

# MISCELLANEOUS MATERIAL

Lecture - 1

Course Coordinator

Dr. Raju Sharma

Assistant Professor

Department of Civil Engineering

Thapar Institute of Engineering and Technology

Patiala, Punjab

# Content



**1**

Asphalt



**2**

Bitumen



**3**

Sound Absorbing Material



**4**

Summary



# Asphalt

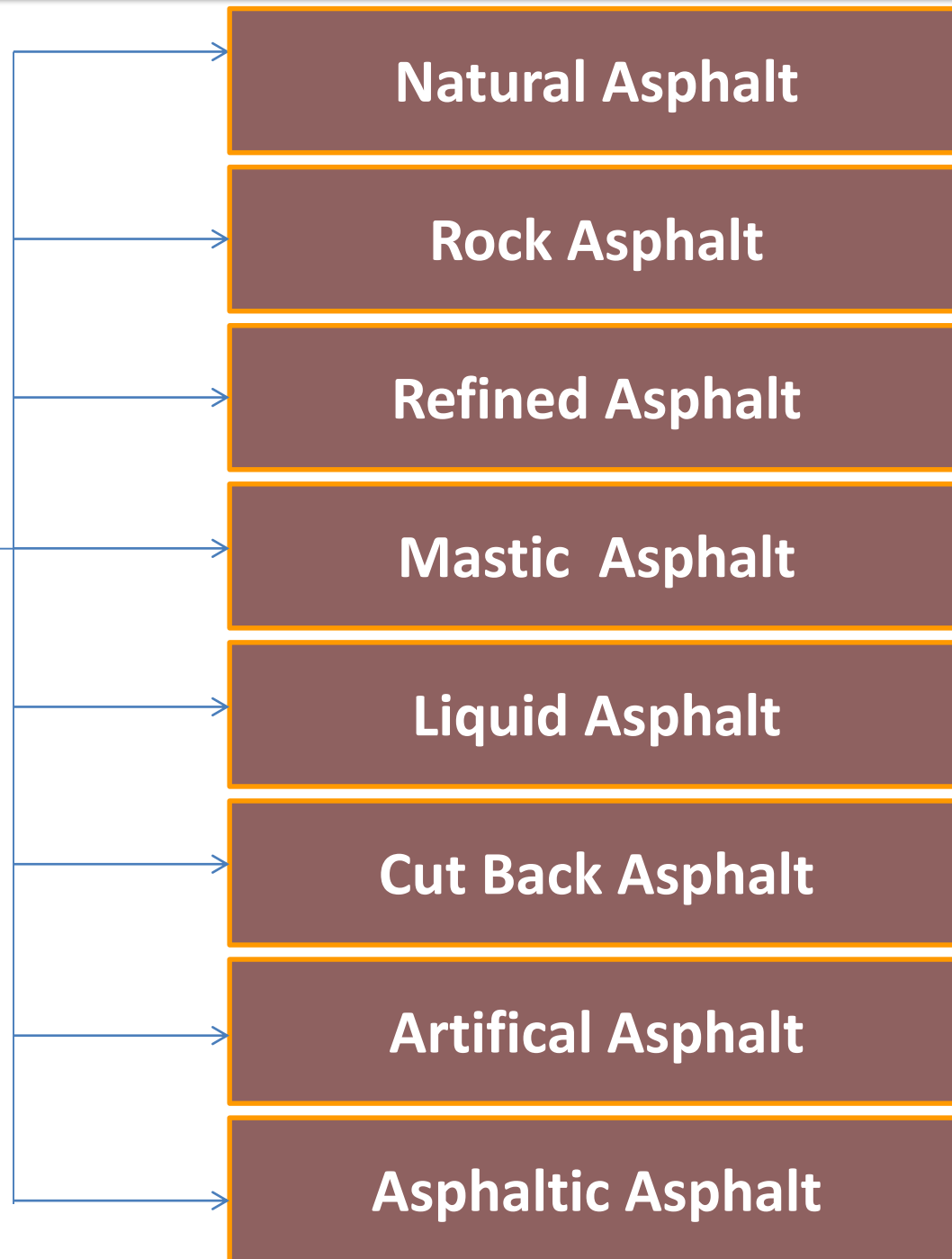


- ❖ Asphalt is a **natural** or **artificial** mixture in which **bitumen** is associated with **inert mineral matter**.
- ❖ In fact, it is a native mixture of hydrocarbons (a product of the decomposition of animal and vegetable substances). It is black or brownish black in colour. At temperature between **50 - 100° C** it is in **liquid state** whereas at **temperature less** than this it remain in **solid state**.
- ❖ Because it is a **thermoplastic material** it **softens** as it **heated** and **hardens** as it is **cooled**. It is the basic paving material in use today.

# Asphalt



## Type of Asphalt



### Natural Asphalt

It is known as native asphalt. When obtained from lakes it is termed as lake asphalt. It is used for making pavements, for water proofing of structure, stooping vibrations in machine foundations, tunnels and subways, in manufacture of marine glue, and in lining trenches.

# Asphalt

## Type of Asphalt

Natural Asphalt

Rock Asphalt

Refined Asphalt

Mastic Asphalt

Liquid Asphalt

Cut Back Asphalt

Artificial Asphalt

Asphaltic Asphalt

Rock Asphalt

It is naturally occurring rock formation, usually limestone or sandstone intimately impregnated throughout its mass with 6 - 14% bitumen.

# Asphalt



## Type of Asphalt

Natural Asphalt

Rock Asphalt

Refined Asphalt

Mastic Asphalt

Liquid Asphalt

Cut Back Asphalt

Artificial Asphalt

Asphaltic Asphalt

Refined Asphalt

It is obtained by heating pitch to drive off the water and to draw off the mineral matter by segregating the impurities.

### Composition

Bitumen	52%
Inorganic matter	38%
Organic Matter	10%

# Asphalt



## Type of Asphalt

Natural Asphalt

Rock Asphalt

Refined Asphalt

Mastic Asphalt

Liquid Asphalt

Cut Back Asphalt

Artificial Asphalt

Asphaltic Asphalt

Mastic Asphalt

It is manufactured by adding pulverized natural rock gradually to molten refined bitumen, agitating the mixture for about 5 hours (200 -250° ) and placing it into moulds for cooling. The mass consolidated into hard elastic blocks which can be remelted when used for pavements. It is tough, durable, non- absorbent, damp proof, non- inflammable, and noiseless. When non- bituminous limestone is mixed with bitumen of residual type it is known as synthetic mastic asphalt.

# Asphalt



## Type of Asphalt

Natural Asphalt

Rock Asphalt

Refined Asphalt

Mastic Asphalt

Liquid Asphalt

Cut Back Asphalt

Artificial Asphalt

Asphaltic Asphalt

Liquid Asphalt

It is the viscous residue obtained by the distillation of asphaltic base crude oil to 425°C

Cut Back Asphalt

It is derived by distillation of asphalt in a volatile solvent. It contains about 80% asphalt and reminder the solvents.



# Asphalt



## Type of Asphalt

Natural Asphalt

Rock Asphalt

Refined Asphalt

Mastic Asphalt

Liquid Asphalt

Cut Back Asphalt

Artificial Asphalt

Asphaltic Asphalt

Artificial Asphalt

It is the pitch residue obtained by evaporation of the volatile constituent of coal tar. It is formed of an admixture of coal tar, pitch, ground iron slag, sawdust, chalk, etc. Composition having Bitumen 12%, Minerals and sand 87%, Organic matter 1%

Asphaltic Asphalt

It is prepared by oxidizing asphalt at a high temperature; the lighter oils vapourize and are drawn off at their condensation temperature, leaving a residual material- asphaltic cement. It is used for flooring and water proofing and in expansion joints in concrete.

# Bitumen



- ❖ It is non-crystalline solid or viscous material derived from petroleum, by natural or refinery process and substantially soluble in carbon disulphide. It occurs either naturally or may be obtained during the distillation of petroleum.
- ❖ Petroleum bitumens are complex mixtures of high molecules weight hydrocarbons. It is asphalt in solid state and mineral tar in semi fluid state. Bitumen is brown or black in colour.
- ❖ The main constituent is petrolene - A yellowish oily substance, an excess of which makes bitumen to melt at low temperature and, asphaltene-hard black substance, an excess of which makes bitumen brittle and non –plastic. Its composition is carbon 87% , hydrogen 11%, and oxygen 2%.

# Bitumen

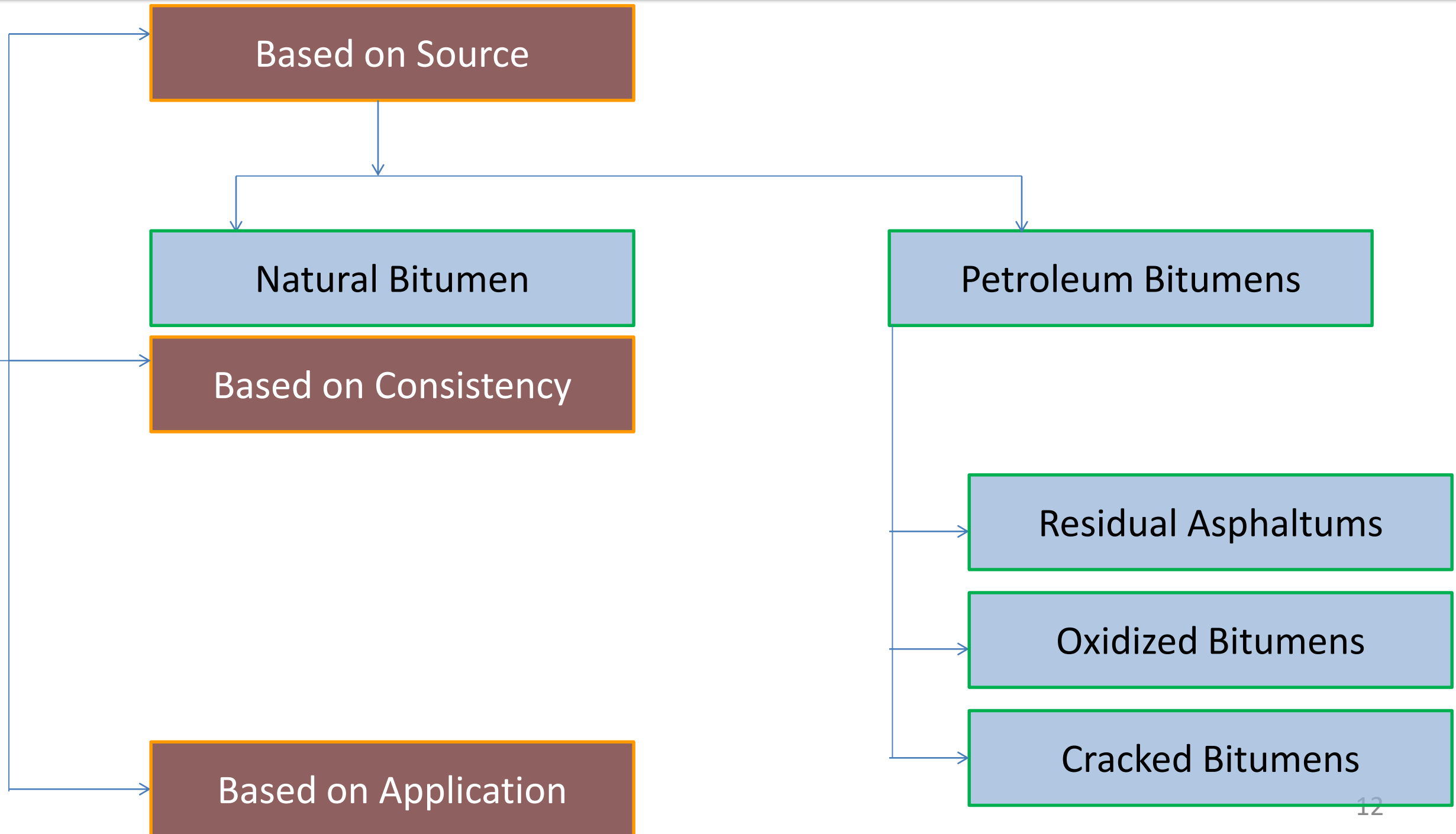


- ❖ Bitumen is not affected by light, air or water individually, but in combination they can make it brittle, porous and susceptible to oxidation forming blisters and cracks. It become soft at temperatures between 30° - 100 °C (no sharp melting point), and therefore must be protected from exposure to heat. Although bitumen is combustible, composite products, such as mastic asphalt, are not readily ignited.
- ❖ Different form of Bitumen is
  - ❖ Bitumen Emulsion
  - ❖ Blown Bitumen
  - ❖ Cut Back Bitumen

# Bitumen



## Type of Bitumen



## ❖ Natural Bitumen

Pure natural bitumen occurs rarely. Limestones, sandstones and soils impregnated with bitumen are frequently found. It originates from the accumulation of petroleum in the top layers of earth crust through migration, filling pores and cavities of rocks, under the action of high temperature and pressure. The natural bitumen is dark-brown in colour which on heating gradually softens and passes to liquid state and on cooling solidifies. It is insoluble in water but dissolves in carbon disulphide, chloroform, benzene and very little in gasoline. Natural bitumen may be extracted from bituminous rocks by blowing in kettles or dissolving in organic solvent (extraction).

# Bitumen



## ❖ Petroleum Bitumen

are product of processing crude petroleum and its resinous residues. These are classified as residual asphaltums, oxidized, cracked and extracted bitumens.

**Residual Asphaltum** are black or dark-brown solid substances at normal temperatures, obtained by atmospheric-vacuum distillation of high-resin petroleum after topping of gasoline, kerosene and fractions.

**Oxidized Bitumen** are produced by blowing air through petroleum residues. Oxygen from air combines with hydrogen of the residues to give water vapour. The petroleum residues thicken because of polymerization and condensation.

**Cracked Bitumen** are obtained by the cracking—high temperature decomposition—of petroleum and petroleum oils allowing high yield of gasoline. Blowing of air through residues gives oxidized cracked bitumens.

# Bitumen



## ❖ Based on Consistency

These are classified as solid, semi-solid and liquid bitumens.

## ❖ Based on Application

Bitumens are classified as road construction bitumen, building bitumen and roofing bitumen.

## Uses

Bitumen is used for manufacture of roofing and damp proofing felts, plastic bitumen for leak stops, waterproof packing paper, pipe asphalt, joint filler, bituminous filling compounds for cable boxes, for sealing accumulators and batteries. It is also used for fixing of roofing felts, dam proofing felts and for heat insulation materials for buildings, refrigeration and cold storage equipments.

# Properties of Bitumen



## Viscosity

depends greatly on temperature. At lower temperature, bitumen has great viscosity and acquires the properties of a solid body, while with increase in temperature the viscosity of bitumen decreases and it passes into liquid state.

## Ductility

it depends upon temperature, group composition and nature of structure. Viscous bitumens, containing solid paraffins at low temperatures are very brittle.

## Softening point

it is related to viscosity . Bitumen needs sufficient fluidity before specific application

## Resilience

Bitumen is resilient, non-rigid and as such it is capable of absorbing shocks and accommodate itself to the movement in structure due to temperature, settlement or shrinkage.



# Insulating Material



A material that reduces or prevents the transmission of heat or sound or electricity is called Insulating Material.

## Heat Insulating Material

The purpose of thermal insulation is to restrict the heat transfer from warmer to cooler areas. Transfer of heat takes place by three processes-

The convection

The radiation

The conduction

# Insulating Material



In *convection*, heat is transferred from one place to another by the movement and mixing of liquids or gases.

*Radiation* is a process of transferring heat in a similar manner to that in which light is transmitted, i.e., by means of an invisible wave radiation.

The extent to which a building material radiates heat is mainly dependent on the emissivity of the surface, on the temperature of the surface and on the temperature of the surrounding surface; metals have very low emissivity.

# Insulating Material



*Conduction* is a process whereby heat is passed on between adjacent stationary particles of matter. The conductivity of building materials depends upon their density and porosity, and upon their water content.

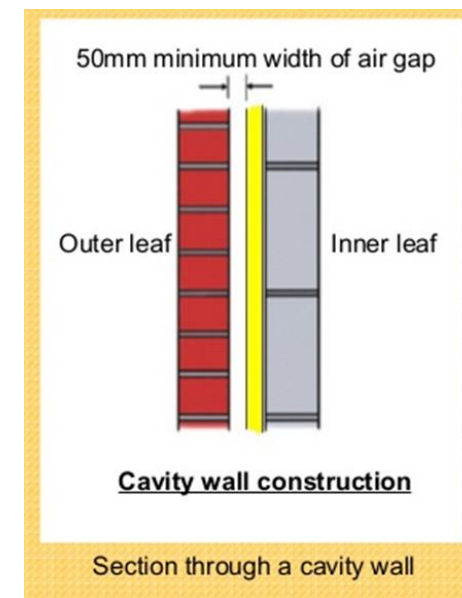
Since bulk density of material vary inversely to their air contents, those materials which enclose a high proportion of air in their structure (material with low bulk density) are generally better heat insulators. Water being a good heat conductor, if present in the material, makes the material a poor insulator.

# Insulating Material



The commonly used heat insulating materials work on the principle of either *air spaces formed b/w structural components*, *surface insulation* or *internal insulation*.

Well known products are aerated concrete, gypsum boards, fibre boards, asbestos cement boards, cork boards, foam plastic, aluminium foil, reflecting paints, expanded blast furnace slag, vermiculite, fibre glass, glass wool etc. Cavity wall, though costly, provides good insulation.



# Insulating Material



Heat insulating material should be impermeable to water, fire proof, resistant to insect attacks, have low thermal conductivity. Since a good heat insulating material has porous structure the strength is lowered affecting its stability

# Sound Insulating Material



A well designed building should insulation to restrain noise level. High noise conditions results in uncomfortable living conditions, mental strain, fatigue and may even lead to nervous break down.

Sound insulating material fall into three main categories.

## **Porous nature material**

Absorption coefficient increase with increase with frequency. They reduce sound reflection because the pressure changes due to the sound waves at the surface cause air flow in and out of the pores, which causes air flow in and out of the pores, which causes friction between the atoms of air material, thus generating heat and dissipating the energy.



# Sound Insulating Material



Accordingly their effectiveness is dependent upon their surface porosity, the proportion of their volume taken up by pores and the extent to which these pores are interconnected.

Acoustic plaster, sprayed asbestos and mineral wool slabs. To overcome the decoration problem, they are therefore sometimes provided with grooves or holes in their surface, e.g., acoustic fiberboard tile, so that they may decorate without disturbing their sound absorbing properties

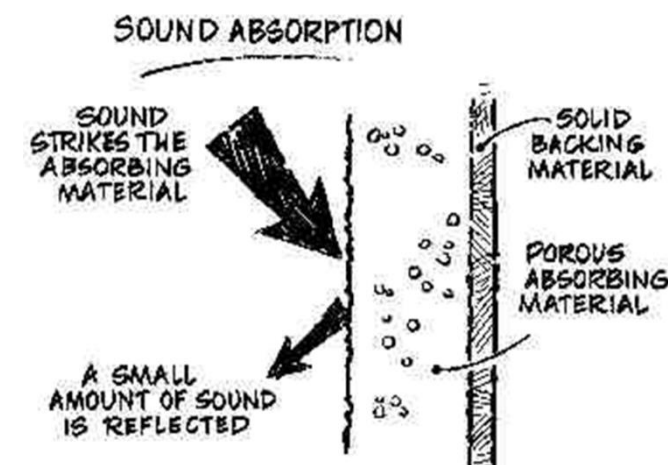
# Sound Insulating Material



The second type of absorber consist of a fairly thin panel mounted in such a fashion as to have an air space between it and room boundary surface.

The third type of absorber consist essentially of a cavity connected to the air of the room by the long thick neck. Such resonators have very narrow high absorption peaks over a very limited range of frequency. It is possible, by using thick planes drilled with a large number of holes mounted with an air space behind, to create effectively a number of such resonators. The drill holes form the neck and the air space functions as the cavity.

A good sound insulator should have low density, porous texture, resistance to moisture and pleasing look. It should be incombustible, light in weight and easy to handle and fix, resistant to attacks of vermins, termite and dry hot.





# Summary



- ✓ Asphalt
- ✓ Bitumen
- ✓ Sound Insulating Material

# Thank You