

**Disclaimer**

This sheet is intended for designers, specifiers and other members of construction project teams wishing to reuse this building material or product. It is part of a collection of sheets aimed at bringing together the available information to date that is likely to facilitate the reuse of building materials and products.

This sheet has been produced by Rotor vzw/asbl within the framework of the Interreg FCRBE project - Facilitating the Circulation of Reclaimed Building Elements, supported by the entire project partnership. Sources of information include the experience of reclamation dealers and involved project partners, lessons learned from exemplary projects, available technical documentation, etc.

The sheets have been produced between 2019 and 2021. As the reclamation sector is evolving, some information, notably regarding pricing and availability, may change over the time. When the text refers to European standards, it is up to the project team to refer, if necessary, to their national implementations and local specificities.

It is important to note that the information presented here is not exhaustive or intended to replace the expertise of professionals. Specific questions are always project related and should be treated as such.

The complete collection of sheets (including the introductory sheet) is freely available from different reference websites (a.o. opalis.eu, nweurope.eu/fcrbe, futureuse.co.uk).

Non-exhaustive directories of dealers in reclaimed building materials are available on www.opalis.eu and www.salvoweb.com.

Interreg FCRBE partnership: Bellastock (FR), the Belgian Building Research Institute / BBRI (BE), Brussels Environment (BE), the Scientific and Technical Center of Building / CSTB (FR), Confederation of Construction (BE), Rotor (BE), Salvo (UK) and University of Brighton (UK).

The information contained in this document does not necessarily reflect the position of all the FCRBE project partners nor that of the funding authorities.

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Material Description

Earthenware tiles can be recognised by their glazed surface. They are made from a biscuit (fired and unglazed ceramics) consisting of a paste of clay, quartz and limestone, whitish, earthy or tinted in colour, fired between 1000 °C and 1200 °C, then covered with a colourless or tinted glaze, plain or patterned, hardened in the kiln at around 1050 °C (double firing). The earthenware biscuit is generally very permeable (porosity $E_b > 10\%$) while the glaze provides a layer of protection against wear and makes the glazed face less permeable to liquids.

This material, produced for centuries, has seen its use spread considerably during the 20th century. A famous example is the 'metro' tile covering the Paris underground stations, and whose tile pattern is still reproduced today. This material is generally used as an interior wall covering, in particular in sanitary facilities, in private, public and community buildings. They can be confused with their counterparts in glazed stoneware or glazed porcelain stoneware, which are stronger, less porous and more resistant to shocks and temperature variations.

The reuse of this product is possible but strongly depends on the state of the glaze layer. If this is altered, the product will lose many of its interesting properties and will see its new uses severely limited. Moreover, their dismantling is often delicate. This material is therefore rarely found in large quantities on



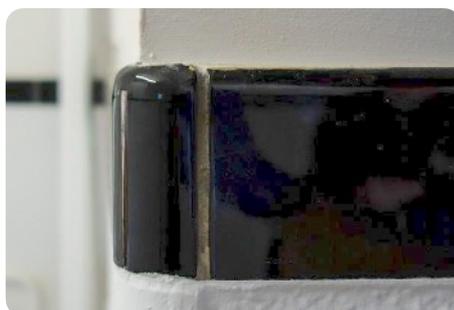
→ **Formats:** there are many formats but generally square and rectangular. Their nominal dimensions are generally in the order of 10 × 10 cm, 15 × 15 cm, 20 × 20 cm and 10 × 20 cm, 7.5 × 15 cm ('metro' tiles). Smaller frieze elements are sometimes present. The thickness is variable according to the models and generally between 5 and 7 mm.

→ **Finish:** visible matte or glossy glazed surface. The finishing of the tile edges can take on various forms: straight edges (glazed or unglazed), chamfered or rounded edges on one side (edge tiles), rounded on two edges (corner tiles).

→ **Texture:** mostly smooth and uniform for the upper surface (visible). The edges can be partly covered with glaze. Some models or frieze elements may also have a relief on the upper surface. The underside (not visible) is generally provided with a slight relief to improve adhesion to the substrate. In many cases, the manufacturer's name is on the underside.

→ **Colours:** the colours vary, generally a solid colour or with decorative patterns. Colours are often brighter than their porcelain stoneware counterparts. When the glaze wears off, the biscuit appears white or earthy in colour.

the reclamation market. On the other hand, there are smaller, much more stable batches of patterned tiles painted by hand and/or which have a high heritage value (e.g. Delft tiles).





Material reclamation

The wall tiles are regularly found in existing buildings. Although their dismantling is delicate, these tiles can represent a great opportunity for reuse, either on-site or through the professional channels of material resellers.

→ *Dismantling tests*: dismantling tests make it possible to verify the feasibility and profitability of the removal. The type of laying (cement/lime mortar, adhesive mortar, adhesive) and the characteristics of the joints (thickness, composition) strongly affect the possibility of cleanly dismantling the material.

→ *Removal*: careful dismantling should aim to ensure the integrity of the tiles and a certain uniformity of the batches. To minimise the risk of deterioration during dismantling, it is advisable to weaken the tensions within the tiles by first freeing 2 sides (perpendicular) of the tiles to be detached. This usually involves breaking non-free edge lines. The tiles will be sorted by quality, colour, size and degree of cleaning. They will be stored on their edge, thereby avoiding the risk of scratching the glaze. 'Face to face' storage will be preferred.

→ *Treatment*: the main treatment offered by the suppliers of reclaimed earthenware tiles is the mechanical cleaning of the remains of mortar on the underside and on the edges. This manual step is generally performed using a sharp tool and requires systematic downstream sorting. Tiles with signs of chips, dents in the glaze and/or cracks are downgraded. Tiles with adhesive residue are often sold as is, which implies special arrangements at the time of laying (*it is recommended to seek advice from a professional tiler*).

→ *Storage*: tiles are stored in bulk on pallets, in boxes or reconditioned in bundles, taking the necessary precautions to prevent wear of the glaze. The tiles must be stored away from frost and bad weather.

→ *Transport and delivery*: the necessary precautions must be taken during transport and delivery in order to minimise breakage (strapped, shrink wrapped pallet, etc.). It should be noted that the pre-packaged tiles facilitate laying.

It is advisable to involve specialised professionals to ensure the smooth running of these operations



Tile removal



Removed tiles



Packed reconditioned tiles

Think reversible!

The use of a hybrid mortar (lime-cement) and cement-based joints without resin facilitates future dismantling. These traditional laying methods, not referenced in the current harmonised European standards, may however have lower adhesion performance and should be reserved for substrates having a very high dimensional stability.



Crazing or crackling is a set of hairline cracks affecting the glaze layer of a tile. This phenomenon is generated by tension between the glaze and the biscuit at the time of its manufacture (desired decorative effect) or abnormally, after laying through tension applied to the tiles (for example: structural constraints, swelling biscuit due to excessive humidity, differentiated expansion, unsuitable laying technique and/or substrate, etc.). This results in a network of cracks within the glaze layer, which is a privileged passageway for water and liquid substances towards the biscuit. It is therefore important to provide for the application of an additional water-repellent protective layer if the use of the tiles involves the presence of liquid and potentially staining substances (kitchens, bathrooms, etc.).

**Applications and laying**

Glazed earthenware ceramic tiles are recommended for interior wall applications, in dry or low humidity spaces (i.e. possible humidification by spraying water at low pressure and maximum air temperature of 40°C). These are spaces and rooms for private use, individual and community shower rooms (but without hydro-therapeutic massage facilities) and sanitary facilities for moderate or frequent (collective) use. Despite its surface glaze layer, the wall tiles (tiles + joints) should not be considered as completely waterproof.

Due to their relative porosity and fragility, *outdoor use is not recommended*. They are also not recommended for more intensive applications such as community kitchens, façades, food production premises, laboratories, cold rooms, etc. In the case of uses involving staining and/or aggressive products, it is advisable to check the condition of the surface glaze layer. If necessary, a suitable water repellent surface treatment can be applied.

The choice of tiles must necessarily take into account the expected stresses (see § 'characteristics and fitness for use'). In all cases, reference should be made to the European and national standards relating to the product (EN 14411) and to the rules of practice in force (or implementation standards).

The reuse of completely cleaned reclaimed tiles is no different from that of new tiles. They lend themselves to the same diversity of laying methods, patterns and fittings. They raise the same points of attention and requirements, in particular: properties and condition of the substrate, laying and jointing products, drying times and installation times, costs, expansion joints, finishing joints, sanitary sealing, accessories (friezes, connecting pieces and edge protection, underlying waterproofing), flatness, etc.

The use of tiles with rounded edges (rare on the reclamation market) or with straight, glazed edges is possible for projecting angles and visible edges. Otherwise, PVC or aluminium corner profiles should be used. If necessary, new elements can supplement a reclaimed batch.

Depending on the planned level of finish and the installation technique chosen, different tolerance classes can be considered for the substrate. Thus, the application of a traditional setting mortar will make it easier to conceal irregularities (due for example to the presence of residual mortar on the underside

of reclaimed tiles) than when the tiles are laid using an adhesive mortar or adhesive. For a thin bed laying, the tolerance classes of flatness, plumb and horizontality of the substrate must be respected and must, therefore, be equal to those required for tiling.

Keeping residual mortar on the edges should be avoided insofar as this risks affecting the nominal size of the joints as well as their colour and composition.

To facilitate *installation*, the designer/specifier will take care to use batches with a certain degree of uniformity in terms of the following characteristics:

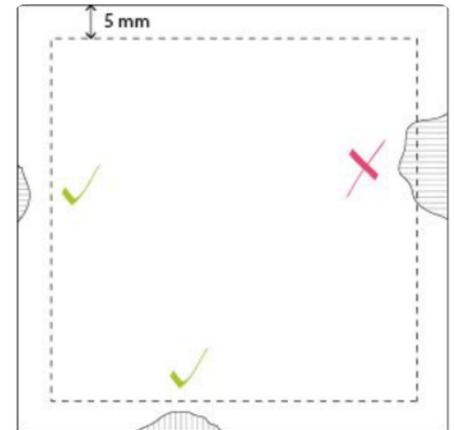
- **Batch composition:** the batch must consist entirely of unglazed porcelain stoneware tiles.
- **Dimensions:** the dimensions of the tiles must be uniform, including their thickness. The dimensional tolerance is determined by the designer/specifier according to the equipment, the thickness of the joints and the laying technique.
- **Colour:** slight variations in colour are possible (even for new products). In the case of reclaimed tiles, these variations may be due to the original exposure. It is advisable to mix the tiles when laying. The designer can also opt expressly for a pattern including tiles of very different colours. This is one way to take advantage of a greater variety of reclaimed tiles that can lead to architecturally interesting results.



Wall tiles on hybrid mortar

- **Condition:** reclaimed wall tiles may show alterations such as signs of surface wear, chipped or cut edges, small holes, shards, manufacturing or firing cracks, the presence of crazing or peeling, which expose the biscuit to degradation. These alterations increase the risk of water penetra-

tion and cause the appearance of stains under the glaze. It is up to the designer/specifier to define the degree of imperfection tolerated, according to the defined use, by specifying the maximum dimensions of the defects (for example, crazing: accepted, breaks and chipping < 25 mm²). This principle can be described in visual form to facilitate the examination of the tiles. Example:



- **Quantity:** some suppliers can include a 5% surplus when the product is delivered if they are not able to guarantee the absolute uniformity of the characteristics mentioned above. This surplus can also be applied in the case of an on-site salvage scenario.

To facilitate installation, the designer/specifier will take care to use batches with a certain degree

Most professional suppliers are able to ensure that delivered batches meet these requirements

Most of the reclaimed building materials are sold as is. The conditions of sale may however contain specific guarantees specific to the material. Some suppliers are able to indicate the origin of the material and/or provide documentation on the product purchased (for more information, see the introductory sheet).



Characteristics and fitness for use

The harmonised European standard EN 14411 establishes the relevant characteristics (depending on the context) in order to determine the fitness for use of ceramic tiles. Although detailed for new materials, these characteristics may prove useful in considering the specific case of reclaimed unglazed porcelain stoneware tiles.

In the event of specific and demanding applications, parameters related to characteristics such as wear resistance, resistance to stains or even water absorption must be measured and quantified using tests carried out by approved laboratories.

Characteristics	Comments
Dimensions (length, width, thickness)	This characteristic is closely related to the degree of sorting and cleaning of reclaimed tiles. A visual or detailed examination of the batch is often sufficient to estimate it.
Geometry (straightness of edges, angularity, flatness of the surface)	ditto
Surface quality	Careful examination of the glaze layer is necessary to ensure the presence/absence of crazing, knocks, chips and cracks.
Slight colour differences	For specific applications.
Flexural strength or Modulus of rupture	Mainly depending on the thickness and porosity of the tile. Relevant performance to be assessed in the event of high static and/or dynamic loads.
Surface abrasion resistance	For specific applications (industrial, commercial, etc.) where the risk of scratches, friction with trolleys, moving barrels, etc. is high.
Shock resistance	For specific applications (industrial, commercial, etc.) where the risk of impact with trolleys, moving barrels, etc. is high.
Linear thermal expansion	Low for most ceramic tiles.
Resistance to low and high temperatures and thermal shock	For specific applications where tiles are subjected to intense temperature values or gradients.
Moisture expansion	Low for most ceramic tiles.
Impermeability to liquids likely to be projected onto the wall and water absorption	A layer of glaze in good condition ensures a relatively good tile seal. However, given the high porosity of the biscuit, it is not recommended to use earthenware tiles in very humid places. Depending on the degree of exposure to water, care must also be taken to ensure that the underlying system is water-proof before laying the tiles.
Resistance to crazing	To be determined if the use of tiles implies the presence of liquid and potentially staining substances (kitchens, bathrooms, etc.).
Adhesion to adhesive mortars, dispersion adhesives or reactive adhesives	Depending on the type of laying recommended and performance classes of the products to be laid.
Reaction to fire	In accordance with European Commission Decision 96/603/EC, ceramic tile floor coverings are classified as non-combustible materials and belong to the European reaction to fire class A1 without prior testing.
Release of hazardous substances (lead and cadmium)	Only applicable for materials in contact with foodstuffs (see EC Regulation No. 1935/2004 and Directive 84/500/EEC).
Resistance to low and high concentrations of acids and base products	Reclaimed wall tiles are not recommended for intensive applications such as laboratories.
Stain resistance	A layer of glaze in good condition usually ensures a good resistance to stains. In the presence of crazing, it is best to provide for the application of an additional water-repellent protective layer to prevent stains.
Suitability for cleaning and maintenance	Depends on the cleaning product used, the water pressure and the surface texture of the tile (condition of the glaze layer).
Ease of repair and adaptation	To be determined with the professional in charge of laying.
VOC emissions	Volatile Organic Compounds are destroyed at the time of combustion of organic materials possibly present in clay raw materials. The original ceramic tiles are therefore considered to be free of VOCs. However, the laying and protection products can potentially emit VOCs.



Embodied carbon (Cradle to gate – production A1-A3)

	kg CO ₂ eq./m ²	kg CO ₂ eq./kg
Mosa Wall Tiles – Individual declaration (Manufacturer data)	5.63	0.31
INIES database (FR) – Generic data	11.30 (*)	0.63
ICE database (UK)	17.94	0.78

Indicative values for an average thickness of 6 mm and estimated density of 1800 kg/m³, (*) Including glue and joint



Reusing 100 m² of tiles prevents the production of ~ 1000 to ~ 1800 kg of CO₂ equivalent related to the manufacture of new tiles (production phase only). This corresponds to a journey of ~ 6000 to ~ 11500 km in a small diesel car.

Availability

Unglazed porcelain stoneware ceramic tiles are a relatively common product in the reclamation market. However, availability depends a lot on the quantities required. As an example :

Frequent	Batch from 1 to 5 m ²
Occasional	Batch from 5 to 20 m ²
Rare	Batch > 20 m ²

Indicative Prices (excl. tax)

A non-exhaustive sample of the Western European reclaim market (Belgium, France, UK, and the Netherlands) has allowed us to extract some indicative prices:

→ Cost of removal: 15 - 25 €/m²

→ Cleaning service: 25 - 35 €/m²

Supply: depending on size, pattern, general condition, etc. (excluding antiques)

→ Cleaned tiles: 25 - 50 €/m²

Hazardous substances and precautions

Heavy metals: The components in the glaze covering reclaimed glazed earthenware tiles are likely to contain atoms of lead and cadmium. These heavy metals are toxic to the body and to the environment and can migrate in contact with food. In the absence of specific technical documentation, attention should be paid to tiles intended for use on worktops and wall surfaces where food is prepared. For more information, you are advised to refer to European Regulation EC No. 1935/2004 and Directive 84/500/EEC which set the recommended limits not to be exceeded. This requirement can be verified by accredited control bodies.

Asbestos: Some tile adhesives used before 1990 may contain asbestos. Even if the risk is low (< 1 to 10% depending on the application and the countries), adequate measures must be taken in order to make a correct diagnosis. The risk is slightly higher for adhesives used in skirting board applications.

Find specialised businesses



salvoweb.com

opalis.eu

Design tip

To increase the chances of meeting the offer available on the reclamation market, the designer/specifier can choose to split large surface areas into smaller quantity batches (for example, by providing different patterns in each room).



Reclaimed wall tiles in a sanitary space (BE)
© VLA Architectes

Did you know?

As an example, the market for new wall tiles in France is around 50 million m²/year (all types included).