

Generic Vinyl Composition Tile

Product Selection and Description

Vinyl composition tile (VCT) is a resilient floor covering. Relative to the other types of vinyl flooring (vinyl sheet flooring and vinyl tile), VCT contains a high proportion of inorganic filler. The tile size modeled in BEES is 30 cm x 30 cm x 0.3 cm (12 in x 12 in x 1/8 in), with a weight of about 0.613 kg (1.35 lb).

Flow Diagram

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

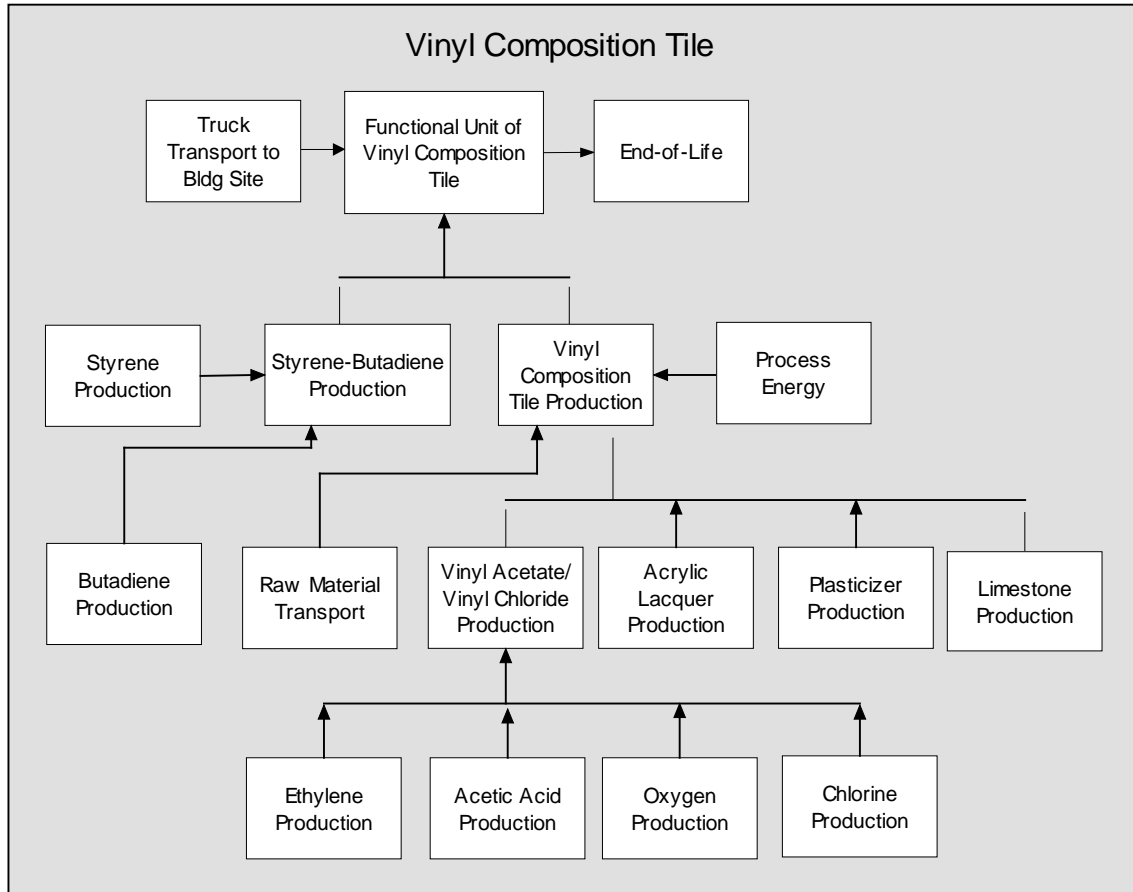


Figure 1: Vinyl Composition Tile System Boundaries

Raw Materials

The average makeup of vinyl composition tile is limestone, plasticizer, and a copolymer of vinyl chloride (95 %) and vinyl acetate (5 %). A layer of styrene-butadiene adhesive is used during installation.

The table below lists the composition by weight of 30 cm x 30 cm x 0.3 cm (12 in x 12 in x 1/8 in) VCT. A finish coat of acrylic latex is applied to the tile at manufacture. The thickness of the finish coat is assumed to be 0.005 mm (0.2 mils). The production of these raw materials is based on the U.S. LCI Database, EcoInvent, and American Chemistry Council data updated in 2010.¹

¹ Franklin Associates, a Division of ERG, for the Plastics Division of the American Chemistry Council: *Cradle-to-Gate Life Cycle Inventory of Nine Plastic Resins and Four Polyurethane Precursors* (Prairie Village, KS, 2010).

Table 1: Vinyl Composition Tile Constituents

<i>Constituent</i>	<i>Mass kg/m² (lb/ft²)</i>	<i>Mass Fraction (%)</i>
Limestone	5.54 (1.14)	84
Vinyl resins: 5 % vinyl acetate / 95 % vinyl chloride	0.797 (0.163)	12
Plasticizer: 60 % BBP (butyl benzyl phthalate) / 40 % DINP (diisononyl phthalate)	0.269 (0.055)	4
Total	6.61 (1.35)	100

Internal recycling is quite common, with at least 99 % of the raw materials initially used in the manufacturing process being ultimately used in the finished product. Typically, all scrap and rejected materials are reused in the manufacturing process for VCT. In fact, the amount of recycled content from tile processing can range from 12 % to 50 % of a finished tile.

It is difficult to provide a representative number for tile recycled content from sources external to the plant, due to multiple manufacturing sites and the lack of a constant supply of both post-industrial and postconsumer polyvinyl chloride (PVC). The majority of the recycled materials used are post-industrial, and a conservative recycled content number from external sources is 1 % by weight of the tile.

Manufacturing

Energy Requirements and Emissions. Energy requirements for the manufacturing processes (mixing, folding/calendaring, finish coating, and die cutting) are listed in the Table below.

Table 2: Energy Requirements for Vinyl Composition Tile Manufacturing

<i>Energy Carrier</i>	<i>MJ/kg (Btu/lb)</i>
Electricity	1.36 (585)
Natural Gas	0.85 (365)
Total	2.21 (950)

Emissions associated with the manufacturing process arise from the combustion of natural gas and are modeled using the U.S. LCI Database.

Transportation. VCT producers are located throughout the country. The bulk of the product weight is limestone, a readily available and plentiful filler typically located in close proximity to manufacturing sites. The raw materials used in the manufacture of the tile are all assumed to be transported to the production facility via diesel truck over a distance of 402 km (250 mi). Transportation of adhesive to the end user is assumed to be 241 km (150 mi) via diesel truck.

Waste. Typically, less than 1 % waste is generated from the production of VCT. This waste is usually comprised of granulated VCT and VCT dust and is disposed of in a landfill.

Transportation

Transportation of vinyl composition tile by heavy-duty truck to the building site is modeled as a variable of the BEES system.

Installation

A layer of styrene-butadiene adhesive is used during installation. The thickness of the adhesive is 0.08 cm (1/32 in) at application. Approximately 0.0133 kg (0.0294 lb) of adhesive is applied per ft² of vinyl composition tile. The adhesive is applied wet, and a loss in volume arises due to evaporation of the water in the adhesive as it dries. Adhesives are typically water-based and thus few volatiles are emitted. Installation of vinyl composition tile is primarily a manual process, so no energy use is modeled for the installation phase. The production of the adhesive is based on the American Chemistry Council data (2010).

Installation scrap varies depending on the job size. It is estimated that, on average, installation scrap for a commercial job is 2 % to 3 %. Scrap is sent to landfill.

Use

Vinyl composition floor tile is most commonly used in applications such as school cafeterias and classrooms, where there is relatively little exposure to abrasion from tracked-in grit and dirt. Based on historical observations, it is estimated that VCT in such applications lasts an average of 40 years before it is replaced due to wear. In extremely heavy traffic areas (which are normally much smaller in area), such as entryways in a school, the tile has a shorter life expectancy.

Because of differing VCT manufacturers' maintenance recommendations, there is not a single industry standard for maintenance of the product over its lifetime. Typically, VCT is stripped and polished annually. Many of the acrylic finishes used after the floor is installed consist of the same general materials as the factory-applied finishes. The equipment used to maintain the floor depends on the maintenance system selected by the building owner, often based on the desired overall appearance. Electric- or propane-powered floor machines may be used for stripping, polishing, and buffing. Frequency of refinishing, and types and quantities of stripping and polishing chemicals used each time, depend on the maintenance programs developed by individual building owners. Today, low-volatile organic compound (VOC) or no-VOC maintenance products are available for maintaining VCT floors. VOC off-gassing from the tile and adhesive at each installation are included in the BEES modeling.

End of Life

At end of life, the VCT and adhesive are assumed to 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.

Franklin Associates, a Division of ERG, for the Plastics Division of the American Chemistry Council: *Cradle-to-Gate Life Cycle Inventory of Nine Plastic Resins and Four Polyurethane Precursors* (Prairie Village, KS, 2010).

Industry Contacts

William Freeman, Resilient Floor Covering Institute, (September-November 2005)