

LIFECERAM. TECHNICAL CHARACTERISTICS OF PRODUCTS FOR URBAN FLOORING

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1. INTRODUCTION

Ceramic tile production in the EU generates wastes in different tile manufacturing process stages. The total quantity of waste is estimated at about 1.5 million tons per annum. Although much of this waste is recycled in current ceramic products and manufacturing processes, a certain amount cannot be recycled owing to the change it would produce in the behaviour and end properties of the tiles. Consequently, an important quantity of this waste is disposed of at landfills or is used as fillers in products with low added value. The main objective of the LIFECERAM project is to achieve zero waste in ceramic tile manufacture. The project therefore proposes:

- To develop a new type of porcelain tile, with a very high waste content in the body and glaze, for outdoor use (urban paving).
- To design a highly sustainable process for preparing the body composition, based on dry milling and granulation technologies.

One of the initial actions of the project is the performance of a comparative study of the properties displayed by tiles that are currently used in urban flooring, with a view to defining the characteristics required of the new product.

2. ANALYSIS OF THE TYPES OF PRODUCTS USED IN URBAN FLOORING

A market survey was performed of the main types of products being used for urban flooring in Europe. The most widely used flooring products in pavements, walkways, and squares are described below:

2.1. NATURAL STONE SLAB

Unit of natural stone obtained by cutting or slabbing, which is used as flooring material for external floors and road finishes, in which the nominal width is more than twice the slab thickness.

2.2. CONCRETE FLAG

Prefabricated concrete unit used as flooring material for external use, which meets the following conditions: total length shall not exceed 1m; total length divided by flag thickness shall be greater than 4.

2.3. TERRAZZO TILE

Element with a uniform shape and thickness that can be made individually, either by compression and/or vibration, or formed as large slabs or blocks of mineral aggregates agglomerated with cement, using vibration and/or compression and/or vacuum systems, before they are cut into the appropriate sizes.

Concrete flags as well as terrazzo tiles are made up of natural or finely ground aggregates of granite or marble stones, cement, water, pigments, and admixtures.

2.4. PORCELAIN STONEWARE TILE

Tile made from clays and/or other inorganic raw materials, which is fully vitrified and has a water absorption of 0.5% or less. Porcelain tile is generally made by dry pressing at ambient temperature (though it can also be formed by extrusion), followed by drying and firing at an appropriate temperature to develop the required properties.



Figure 1. Most common types of urban flooring:
a) natural stone slab, b) concrete flag, c) terrazzo tile, d) porcelain stoneware tile.

3. APPLICABLE REGULATIONS

Each of the products detailed in the previous section is covered by its own standards in regard to testing and technical requirements or specifications. That is, the method of measuring a given property is not exactly the same for each type of tile, so that the test results are not comparable.

The following table details the different reference standards:

Type of tile	Standard
Natural stone	UNE-EN 1341:2013 Slabs of natural stone for external paving. Requirements and test methods.
Concrete	UNE-EN 1339:2004 y UNE-EN 1339:2004/AC:2006 Concrete paving flags. Requirements and test methods.
Terrazzo	UNE-EN 13748-2:2005 Terrazzo tiles. Part 2: Terrazzo tiles for external use.
Porcelain stoneware	UNE-EN 14411:2013 Ceramic tiles. Definitions, classification, characteristics, evaluation of conformity and marking.

Table 1. European standards applicable to the different types of urban flooring.

On the other hand, most of the standards lay down the minimum requirements to be met or strength or resistance classes, which are not correlated with possible actual uses, i.e. for pedestrian flooring, paving with occasional vehicular traffic, etc.

In order to compare the different materials, single test techniques therefore need to be chosen that are able to reproduce the actual performance of the materials in the most precise possible way.

4. TECHNICAL CHARACTERISTICS

First, the different technical characteristics or properties were compiled that are set out in each of the reference standards cited above, selecting those that were related to the suitability for intended use of the material.

A single measurement method was then selected that could be applied to each of the different materials and would be able to supply information on the actual performance of the product for each of these technical characteristics.

Finally, representative commercial samples of the different types of products were obtained and the selected test techniques were applied.

A summary of the results obtained, indicating the methods or standards used to measure each technical characteristic, is detailed in the following table.

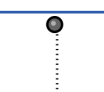
Technical characteristics	Natural stone	Concrete	Terrazzo	Porcelain stoneware
 Mechanical strength. EN ISO 10545-4				
Modulus of rupture (N/mm ²)	10-15	3-10	3-10	45-55
 Abrasion resistance. EN ISO 10545-6				
Volume of material removed (mm ³)	150-350	500-600	450-550	110-130
 Impact resistance. Cahier 3659 CSTB				
Test result	Passed	Passed	Passed	Passed
 Slip resistance. ENV 12633				
Pendulum value USRV	> 45	> 45	> 45	> 45
 Frost resistance. EN ISO 10545-12				
Test result	Passed	Passed	Passed	Passed
 Water absorption. EN 13748-2				
% mass of absorbed water	0,3-0,5	4-6	4-6	< 0,1

Table 2. Technical characteristics tested for urban flooring.

The information compiled will be used to define the technical characteristics of the new product it is sought to develop.

The new ceramic product, designed with a view to incorporating a very high waste content, must meet these technical characteristics, or even improve upon those deemed most critical, in order to minimise the pathologies that currently appear in urban flooring.

5. ACKNOWLEDGEMENTS

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