

Generic Terrazzo

Product Selection and Description

Terrazzo is a type of composition flooring. It consists of a mix of marble, granite, onyx, or glass chips in Portland cement, modified Portland cement, or resinous matrix that is poured, cured, ground, and polished.

BEES evaluates an epoxy, or resinous, terrazzo containing a high proportion of inorganic filler (principally marble dust and chips), a pigment for aesthetic purposes, and epoxy resin. The materials are mixed and installed directly on site and, when dry, are polished. The epoxy terrazzo is 9.5 mm (3/8 in) thick.

Flow Diagram

The flow diagram below shows the major elements of the production of this product, as it is currently modeled for BEES.

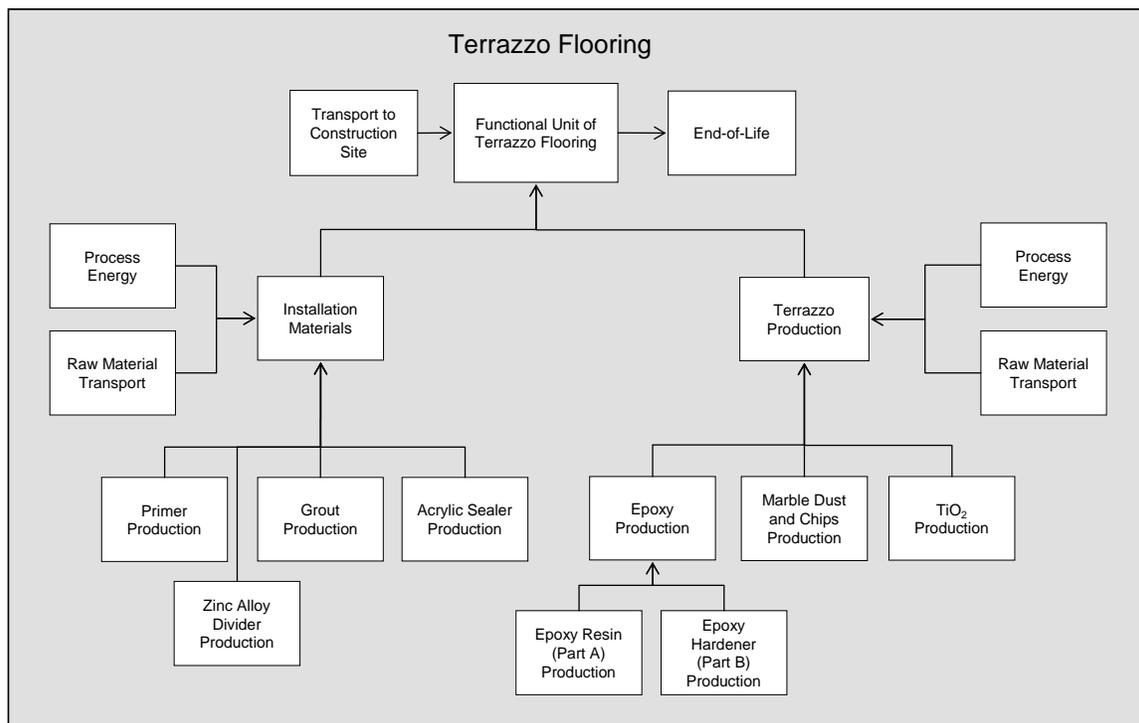


Figure 1: Terrazzo Flooring System Boundaries

Raw Materials

The Table below lists the constituents of epoxy terrazzo and their proportions.

Table 1: Terrazzo Flooring Constituents

Terrazzo Constituents	Mass Fraction (%)
Marble dust and chips	77
Epoxy resin	22
Pigment (titanium dioxide)	1

The term “marble” refers to all calcareous rocks capable of taking a polish (e.g., onyx, travertine, and some serpentine rocks). Marble is quarried, selected to avoid off-color or contaminated material, crushed, washed, and sized to yield marble chips for Terrazzo.¹ Note that because marble dust is assumed to be a coproduct

¹ National Terrazzo and Mosaic Association, Inc. (NMTA) website, <http://www.ntma.com>; Phone conversation with NMTA representative February 2006.

rather than a waste byproduct of marble production, a portion of the burdens of marble quarrying is allocated to marble dust production. The EcoInvent data set for basalt mining was used to represent marble quarrying.

Typical amounts of raw materials used are as follows: 1.5 kg (3.3 lb) of marble dust and 0.23 kg (0.51 lb) of marble chips per 0.09 m² (1 ft²); 3.8 L (1 gal) of epoxy resin per 0.8 m² (8.5 ft²); and, depending on customer selection, from 1 % to 15 % pigment content. The density of epoxy resin is approximately 1.1 kg/L (9.3 lb/gal).

Manufacturing

Energy Requirements and Emissions. Terrazzo is “manufactured” at the site of installation. The energy requirements for the on-site process include mixing the primer, mixing the terrazzo, grinding the surface (occurs before and after grouting), controlling the dust from grinding, mixing grout, and polishing the floor.

The only energy data available are for mixing the terrazzo, which is assumed to require a 5.97 kW (8 hp) gasoline-powered mixer running for 5 minutes.

Table 2: Energy Requirements for Terrazzo Manufacturing

<i>Energy Carrier</i>	<i>MJ/kg (Btu/lb)</i>
Gasoline	0.003 (1.17)

Transportation. The terrazzo constituents are assumed to be transported 402 km (250 mi) by diesel truck to the terrazzo supplier.

Waste. Approximately 1 % of the materials used to make the terrazzo are wasted during manufacturing. This waste is assumed to be disposed of in a landfill.

Transportation

Transportation of terrazzo flooring by heavy-duty truck to the building site is modeled as a variable of the BEES system.

Installation

Installing epoxy terrazzo requires a sub-floor of a compatible type, such as cement board, exterior grade plywood, concrete block, concrete, or cement plaster. Most systems adhere to concrete slabs.

Table 3: Terrazzo Flooring Installation Materials

<i>Installation Materials</i>	<i>Mass Fraction (%)</i>
Divider Strips (Zinc)	54.4
Epoxy Resin	34.3
Acrylic Sealer	11.3

To prevent the terrazzo from cracking, dividers are placed precisely above any concrete joints. Back-to-back “L” strip dividers are recommended for construction joints. Standard dividers are a 9.5 mm (3/8 in) wide, 16 gauge white zinc alloy, and weigh approximately 0.177 kg/m (0.119 lb/ft). A 10 cm (4 in) thick concrete slab should have concrete joints at a maximum spacing of 3.7 m (12 ft); therefore, 29 m (96 ft) of divider are required for every 13.4 m² (144 ft²). Manufacturer specifications suggest bonding the divider strips to the floor using 100 % solid epoxy resin. The BEES model does not account for the bonding material; the amount is assumed to be negligible.

Prior to applying the epoxy terrazzo, the sub-floor must be primed. The primer is made by mixing the epoxy resin components at a lower ratio than that used for the epoxy terrazzo. Typical coverage is approximately 18.6

m² to 23.2 m² (200 ft² to 250 ft²) per blended gal of primer.

After the terrazzo mixture has been applied and the surface has been grinded, the surface is grouted to fill and seal any voids. The grout is made by mixing the epoxy resin components in the same ratio used in the epoxy terrazzo. Typical coverage is approximately 46.5 m² to 65.0 m² (500 ft² to 700 ft²) per blended gal of grout.

After the floor has been grouted and polished, two coats of acrylic sealer are applied at an approximate thickness of one to two mils. Typical coverage for a single coat is approximately 74.3 m² to 92.9 m² (800 ft² to 1 000 ft²) per gal of sealer.

Data for these installation materials come from EcoInvent and elements of the SimaPro database.

Use

With general maintenance, a properly installed terrazzo floor will have a useful life of 75 years. Maintenance – such as cleaning and sealing of the tile - is not included within the boundaries of the BEES model.

End of Life

At end of life, it is assumed that the terrazzo and any installation materials will be disposed of in a landfill.

References

Life Cycle Data

National Renewable Energy Laboratory (NREL): *U.S. Life-Cycle Inventory Database*. 2005. Golden, CO.

Found at: <http://www.nrel.gov/lci/database>.

PRé Consultants: *SimaPro 6.0 LCA Software*. 2005. The Netherlands.

EcoInvent Centre: *EcoInvent data v2.0* (Dübendorf: Swiss Centre for Life Cycle Inventories, 2007). Found at: www.ecoinvent.org.

Industry Contacts

The National Terrazzo and Mosaic Association, Inc. (December 2005 – February 2006)