Building Materials
Lect. Harish Gupta
Department of Architecture
Govt. Polytechnic Panchkula

Lecture
Roofing Materials

1.0 ASBESTOS SHEETS

Asbestos is a naturally occurring mineral that can be fluffed into a wooly consistency and mixed into building materials such as cement. Adding asbestos makes cement more durable, weather proof and heat resistant, and because asbestos cement sheets are fireproof, builders initially considered them a much safer material than wood. Unfortunately, it is now well known that adding asbestos to cement also makes it highly toxic. “Asbestos cement sheet” was once synonymous with “fibrous cement sheet,” and it has also been generically called “AC sheet” and “fibro.”

Fibrous cement created an easy and affordable alternative to corrugated metal panels, which offer little insulation and inevitably rust over time. Corrugated asbestos sheets were used in the roofing and siding of all types of buildings, especially in factories and farms

Corrugated asbestos sheets

2.0 GALVANIZED IRON SHEETS

Galvanization is the process of applying a protective zinc coating to steel or iron in order to prevent it from rusting. The term is derived from the name of Italian scientist Luigi Galvani. Galvanized iron (GI) sheets are steel sheets which are basically coated with zinc and include a range of hot dip galvanized and electro-galvanized steel sheets. Zinc weathers at a very slow rate, so the coating generally has a long life. Zinc has a greater electro-negativity than iron and hence provides cathodic (or sacrificial) protection to the steel. This results in the zinc corroding in preference to the steel if the coating is chipped or damaged to expose the base

metal. Besides acting as galvanic protector, The other functions of the zinc layer are as follow:

- To retain the steel intact with its full initial strength.
- To provide the surface a more pleasing appearance.
- To increase the life of any suitable organic finishing system applied over it.
- To protect the steel from corrosive attack in most atmospheres, acting as a continuous and lasting shield between steel and the atmosphere.

Galvanised steel sheets form the base material for different types of corrugated sheets, such as the ones coated with polyester paint or protected by PVC plastisol coated roof sheets. ... They comprise steel sheets treated with primer paint and PVC rolled on their surface.

Application of GI sheets

GI sheets are sheets are used extensively in various applications. Some of common uses are given below.

Agriculture – Grain silos, sprayers, ghamellas, pans and feeding troughs etc.

Automobile sector – Car, bus and truck bodies, undercarriage work, air and oil filters, fuel and oil tanks, exhaust pipes etc.

Construction – Roofing, side walls, partitions, panels, valley gutters, louvers, false ceilings, partition walls and ducks, rolling shutters, highway bumpers, slotted angles and paint coated products etc.

House hold things – Trunks, ice boxes, tubs, buckets, storage bins, water tanks, washing machines, house hold machines, pipes, pipe fittings and bath room doors etc.

Electrical appliances – Air conditioners, refrigerators, freezers, electrical panels, decorative lamps etc.

Furniture and fixtures – Desk, lockers, almirahs, racks, light weight chairs etc.

Other general uses – Ducting, drums/barrels, containers, thermal cladding, railway coaches, sign boards, hoardings and road signs etc.

Advantages with use of GI sheets

The use of GI sheets gives the following advantages.

1. **Low cost** – Galvanizing is lower in first cost than many other commonly specified protective coatings for steel.
2. **Less maintenance cost** – GI sheets are virtually maintenance free and last longer.
3. **Long life** -The life expectancy of GI sheets is quite high in rural, urban and coastal environments.
4. **Reliability-** Galvanizing is usually carried out as per standards and minimum coating thicknesses are applied. Coating life and performance are reliable and predictable.
5. **Toughest coating** – A galvanized coating has a unique metallurgical structure which gives outstanding resistance to mechanical damage in transport, erection and service.
6. **Automatic protection for damaged areas** – Galvanized coatings corrode preferentially to steel, providing cathodic or sacrificial protection to small areas of steel exposed through damage. Unlike organic coatings, small damaged areas need no touch up.
7. **Complete protection** – Every part of a galvanized iron sheet is protected.
8. **Ease of inspection** – Galvanized coating is assessed readily by eye, and simple non-destructive thickness testing methods can be used.
9. **Galvanizing** process is not dependent on weather conditions.
10. The surface of GI sheet is aesthetically pleasing.

3.0 SHINGLES

Roof shingles are a roof covering consisting of individual overlapping elements. These elements are typically flat, rectangular shapes laid in courses from the bottom edge of the roof up, with each successive course overlapping the joints below. Shingles are made of various materials such as wood, slate, flagstone, metal, plastic, and composite materials such as fibre cement and asphalt shingles. Ceramic roof tiles, which still dominate in Europe and some parts of Asia, are still usually called tiles.

Installation:

Roof shingles are almost always highly visible and so are an important aspect of a building's aesthetics in patterns, textures and colors. Roof shingles, like other building materials on vernacular buildings, are typically of a material locally available. The type of shingle is taken into account before construction because the material affects the roof pitch and construction method: Some shingles can be installed on lath where others need solid sheathing (sheeting) on the roof deck. All shingle roofs are installed from the bottom upward beginning with a *starter course* and the edge seams offset to avoid leaks. Many shingle installations benefit from being placed on top of an underlayment material such as asphalt felt paper to prevent leaks even from wind driven rain and snow and ice dams in cold climates. At the ridge the shingles on one side of the roof simply extend past the ridge or there is a *ridge cap* consisting of boards, copper, or lead sheeting. An asphalt shingle roof has flexible asphalt shingles as the ridge cap. Some roof shingles are non-combustible or have a better fire rating than others which influence their use, some building codes do not allow the use of shingles with less than a class-A fire rating to be used on some types of buildings. Due to increased fire hazard, wood shingles and organic-based asphalt shingles have become less common than fiberglass-based asphalt shingles. No shingles are water-tight so the minimum recommended roof pitch is 4:12 without additional underlayment materials.

Asphalt Shingles

In the United States, fiberglass-based asphalt shingles are by far the most common roofing material used for residential roofing applications. In Europe they are called bitumen roof shingles or tile strips, and are much less common. They are easy to install, relatively affordable, last 20 to 60 years and are recyclable in some areas. Asphalt shingles come in a large number of styles and colors.

The protective nature of paper and fiberglass asphalt shingles primarily comes from the long-chain petroleum hydrocarbons, while wood shingles are protected by natural oils in the cellulose structure. Over time in the hot sun, these oils soften and when rain falls the oils are gradually washed out of the shingles.

Wooden Shingles

Wood shingles are thin, tapered pieces of wood primarily used to cover roofs and walls of buildings to protect them from the weather. Historically shingles were split from straight grained, knot free bolts of wood. Today shingles are mostly made by being cut which distinguishes them from shakes which are made by being split out of a bolt.

Wooden shingle roofs were prevalent in the North American colonies, while in central and southern Europe at the same time, thatch, slate and tile were the prevalent roofing materials. In rural Scandinavia, wood shingle roofs were a common roofing material until the 1950s. Wood shingles are susceptible to fire and cost more than other types of shingle so they are not as common today as in the past. Distinctive shingle patterns exist in various regions created by the size, shape, and application method. Special treatments such as swept valleys, combed ridges, decorative butt ends, and decorative patterns impart a special character to each building. Wood shingles can also be shaped by steam bending to create a thatch-like appearance, with unique roof details and contours. Two basic types of wood shingles are called shingles and shakes. Wood shakes are typically longer and thicker than wood shingles. The main difference is in how they are made, with shingles always being sawn and shakes normally being split, at least on

one side. Untreated wood shingles and shakes have long been known as a fire hazard and have been banned in various places, particularly in urban areas where exterior, combustible building materials contribute to devastating fires known as conflagrations.

Stone Shingles

Flagstone shingles are a traditional roofing material. Some stone shingles are fastened in place but some simply are held by gravity so the roof pitch cannot be too steep or the stones will slide off the roof. Sandstone has also been used to make shingles. Slate shingles are also called slate tiles, the usual name outside the US. Slate roof shingles are relatively expensive to install but can last 80 to 400 years depending on the quality of the slate used, and how well they are maintained.

Fibre cement shingles

Fibre (fiber) cement shingles are often known by their manufacturer's name such as eternit or transite. Sometimes the fiber in the cement material was asbestos which has been banned for health reasons since the 1980s. Removal of asbestos shingles requires extra precautions and disposal methods.

Metal Shingles

Metal shingles are made from steel that has a zinc or zinc and aluminium metallic coating on top of the carbon steel. This anti-corrosive metallic coating protects the steel from rusting. On top of the coating, manufacturers typically have a paint finish or an aggregate coating for added protection. Many metal shingles are also produced from aluminium and copper, which are inherently rust-free metals. Metal shingles are extremely fire resistant, so are used in fire prone areas. Metal has been used for many years as a roofing material. Thomas Jefferson worked with metal shingles for his home at Monticello and other buildings. Metal shingles have also been used for many years by commercial chains such as IHOP and Dunkin' Donuts. Residential metal market share for metal roofing is currently 14%. The oldest commercial metal shingles were developed in 1959 by Kaiser Aluminum; their product line was later bought out by Isaiah Industries, Inc. in 1980. Most other metal roofing products available today were invented in 1980 or later.

Plastic Shingles

Plastic has been used to produce imitation slate shingles. These are lightweight and durable, but combustible. Also, they are very lightweight and are one of the cheapest shingles to have installed. Companies like Barrington Roof Tiles Australia make Plastic or Composite Roof Shingles. Plastic roof tiles are an inexpensive, high quality and practical material. Plastic panels are made by extrusion of rigid polyvinyl chloride (PVC), followed by application of the decorative pattern with a special printing method and a protective layer of glossy or matte varnish, which give the panels wear resistance, anti-static qualities, UV-resistance and also high resistance to physical impact. By using plastic slate roof tiles as a finishing material you can manage to carry out a quick, clean and high-quality repair. Plastic panels are also installed on walls and ceilings in wet areas (because they are 100% resistant to water), on balconies as a frost resistant material, in living rooms, kitchens, utility rooms as PVC panels are easy to clean. The lightweight plastic roof tiles are cheaper than usual asbestos slates; their second advantage is their light weight that allows you to save up on the truss system since it doesn't require the construction of durable structures with a large margin of safety. In turn, a lightweight truss system makes it possible to make the walls and foundation lighter.

Basic advantages of installing plastic roof tiles:

1. Resistance to UV radiation
2. Strength, resistance to adverse environmental effects
3. Ductility and flexibility, which allow using them on roofs of a complex configuration
4. Ability to withstand temperature drops from +60 C to – 50 C
5. Low thermal conductivity
6. Environmental friendliness. Recycled plastic roof tiles can be used as a perfect substitute of traditional materials because they are easy to use, low maintenance, do not rot, are recyclable, which makes them a perfect eco-friendly material. Fully

recycled industrial plastic products are extremely safe, have a very long service life, do not require any maintenance and are environmentally friendly.

7. Good sound insulation
8. Moisture resistance
9. Easy in processing
10. High light transmission capacity
11. Durability
12. Attractive appearance

The disadvantages of this material can be attributed to certain brittleness when compared to other roofing materials.

Distinctive Features of Plastic Roof Shingles

PVC sheets are environmentally friendly as they are made out of food graded plastic unlike asbestos cement shingles where asbestos fiber is present in the composition, which in contact with the human body causes various diseases. In case the fire starts it will not burn the plastic sheet itself but the shingle can melt and thereby lose its shape and attractive appearance. Sufficient strength and ductility allows the roof to live a long service life.

If certain rules are followed, the installation of plastic slate shingles will not cause much difficulty compared to other roofing materials due to their small weight. The ease of processing eliminates the use of sophisticated equipment, plastic sheets can be cut using any hand tools. Light transmission of these plastic sheets cannot be compared with polycarbonate or glass, though a certain amount of sunlight is still able to pass, therefore, plastic shingles are also advantageous in terms of energy savings.

Plastic is known for tolerating the contact with various chemicals, without using its properties. Plastic proofing panels also cope with environmental factors like acid rain and other precipitation. Despite the fact that this new roofing material is made of plastic, the roof made of it perfectly resists snow and wind loads, summer heat and sever cold.