

# Analysis of Linoleum, its Advances in the field of Building Materials and its Properties

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**Abstract** — This document introduces the basic understanding to the building material Linoleum and further explains the uses, current trends and advances in the applications and manufacturing. In addition, its history, suitable flooring methods are also described in brief. Also, a comparison is drawn between the practice of using vinyl floor coverings and linoleum floor coverings.

## I. INTRODUCTION

“When concrete is used as the structural deck in a building, it may be left exposed to serve as a wearing surface, depending on the quality of the surface and the type of occupancy. This is generally done in warehouses and industrial buildings with heavy moving loads. Some engineers, however prefer to place a higher-quality topping on the structural concrete slab. The topping may be applied before or after the base slab has hardened. Usually, integral toppings are half inch thick, independent toppings about 1in. (Finishing concrete Slabs with colour and texture, SS391, Portland Cement Association, Skokie, III – [www.portcement.org](http://www.portcement.org) )In office buildings where electricity and telephone wiring are distributed above the structural slab, a lightweight concrete fill covers the conduit and a floor covering protects the pill.”[1]

“Linoleum is made from drying oils, such as linseed, natural and synthetic resins, a filler, and pigments similar to those used in paints. Usually, it is backed with burlap or rug felt. Since the backing is susceptible to moisture and fungus attack, linoleum should not be used for floors where moisture can reach the backing. Properly maintained, it performs outstandingly on rigid subfloors above grade in residential and commercial buildings. Since protection from moisture is a prime consideration for most thin floor coverings, moisture within a concrete slab must be brought to a low level before installation of the flooring begins. Moisture barriers should be placed under concrete slabs at or below grade, and a minimum of 30 days drying time should be allowed after concrete placement before installing the flooring. A longer drying time should be allowed for lightweight concrete.”[1] It is most suitable for decorative floor covering for wood and concrete floors.

Floor coverings are used to improve the appearance, cleanliness, noiselessness and damp-proofing of the floors. Various types of materials are used and different treatments are done. Generally used:

1. Brick floor covering
2. Concrete floor covering
3. Stone floor covering
4. Tiled floor covering
5. Wood-block floor covering
6. Terrazzo floor covering
7. Mosaic floor covering
8. Asphalt floor covering
9. Rubber floor covering
10. Linoleum floor covering
11. Glass floor covering
12. Cork floor covering
13. Magnetic floor covering
14. Plastic floor covering

## II. HISTORY, TYPES AND PROPERTIES

It is considered a plastic material, classified as plain, printed and inlaid. Plain linoleum has uniform colour and a thickness of 2-4.5mm. Printed linoleum has patterns printed on it in oil paints and its thickness varies from 1.25-2mm. Inlaid linoleum has small units of linoleum in different colours and shapes patterned and pressed on a burlap black.

“Frederick Walton created natural linoleum in the mid-1800s. The name came from the Latin words *linum* (“flax”) and *oleum* (“oil”). Over the next fifty years, Walton developed a wide range of linoleum styles – including marbled linoleum, produced by adding other elements to the hot sheets of linoleum so they would marble or speckle before they dried, and striped linoleum, made by cutting coloured strips and placing them side-by-side then heat fusing them together. The colourful combinations made them popular choices to jazz up heavy traffic areas.”[2]. Between the time of its invention in 1860 and its being largely superseded by other hard floor coverings in the 1950s, linoleum was considered to be an excellent, inexpensive material for high use areas. In the late nineteenth and early twentieth centuries, it was favoured in hallways and passages, and as a surround for carpet squares. However, most people associate linoleum with its common twentieth century use on kitchen floors. Its water resistance enabled easy maintenance of sanitary conditions and its resilience made standing easier and reduced breakage of dropped china.



#### A. Thickness

Linoleum is available in different gauges – with thickness

- 6.7 mm,
- 6.0 mm,
- 4.5 mm,
- 3.2 mm,
- 2.0 mm,
- 1.6 mm.

Linoleum is available in rolls, and is spread directly on concrete or wooden flooring. The sheets are either plain or printed, available in 2 to 6mm thickness, and 2 to 4m wide rolls. [3]

#### B. Types of Flooring Suitable and Required Damp-Proofing

Since Linoleum can't withstand moisture, the suitable floorings should be capable of preventing moisture. "Dampness and damp proofing are the important factors which require careful consideration, especially in the construction of ground floors. A damp floor creates very unhealthy environment in the building." [4] Two such flooring types are suitable:

1. Hollow tiled ribbed floor – To reduce the weight of a solid floor structure, a hollow tiled ribbed floor is constructed. In this type of construction, hollow blocks of clay or concrete are used. These hollow blocks or tiles are placed at about 10cm apart. In this space of 10cm mild steel bars of 8 to 12 diameter are placed. The surfaces of the hollow tiles are kept rough to develop a better bond with the surrounding concrete. A minimum cover of 8cm. is provided at the top of the

tile. The empty spaces are filled up with the concrete. These floors are fire proof, sound-proof, damp-proof, light and economical. A properly designed floor of this type can carry heavy loads. [4]

2. Double joist timber floor – stronger than single joist timber floor, used for longer spans for 3.6 to 7.5 m and prevent the travel of sound waves to a great extent. This is a more rigid type of flooring and hence there is less chance of developing cracks in the plastered ceiling. More sound proof. [4]

"Methods of damp-proofing:

1. Use of Damp proof course (D.P.C): membrane damp proofing
2. Integral damp proofing
3. Surface treatment
4. Cavity wall construction
5. Guniting
6. Pressure grouting" [3]

#### C. Types on basis of installation:

For installation, there are three types of linoleum:

1. Sheet, which are both secured to the subfloor with a full-spread adhesive
2. Tiles, which are secured the same way sheet is
3. Floating (or click-lock) linoleum, which comes in panels that click and lock together to form a floating floor.

### III. USES IN MODERN DAY

It is a majorly used floor covering in many parts of the world.

#### A. Inlaid Linoleum

Walton also created the high-end, very durable 'inlaid' linoleum. This is created by pouring the liquid that becomes linoleum flooring into metal trays that have been cut into designs. These designs shape the cooling linoleum as it dries. The results are thicker, harder, customized tiles that could be done in detailed patterns – almost like parquet flooring, but in coloured tile. [2]

#### B. Battleship Linoleum

Today there is also the 'battleship' option, which is a very heavy linoleum originally manufactured for the U.S. Navy to use on its warships. After the attack on Pearl Harbor, however, the Navy stopped using linoleum because it was too flammable (though not as flammable, obviously, as wood). Battleship linoleum is still used in heavy traffic areas, like public buildings. [2]

The largest present day manufacturer of linoleum is Forbo Flooring which is based both in Assendelft (the Netherlands) and Kirkcaldy (Scotland), which sells the material under the trademarked name of Marmoleum. The company, which is

part of the Switzerland-based Forbo Group, is the oldest manufacturer of linoleum in the world.

BLICK BATTLESHIP GRAY LINOLEUM



C. Tiles and Sheets

As already discussed, Linoleum is used widely both in the forms of tiles as well as sheets.



D. How Vinyl and Linoleum compete in the modern day

TABLE I  
DIFFERENCES BETWEEN VINYL AND LINOLEUM FLOORING

Appearance (in Time New Roman or Times)	
Vinyl	Linoleum
Pros: 1. Durable, 2. Water-resistant in sheet form, 3. Easy to clean, comfortable, 4. Less expensive than most flooring choices.	Pros: 1. Made of natural raw materials, 2. More durable than vinyl, 3. Colour extends through entire material, 4. Can be hand-cut for

	intricate patterns and installation artistry.
Cons: 1. Difficult to repair, 2. Less expensive grades may discolour, 3. In tile form- moisture can get into seams between tiles	Cons: 1. Should be tested annually, 2. Cannot be left wet, 3. May scuff if not well polished
Cost: \$1-\$7, installed	Cost: \$6-\$9, installed
Synthetic product made of chlorinated petrochemicals	linoleum is made from raw and natural ingredients
Vinyl will melt if a lighted match lands on it	Linoleum can't.
Vinyl cannot be used on countertops and backsplashes.	Linoleum can be used on countertops and backsplashes.
Most vinyl patterns are printed into the surface	Linoleum's colours go all the way through.

Linoleum has been steadily gaining ground on vinyl flooring for many years. Aside from the fact that linoleum can be made from natural products (no PVC), the colour or image on linoleum is continuous from top to bottom, unlike vinyl flooring. Vinyl flooring imprints the colour on the top layer only, so if the vinyl floor is dinged, it disturbs the pattern and makes the damage very noticeable.

Linoleum is a more affordable and offers an easier cushion to your feet than hardwood flooring, bamboo flooring, or ceramic tile, though it is more expensive than most carpet. Linoleum is the choice of many hospitals and clinics because in addition to being affordable, easy to replace, and comfortable to stand on, it is also hypoallergenic. [4][5][6]

IV. BUREAU OF INDIAN STANDARDS

Both these codes primarily mention the methods for linoleum. [7]

IS 653: 1992 – Specification for linoleum sheets and tiles (third revision)

IS 9704: 1980 – Methods of tests for linoleum sheets and tiles.

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Linoleum as a floor covering has been largely replaced with polyvinyl chloride (yet still colloquially known as "linoleum"), which has similar properties of flexibility and durability, but which has greater brightness and translucency and which is relatively less flammable. The fire-retardant properties of PVC are due to chlorine-containing combustion products, some of which are highly toxic. Dioxins are released by burning PVC. While the polymer itself is generally considered safe, additives such as plasticizers and unintentional impurities such as free monomers are considered a hazard by some. [5]

Because it is made of organic materials and is purportedly non-allergenic in nature, high quality linoleum is still in use in many places (especially in non-allergenic homes, hospitals and health care facilities). Linoleum tiles can be made to various designs and inlaid with various colours to form patterns reflecting the shape and use of a room. [6]

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- [7] National Building Code of India, Bureau of Indian Standards, p19, Part 5 Building Materials