EPD) of ceramic tiles have assumed a useful life of 50 years and these considerations make the useful life shorter.

An example of this is the case of ceramic tiling, which have a type III environmental label, known as the Environmental Product Declaration (EPD) for their entire life cycle (cradle to grave), owned by the Spanish Association of Manufacturers of Ceramic Tiles and Flooring (ASCER).

Ceramic coverings, being totally inert products, do not emit any compounds to soil or water at their use stage, i.e. they do not undergo any physical, chemical or biological transformation, they are not soluble or combustible, they do not react physically, chemically or in any way, they are not biodegradable, they do not adversely affect other materials with which they may come into contact in such a way as to lead to pollution of the environment or harm human health. It is a product that does not leach and therefore does not pose a risk to the quality of surface water or groundwater.

The results of the Life Cycle Analysis (LCA) of this DAP are based on the data provided by the manufacturers of 40% of the national production of ceramic tiling, so it is a representative study of this sector at a national level.

GlobalEPD 002-042. Rules on Ceramic Coverings



		A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
CO_2	GWP	10,7	3,8E-01	5,2E-01		3,9E-02							8,8E-02	0	6,1E-02	-2,7E-01
	ODP	5,9E-08	1,0E-14	2,6E-13		1,3E-10							2,4E-15	0	6,2E-14	-4,6E-09
	AP	1,7E-02	3,3E-04	8,0E-04		4,1E-05							6,7E-05	0	3,6E-04	-10,0E-04
	EP	2,8E-03	7,0E-05	1,7E-04	NR	2,0E-05	NR	NR	NR	NR	NR	NR	1,6E-05	0	4,9E-05	-1,1E-04
O_3	POCP	1,5E-03	4,3E-05	7,0E-05		3,6E-06							9,7E-06	0	2,8E-05	-1,1E-04
	ADPE	2,5E-05	3,1E-08	7,3E-07		6,9E-09							7,2E-09	0	2,2E-08	-5,3E-08
	ADPF	148,1	5,1	2,5		2,2E-01							1,2	0	7,9E-01	-6,3

GWP [kg CO_2 eq] Potencial de calentamiento global
ODP [kg CFC-11 eq] Potencial de agotamiento de la capa de ozono estratosférico
AP [kg SO_2 eq] Potencial de acidificación del suelo y de los recursos de agua
EP [kg $(PO_4)^{3-}$ eq] Potencial de eutrofización
POCP [kg etileno eq] Potencial de formación de ozono troposférico
ADPE [kg Sb eq] Potencial de agotamiento de recursos abióticos para recursos no fósiles (ADP-elementos)
ADPF [MJ] Potencial de agotamiento de recursos abióticos para recursos fósiles (ADP-combustibles fósiles)

Tabla 10. Parámetros que describen los impactos ambientales definidos en la Norma UNE-EN 15804

Source: AENOR.

3. CONSTRUCTIVE CONSIDERATIONS

In Spain, standard UNE 138002:2017 "General rules for the installation of ceramic tiles by adhesion" defines the quality of ceramic tiles and aims to establish the general rules and associated processes for the design, selection of materials, preparation, installation, delivery and maintenance of the use of ceramic systems that must be considered to guarantee their quality and durability as well as their technical and aesthetic performance.

In addition, the Basic Requirements for each requirement of the Technical Building Code (CTE) must be fulfilled.

In terms of design and execution of coatings with ceramic tiles with adhesives, the provisions of the following sections of the Technical Code must be complied with:

- Structural safety. DB SE.
- Fire Safety DB SI.
- Healthiness. DB HS.
- Protection against noise. DB HR.
- Energy saving DB HE.

4. EXECUTION PROCESS

1. Demolition of the skirting board.

For the description of the constructive process of renovation of the existing pavement, the option of covering it with a wood imitation ceramic floor has been chosen. To do this, it must first be checked that the previous surface is in good condition and, in this way, the new tiles will not suffer damages such as screams, lack of levelling, etc.

Since in the selected process a remodelling of the room has been considered and the material to be installed is totally different from the current one, as a previous step to the preparation of the support, all the skirting board and the remains of mortar that may remain after its demolition must be removed.

Source: YouTube.

Subsequently, the surface must be cleaned, leaving it free of dust and loose debris.

Source: YouTube.

2. Preparation of the substrate.

To ensure proper adhesion of new tiles, enamel or finish must be removed from the existing surface with the aid of an emery. This creates a rough surface with grooves so that the mortar can be absorbed and adhered better, thus facilitating optimum adhesion of the new tiles.

Once the entire surface has been polished, it is swept and cleaned thoroughly to ensure that no loose material remains.

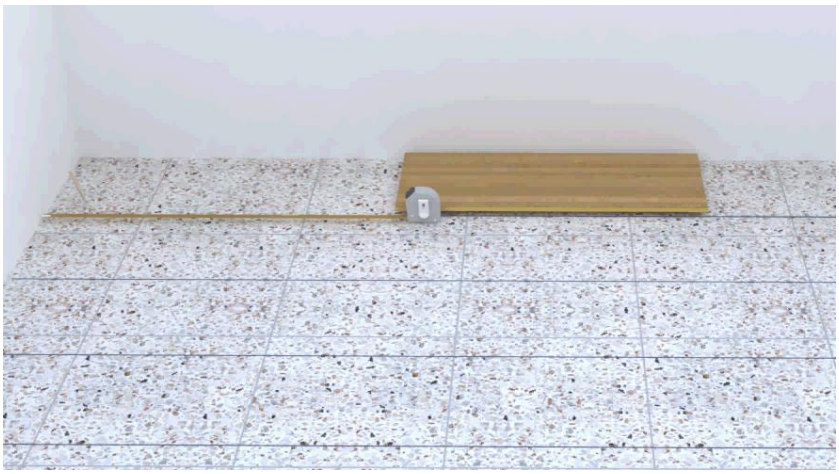
Source: YouTube.

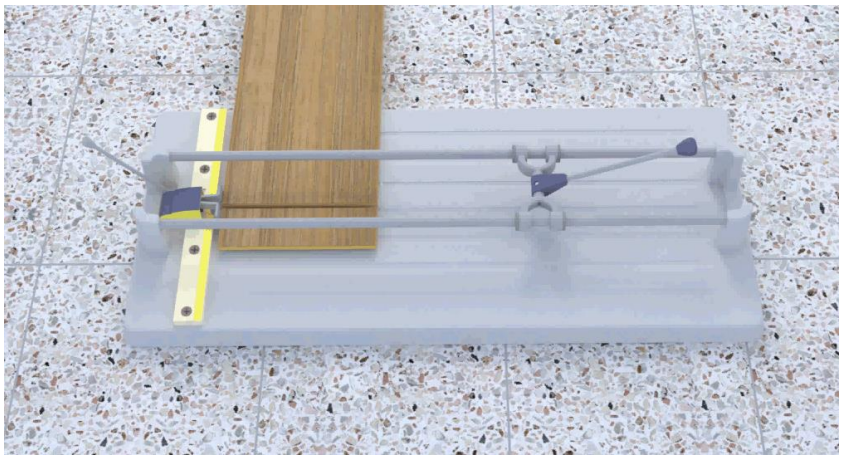
3. Measurement.

With the surface ready, measures are taken to frame the room and establish a centre from which the tiles will be laid. Knowing the width of the slab, you mark on the floor what will be the boundaries of the tiles once laid, using a linear drawing.

Source: YouTube.

Next, measurements are taken in the longitudinal direction of the tile and, in this way, the dimensions of the cuts to be made so that the surface is completely covered.





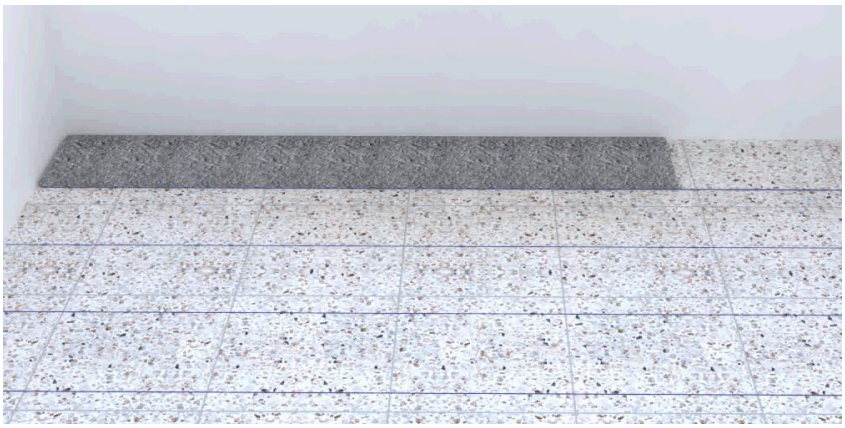
Source: YouTube.

4. Adhesive application.

For a correct placement of the porcelain material we must use white coloured adhesive cement, provided that a previous adhesion test has been carried out.

Once the necessary consistency of the mixture has been achieved, the mixture should be spread on the surface of the substrate. A regular layer of 2 to 3 mm should be applied with the help of a notched trowel number 3 in the longitudinal direction of the tiles to be laid.

In the case of large-format tiles, a thin layer of adhesive must be applied to both the substrate and the tile.

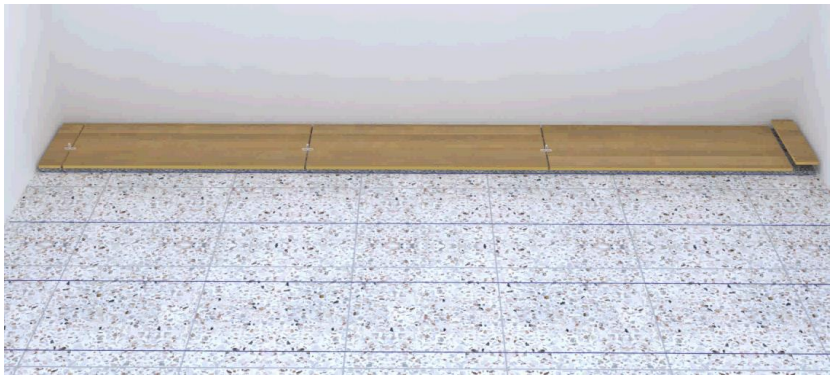


Source: YouTube.

4. Laying the tiles.

The tiles are then carefully laid while the adhesive is still soft, by pressing them with your hands, as well as by tapping with a rubber mallet and checking that the back is completely covered by the adhesive. This ensures that no air bubbles form under the tile and prevents future tile breakage.

In order to maintain the uniformity of the joints over the entire surface, crossarms must be used.



Source: YouTube.

5. Cleaning the tiles.

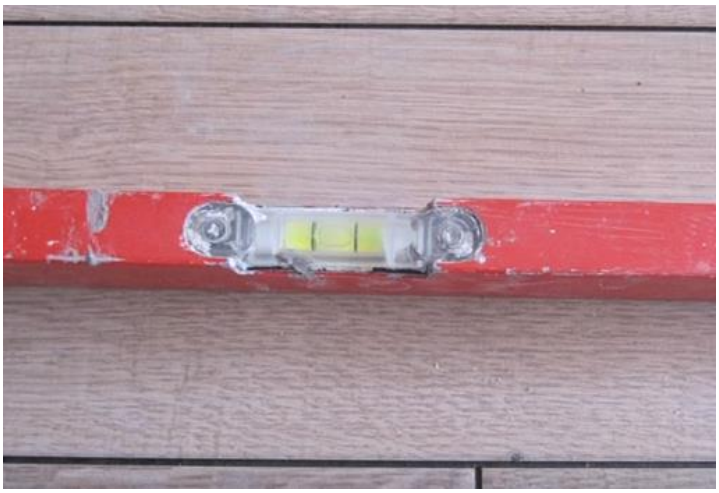
To ensure that no adhesive residue remains on the tile, the excess material should be removed with a damp sponge.

Source: Proalso.

6. Levelling of the tiles.

Once the remains have been removed, the correct leveling of the tiles should be checked periodically, as well as any possible defects in planimetry that may exist between the tiles. For this purpose, a bubble level or a metal strip should be used.

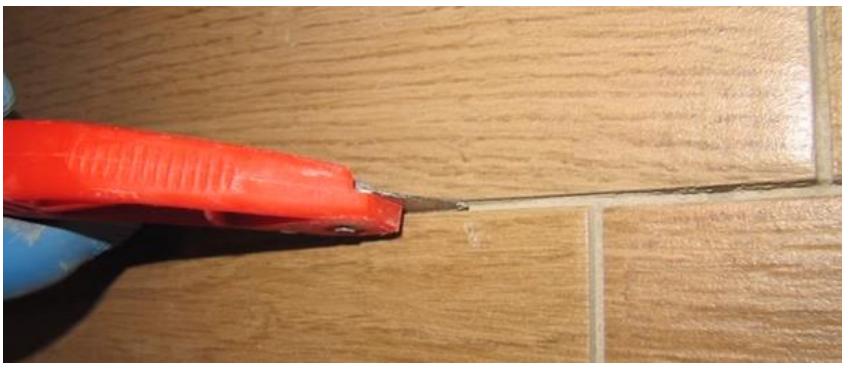
Also, it should be checked periodically that the tiles are level using a spirit level and a metal strip.

Source: Proalso.

7. Cleaning the joints.

With the aid of a cutter, the adhesive residues in the tile joints are removed, thus leaving the joint clean and ready to proceed with the spreading of the grout material.

Source: Proalso.

8. Grouting of tiles.

After the time necessary for the glue cement recommended by the manufacturer to dry correctly, the tiles will be grouted. For the extension of this grout, a smooth rubber trowel should be used, and diagonal movements should be made to the tile joints.

Source: Proalso.

9. Cleaning the tiles.

Next, remove the remaining surface paste with a glass cleaner and a wet sponge. To do this, press diagonally to lose the joint material.

Source: Proalso.

5. SUMMARY OF STEPS TO BE FOLLOWED IN THE CONSTRUCTION PROCESS

INSTALLATION PROCESS OF CERAMIC FLOOR OVER EXISTING FLOOR:

1. Demolition of the skirting board.
2. Preparation of the substrate.
3. Adhesive application.
4. Laying the tiles.
5. Cleaning the tiles.
6. Levelling of the tiles.
7. Cleaning the joints.
8. Grouting of tiles.
9. Cleaning the tiles.

6. REFERENCES

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