

## 2.4 Concrete Flooring & floor finishes

Concrete floor finishes are typically only used in basements and garages. The floor should slopedown to a floor drain in basements and other areas where water may accumulate. In modern construction, a four to six inch gravel base below the 3-inch thick floor slab allows water below the slab to drain away. Moisture barriers (plastic sheets) may also be provided under the slab, and in energy efficient construction or slab-on-grade construction, rigid insulation may be used below the floor. In older construction, concrete floor slabs were as thin as 1/2 inch. These are prone to impact damage, heaving and break-up.

This is a cosmetic issue and may be a trip hazard. Most concrete floors are not part of the structure. Basement floors are typically installed after the home is completed, and their mainfunction is to keep our feet out of the mud.

Concrete basement floors can be overlaid with finished flooring. Since almost every house with a basement has water on the basement floor at some point, water-resistant floors make sense. In slab-on-grade construction, the concrete floors provide a substrate for floor finishes. - Citation: Carson Dunlop Associates, *Home Reference Book* , quoted with permission.

### Concrete Floor details

- FLOOR, CERAMIC TILE
- FLOOR, CONCRETE SLAB CHOICES
- FLOOR DAMAGE DIAGNOSIS
- FLOOR, ENGINEERED WOOD, LAMINATES INSTALL

- FLOOR FRAMING & SUBFLOOR for TILE
- FLOOR, KITCHEN & BATH OPTIONS
- FLOOR, LAMINATE PLASTIC
- FLOOR, CONCRETE POURED FINISH

Cork Flooring - Details about cork flooring are at these articles



- CORK FLOORING & FLOOR TILES
- FLOORING COMPANIES

FLOOR TILE HISTORY & INGREDIENTS - history, dates, and description of the production process and ingredients in asphalt floor tiles, asphalt-asbestos floor tiles, & vinyl-asbestos floor tiles 1900 to present.

- FLOORING MATERIALS, Age, Types - Age of Building Flooring Materials - A Guide to Estimating Building Age, This article describes types and ingredients in flooring materials: Asphalt floor tile, Cork floor tile or planks, Laminate flooring (modern), Linoleum & older sheet flooring (painted canvas), Vinyl-asbestos floor tiles, Wood flooring.

FLOOR TYPES & DEFECTS - Asphalt floor tiles, asphalt-saturated asbestos felt, carpeting, cork floor tiles & planks, laminate flooring (modern), linoleum (sheet flooring) & earlier painted fabric floor coverings, vinyl-asbestos tile floors, wood flooring.

□ Resilient Floor List

- Asphalt Tile
- Cork Flooring Tiles
- LINOLEUM & Other Sheet Flooring
- Sheet Flooring Materials
- Vinyl Asbestos Tiles

□ Non-Resilient Floor Coverings

- Carpeting
- Laminate Flooring Products
- Tile Floors
- Wood Flooring

### **Hardwood Flooring, the Basics**

Hardwood floors are traditionally oak, although other woods such as cherry, walnut, birch, beech, mahogany, elm and maple, are also used. Bamboo is not technically wood, but is also used as flooring. Hardwood flooring may be in the form of strips or parquet, which often consist of six inch squares with each square made up of six one-inch strips. The squares are laid with the grain in adjoining squares at right angles, giving a checkerboard effect. Parquet flooring may be nailed

or glued down. There are several different types and installation techniques. Parquet flooring can also be made up of a combination of rectangles, triangles and lozenges and can be very decorative and very expensive. Strip flooring is typically tongue and groove, secured with nails driven diagonally through the tongues into the subfloor. Hardwood flooring in modern construction is typically 3/8 inch to 3/4 inch thick and may be pre-finished or finished on site. Hardwood flooring is a high quality and durable floor system. It can be mechanically damaged, attacked by termites, rot and fire, or damaged by water.

Wood flooring is not ideally suited to kitchen and bathroom areas, since it is susceptible to water damage. Nonetheless, hardwood flooring is regularly found in kitchens. Individual boards can be replaced, but matching can be tricky. Worn 3/8 inch thick hardwood flooring can be sanded once to provide a new wood surface. 3/4 inch hardwood flooring can be sanded several times before the tongues are exposed. Wood flooring can be covered with carpeting or other flooring materials. - Citation: Carson Dunlop Associates, *Home Reference Book*, quoted with permission.

**Kitchen & Bath Floor Options** - Table comparing properties of different flooring materials

FLOOR, KITCHEN & BATH OPTIONS

**Laminate Flooring,** (Plastic Laminate Floors and Engineered Wood floors)

In recent years, laminate flooring has become very popular, especially among do-it-yourselfers. Laminate floor planks (or tiles) have several layers. The top layer is

generally a clear laminate that is bonded to a decorative layer below, often creating the look of a wood floor. These layers are bonded to a wood- or fiber-based core. The bottom layer may be a paper or melamine backing. The product is similar to resilient countertops. A complete floor is created by either snapping planks together with specially-designed fasteners along the edges, or by gluing planks together along traditional tongue and groove edges.

Laminate flooring is not secured to the subfloor beneath it. Instead, it is installed as a floating floor, allowing it to expand and contract. A sheet of cushioning foam is installed between the laminate flooring and the subfloor. There may also be a sheet of plastic below the foam to act as a moisture barrier and to allow the floor to slide as it expands. A gap is required between the flooring and the walls to allow for expansion. This gap is covered by trim. Laminate flooring cannot be sanded, stained, or otherwise refinished, although damaged planks can be replaced.

Laminate flooring is resistant to small amounts of water, such as quickly wiped-up spills, but precautions should be taken in kitchens or bathrooms including applying a sealant around the perimeter. This is not visible during a home inspection. Laminate flooring should not be installed in damp basement areas. - Citation: Carson Dunlop Associates, *Home Reference Book* , quoted with permission

See these detailed articles on laminate floor materials:

#### □ LAMINATE PLASTIC FLOORING

- LAMINATE WOOD & Other Laminate Floors
- WOOD FLOORING & Engineered Wood Floors

### **Linoleum Flooring articles**

- LINOLEUM & Other Sheet Flooring shown at left, Congoleum sheet flooring also see Congoleum Flooring History



### **Mold on or hidden in flooring**

- FLOOR & SUBFLOOR MOLD, HIDDEN

### **Non-Resilient Floor Coverings - article list**

- Non-Resilient Floor Coverings
- Laminate Flooring Products
- Wood Flooring
- Tile Floors
- Carpeting

- **Peel and Stick** / Self-Adhesive Floor Tiles - types of self-adhesive floor tiles and peel and stick tiles intended for consumer installation

**Resilient Flooring** - see details at FLOOR, RESILIENT VINYL or CORK

Resilient floor coverings include vinyl-asbestos, solid vinyl, vinyl faced, rubber, cork, asphalt and linoleum. It is installed in sheets or tiles. More expensive products include a cushioned backing material and a no-wax surface. In modern construction, these materials are typically applied over a 1/4 inch plywood underlayment. These thin, flexible materials will show through any irregularities in the floor surface. -

Citation: Carson Dunlop Associates, *Home Reference Book*

Also see:

- Asphalt Tile
- Cork Flooring Tiles
- LINOLEUM & Other Sheet Flooring
- Vinyl Asbestos Tiles
- Resilient Floor List
- Sheet Flooring Materials

**Sheet Flooring** see sheet linoleum & vinyl flooring

- FLOOR TILE ASBESTOS IDENTIFICATION
- FLOOR TILE HISTORY & INGREDIENTS
- Sheet Flooring Materials

## **Stone Floors - Slate, Granite, Limestone, Marble**

These are natural materials cut into flooring tiles. Terrazzo is made of marble chips set in concrete, usually laid in squares defined by lead beading. The surface is polished to give a smooth floor. Terrazzo is more common in commercial buildings, hospitals and schools than in homes. Stone and terrazzo are good flooring materials because of their strength, appearance and durability. Installation considerations are similar to ceramic and quarry tile, in that the weight of the material itself may deflect conventional flooring systems. Joints on stone floors are grouted. -Citation: Carson Dunlop Associates, *Home Reference Book*

## **Tile Flooring - ceramic**

Generally considered high quality, ceramic or quarry tiles are hard, fired-clay products that may be glazed or unglazed. These materials stand up well to heat, water and normal wear and tear, and have good resistance to stains and cuts. These brittle floor systems will crack if not well supported. A conventional wood flooring system often has too much flex to support ceramic or quarry tile. Better installations include a concrete base for the tile, typically one to five inches thick. Tiles may be pressed into the concrete while it is setting. Joints are then grouted. Tiles are typically 1/16-inch to 1-inch thick and are commonly from one inch by one inch to 24 inches by 24 inches. Many shapes, colors, patterns and finishes are available. In modern construction, a thin mortar base or adhesive is used over a thick subfloor. If well installed, this can be satisfactory. Again, joints have to be appropriately grouted. It is common for ceramic



or quarry tile floors to be cracked where floor joists deflect, or in heavy traffic patterns. Tiles can be damaged by dropping tools, pots, pans or other heavy objects.

Traditionally, ceramic tile floors were used in bathrooms and vestibules, because of their natural resistance to moisture. Ceramic or quarry tile floors are used in kitchens, for the same reason, although they are unforgiving if one drops glass on them, and they are also more tiring to stand on because of their hard surface. Wet floors can be slippery. - Citation: Carson Dunlop Associates, *Home Reference Book*

### **Tile Flooring - resilient, vinyl, vinyl-asbestos**

- FLOOR TILE HISTORY & INGREDIENTS
- **Vinyl Asbestos Flooring Information: Tiles & Sheet Flooring**
  - Vinyl Asbestos Floor Tile Age
  - Vinyl-Asbestos Floor Tile History
  - Vinyl Asbestos Floor Tile Packaging
  - Vinyl Asbestos Floor Thickness & Dimensions
  - Vinyl Asbestos Sheet Flooring

### **Wood Flooring & Engineered Wood Floors**

- **Engineered wood flooring** is similar to laminate flooring, except the thin top layer is actually hardwood that is bonded to a base that may be hardwood, plywood, or high-density fiberboard. The hardwood layer is usually pre-

finished. The floor may be sanded and refinished, depending on the thickness of the hardwood layer. Engineered wood flooring may be installed as a floating floor, or it may be glued, stapled, or nailed in place.

- Citation: Carson Dunlop Associates, *Home Reference Book* , quoted with permission.

- **Softwood Wood Flooring:** Pine is the most common softwood flooring. Fir and cedar are also used. Pine floors were typically used as a subfloor or as finish flooring in a 1x4 tongue-and-groove configuration. When used as a subfloor below hardwood, the softwood was typically laid in 1x4 or 1x6 planks, perpendicular or diagonal to the floor joists. The boards were typically separated slightly to allow for expansion.
- Softwood subflooring used under linoleum or other thin kitchen floor coverings was usually tongue-and-groove and tightly fit to provide a smooth, continuous surface to support the flexible flooring system. Modern construction often includes 1/4 inch plywood underlayment between the subfloor and finish flooring to provide a smooth surface for the finishing material. - Citation:  
Carson Dunlop Associates, *Home Reference Book* ,
- **Laminate Wood & Other Laminate Floors**

- Also see Laminate Flooring where we describe plastic laminate floors in this article
- FLOOR WOOD AGE TYPES HISTORY
- FLOOR WOOD, DAMAGE DIAGNOSIS
- FLOOR, WOOD ENGINEERED, LAMINATE, INSTALL
- FLOOR, WOOD FINISHES
- FLOOR, WOOD INSTALLATION GUIDE
- FLOOR, WOOD MOISTURE
- FLOOR, WOOD RADIANT HEAT
- FLOOR, WOOD SOLID STRIP, PLANK
- FLOOR, WOOD TYPES
- Also see FLOOR TILE HISTORY & INGREDIENTS and
- FLOOR, CONCRETE SLAB CHOICES,
- SLAB INSULATION, PASSIVE SOLAR for examples of discussion of energy-efficient floor designs and passive solar floor systems.

### **Guide to Inspection & Diagnosis of Flooring Materials in buildings**

#### **List of Non-Resilient & Resilient Floor Coverings Used in buildings. Definitions of Non-resilient Flooring & Resilient Flooring**

Non-resilient floor coverings used in buildings that can assist in determining the age of a structure include bamboo, brick, concrete, stone, slate, and a wide variety of wood products.

***Definition of non-resilient flooring:***

"Non-resilient" flooring is defined as hard surfaced flooring material such as stone, brick, slate, or ceramic tile.

***Definition of resilient flooring***

"Resilient flooring" is defined as materials softer than the non-resilient materials we just listed (stone, slate, brick, ceramic tile), and includes organic types of flooring: asphalt based floor tiles, cork floor tiles, cork floor planks, linoleum sheet flooring (antique & modern), plastic floor tiles, rubber floor tiles, vinyl-asbestos floor tiles. So what's "wood flooring" ? After all, it is organic too. Is a wood floor non-resilient, resilient, or just "wood"?

Non-resilient.

See Asphalt & Vinyl Floor Tile History - history, dates, and description of the production process and ingredients in asphalt floor tiles, asphalt-asbestos floor tiles, & vinyl-asbestos floor tiles.

**Asphalt Tile Flooring - 1920 - 1960 (est.)**

Asphalt floor tiles are 9" square (or other sized) tiles which used asphalt as the main binding material. the original asphalt tiles were produced only in dark colors because asphalt was a main ingredient.

The black tiles shown at left were not dated and may be a newer product, but in general, if you find very old black floor tiles they are probably an asphalt-asbestos product.

Rosato indicates that the first publicized asphalt tile installation was in 1920 in New York City's Western Union office. The product was very successful and by 1936 over four million square yards of asphalt floor tiles were being sold annually.

By 1940, 5% of floor coverings sold in the U.S. were asphalt tile. -- Rosato In 1920 asphalt roofing manufacturers, who had been using asphalt and fiber binders to make asphalt roofing shingles for some time, tried to develop a rigid product that could be a substitute for (more costly) slate roofing. The material did not perform acceptably as a roof covering, but it led to the development of asphalt floor tiles.

At AGE of a BUILDING - how to determine in our section titled Flooring Materials we discuss the eras during which various flooring materials were first used in modern buildings and how to use these to help identify the age of a building.

### ***Asphalt Floor Tiles Pose an Asbestos Risk***

Asphalt-asbestos floor tiles were produced at first in dark colors using a heavy asphalt binder combined with a very high percentage of asbestos filler fibers. It would be

uncommon to find these floors still in use today, but if you encounter black or very dark asphalt floor tiles they are probably very high in asbestos fibers. We discuss floor tiles as an asbestos fiber source in buildings in more detail at ASBESTOS FLOOR TILE IDENTIFICATION where we elaborate the concerns about asbestos used in the manufacture of asphalt-based floor tiles.

### ***Colors & Composition of Asphalt Asbestos Floor Tiles***

Asphalt -asbestos tiles manufactured early in their life (1920's) were either black, near black, brown, or a gray-brown tone. Brown asphalt-asbestos tiles were made by substituting gilsonite as a binder. In both cases the tiles were hardened by evaporating a solvent used in the fabrication process, or by cooling of hot asphalt used in the mixture.

Gilsonite could be used to produce a wider range of mixtures, but required some asphalt as a softener. Dark vinyl-asbestos tiles used, for example, a mixture of 40 parts asphalt or gilsonite, 60 parts asbestos floats, 30 parts powdered limestone, and pigments (parts by weight). Another typical mixture cited by Rosato contained 70% asbestos fiber.

See these articles on asphalt and vinyl-asbestos floor tile identification:

- ASBESTOS FLOOR TILE IDENTIFICATION - How to Identify Floor Tiles That May Contain Asbestos

- ASBESTOS FLOOR TILE IDENTIFICATION PHOTOS by YEAR - detailed photo guide to asphalt asbestos and vinyl asbestos floor tiles, 1900 -1986
- FLOOR TILE HISTORY & INGREDIENTS - history, dates, and description of the production process and ingredients in asphalt floor tiles, asphalt-asbestos floor tiles, & vinyl-asbestos floor tiles 1900 to present.
- FLOORING MATERIALS, Age, Types - Age of Building Flooring Materials - A Guide to Estimating Building Age, This article describes types and ingredients in flooring materials: Asphalt floor tile, Cork floor tile or planks, Laminate flooring (modern), Linoleum & older sheet flooring (painted canvas), Vinyl-asbestos floor tiles, Wood flooring.
- FLOOR TYPES & DEFECTS - Asphalt floor tiles, asphalt-saturated asbestos felt, carpeting, cork floor tiles & planks, laminate flooring (modern), linoleum (sheet flooring) & earlier painted fabric floor coverings, vinyl-asbestos tile floors, wood flooring.
- ASBESTOS FLOOR TILE LAB PROCEDURES - photos of how vinyl asbestos flooring is analyzed in the lab.

### **Cork Flooring Tiles**

Cork floor tiles were considered a warm, quiet, but less durable resilient floor covering than some of its competitors. It was sold often for use in residential dens, family rooms, or other warm, low-traffic areas, and it may have been popular (research needed) for use in areas where workers had to spend long periods standing - where it would have competed with rubber floor coverings. In 1952 cork flooring

sales made up 2% of total floor tile sales. -- Rosato p88.

Details about cork flooring are at **CORK FLOORING & FLOOR TILES** and also at **FLOORING COMPANIES** (see Armstrong Corporation).

### **Vinyl Asbestos Floor Tiles - 1930 - 1976 (est)**



Vinyl floor tiles, including vinyl-asbestos floortiles and homogenous vinyl floor tiles (non-asbestos product) are almost as old as asphalt floor tiles. By the early 1950's in the U.S. vinyl tile floor products were more popular than asphalt- based flooring. The reason is pretty obvious.

Asphalt-based flooring as it was originally produced used heavy asphalt products which meant that the floor tiles could be made in dark colors only. Soon after asphalt-asbestos floor tiles were marketed manufacturers heard from their buyers that consumers wanted lighter floor tiles and tiles of varying color and pattern.



Organic resin vinyl increased in popularity for this reason, but slowly. By 1952, the production of vinyl plastic floor tile sales in the U.S. was about half the volume of asphalt floor tiles, selling 35 million square yards.

We discuss vinyl-asbestos floor tiles as an asbestos fiber source in buildings in more detail at ASBESTOS FLOOR TILE IDENTIFICATION where we elaborate the concerns about asbestos used in the manufacture of vinyl based floor tiles that used high levels of asbestos fibers as a filler material and to provide other properties to that product. More photos of vinyl asbestos floor tiles, including microphotographs of vinyl-asbestos floor tiles can be seen at that article.

See these articles on asphalt and vinyl-asbestos floor tile identification:

- ASBESTOS FLOOR TILE IDENTIFICATION - How to Identify Floor Tiles That May Contain Asbestos
- ASBESTOS FLOOR TILE IDENTIFICATION PHOTOS by YEAR - detailed photo guide to asphalt asbestos and vinyl asbestos floor tiles, 1900 -1986
- FLOOR TILE HISTORY & INGREDIENTS - history, dates, and description of the production process and ingredients in asphalt floor tiles, asphalt-asbestos floor tiles, & vinyl-asbestos floor tiles 1900 to present.
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Laminate flooring (modern), Linoleum & older sheet flooring (painted canvas), Vinyl-asbestos floor tiles, Wood flooring

- FLOOR TILE / SHEET FLOORING PHOTO GUIDES - list of photo guides
- FLOOR TYPES & DEFECTS - Asphalt floor tiles, asphalt-saturated asbestos felt, carpeting, cork floor tiles & planks, laminate flooring (modern), linoleum (sheet flooring) & earlier painted fabric floor coverings, vinyl-asbestos tile floors, wood flooring.
- ASBESTOS FLOOR TILE LAB PROCEDURES - photos of how vinyl asbestos flooring is analyzed in the lab.



### **Sheet Flooring Materials That Indicate Age of a Building**

Here is a photograph of an early (pre-vinyl) continuous floor covering, 1900, in an 1840 historic Vermont house.

Note the fabric backing of the flooring material. This article explains various common flooring materials (rough wood, finished wood, parquet, carpeting, linocrusta, sheet

vinyl, and other items as they assist in determining the age of a house or other building.

Details about sheet flooring are at SHEET FLOORING MATERIALS and at LINOLEUM & Other Sheet Flooring.



### **Linoleum Sheet Flooring As an Indicator of Building Age - 1890 - 1960 (est)**

At LINOLEUM & Other Sheet Flooring we describe the history and properties of linoleum sheet flooring using the Congoleum-Nairn corporation history to obtain some useful dates on when different sheet flooring products were produced.

The resilient flooring product shown at left was made in the late 1990's and is not an asbestos concern, though in this case the flooring was damaged by water and movement of a cabinet.

According to Rosato, "The original resilient floor coverings were developed during the latter part of the Nineteenth Century by Frederick Walton.

The original covering was linoleum for use as a floor decking on British naval ships." The composition of the original products included asphaltic binders to which asbestos filler was added by mixing on a rubber mill.

**Details are at LINOLEUM & Other Sheet Flooring and at Congoleum Flooring History.**

### **List of Non-Resilient Floor Coverings Used in buildings**

Non-resilient floor coverings used in buildings that can assist in determining the age of a structure include bamboo, brick, concrete, stone, and a wide variety of wood products.



### **Laminate Wood & Plastic Flooring Products**

The laminate wood flooring shown at left was buckled and destroyed by flooding caused by a leaky heating pipe. As we discussed with traditional wood flooring above, severe flooding or installation errors can lead to total loss of the finish floor system.

Contemporary snap-together flooring products that resemble wood or other surfaces, but are made of plastic, and other pre-finished and ready-to-assemble wood flooring products are a much more modern product.

Pergo (TM) laminate flooring, for example, was developed by Pergo AB, a Swedish company founded around 1890 as a vinegar manufacturer. Product developments for Pergo laminate

flooring began in 1977 and was first brought to the market in 1984. Pergo laminate flooring was first sold in the U.S. in 1994.

It's safe to say that if you see a Pergo product in a building in U.S. the flooring was installed no longer ago than 1994. But because this product has been widely used as a renovation material installed atop older pre-existing finish floor surfaces, one should not presume that the product age is the same as the building age unless the floor was installed as original material - that is, unless it was not installed over an older floor covering.

Just seeing Pergo TM laminate flooring over a plywood subfloor is not sufficient data to conclude the age of a home. Older carpeting may have been removed to expose a plywood subfloor over which the laminate flooring was then installed.

## **Wood Flooring Inspection, Diagnosis, Repair**



Wood flooring, one of the most warm and beautiful materials that can be placed in a home (OPINION-DF) needs to be installed following proper practices.

The gaps that appeared in the wood floor shown at left were caused by installation of the floor in a new home, over radiant heat tubing, and without allowing the flooring to reach a proper moisture level before it was nailed in place.



Extreme buckling can cause an upwards explosion of a wood floor when flooring is exposed to flooding or prolonged leaks.

This severe buckling wood floor damage can occur even at much smaller increases in interior moisture if a tongue and groove wood floor is improperly installed - leaving inadequate free space margin around the floor perimeter.

See Wood Floor Types for a catalog of types and ages of wood flooring.

See WOOD FLOOR DAMAGE REPAIR for details of types of damage to wood flooring and for a description of wood floor repair approaches.

### **Tile Floor Inspection, Diagnosis, Repair**



SIZE OUTSPREAD

Cracked floor tiles like this can be diagnosed in order to decide if the cracking shows a serious structural problem, inadequate floor support, mechanical damage, or as in this case, damage from a loose, rocky toilet.

More Places to Look for Hidden Mold in buildings includes a discussion of how even a slight slope in a tile bathroom floor leads to bath leaks under and behind bathroom vanity cabinets and floor trim, and we discuss how to prevent this problem

### **Wall-to-wall Floor Carpeting Inspection, Diagnosis, Repair**





See these articles about diagnosing stains, mold, and allergens in carpeting

- CARPET DUST IDENTIFICATION
- CARPET MOLD CONTAMINATION
- CARPET PADDING ASBESTOS, MOLD, ODORS
- CARPET STAIN DIAGNOSIS
- CARPET & other STAIN TESTS
- CARPET TEST PROCEDURE
- CABINETS & COUNTERTOPS
- CARPETING & INDOOR AIR QUALITY
- CARPETING, SELECTION & INSTALLATION
- Thermal Tracking: How to Diagnose Indoor Carpeting Stains Due To Building Air Leaks
- How to Find and Test for Moldy Carpeting in buildings
- Carpet Test for Mold: How to Collect Test Samples from Carpets & Soft Surfaces