Module 16: Pitched roof coverings

Module Objectives

By the end of this session, participants will understand:

1. The many different kinds of roof coverings used to clad roofs in South Africa
2. Basic rules and guidelines for roof sheathing.
3. Basic rules and guidelines for tiles, slates and shingles
4. Basic rules and guidelines for thatch roofs

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Metal roof sheeting

Metal sheeting is always galvanised iron and is further distinguished by profile, type of sheeting and installation requirements.

Sheet profiles

Metal roof sheeting has a variety of profiles, the most common being:

- **Victorian or corrugated profile**
- **IBR (inverted box rib) profile**
- **Concealed fix profile** (also known as Klipok)

Concealed fix roof sheeting is designed with an interlocking profile and clip fixing system that eliminates the need for holes in the sheets. The clips allow expansion and contraction of the sheets without straining the securing points. The design provides the sheets with an excellent water-carrying capacity, as well as structural strength, ease of erection, dust and watertightness, and the versatility to be cranked.
Galvanised metal sheeting

Galvanised metal roofing comes in a range of thicknesses: From 0.3mm (Z-100) to 0.8mm (Z-275). The most common gauge is 0.5mm (Z-275). The "Z" indicates the zinc coating of the metal.

Did you know...

Galvanised sheeting can be left unpainted for many years. This sheeting can be painted after a suitable period of weathering, or after it has been suitably cleaned and primed.

Two main types of factory coated galvanised metal sheeting are encountered in South Africa.

- The local product – Chromadek. This is Mittal Steel South Africa's trade name for a range of colour coated sheet products and is produced in a range of 14 standard colours. Special pigments are used to ensure that the paint will withstand extended outdoor exposure under the harsh S.A. conditions (high UV-radiation).

- Colorbond and Zincalume – these are Australian origin products produced internationally by Bluescope Steel and now widely available in South Africa. Both Colorbond and Zincalume are manufactured with a zinc/aluminium alloy coating. The aluminium in the alloy provides increased corrosion resistance over ordinary zinc galvanised sheeting. Like Chromadek Colorbond is factory painted and when correctly installed by an approved installer, Colorbond is guaranteed for 10-15 years and should last up to 25 years if correctly installed with Class 3 fasteners.

Roof fasteners

These should be in accordance with manufacturer's specifications. Use of incorrect fasteners can shorten sheet life and may void a manufacturer's warranty. It is important that fasteners have a service life equivalent to that of the sheeting. Fastener costs are minimal relative to the overall cost of a building project, so no benefit is gained by using inferior fasteners. Fastener materials include carbon steel, stainless steel and aluminum.
Class 3 self-drilling fasteners are mandatory for Colorbond and Zincalume sheeting if the warranty is not to be voided.

During installation fasteners should be properly tightened and not overdriven or driven at an angle. (Leaks can potentially occur at improperly-seated fasteners, as well as at under-driven fasteners). Overdriving a fastener may also cause a depression on some panel profiles, which can then collect water and accelerate corrosion. Driving tools equipped with depth-sensing nose pieces and suitable RPM speeds can assist in avoiding these problems. Impact-type tools should not be used.

**Swarf**

Swarf is metal particles (metal filings from cutting sheets with an angle grinder) and other metal scraps, such as poprivet stems and fasteners, which, if left on roof sheeting, will cause rust stains which detract from the finished appearance. Swarf should be swept or hosed from the job at least at the end of each day. Many swarf problems arise not from the roof installers but from the activities of other tradesmen work on the completed roof.

**Fibre-cement roof sheeting**

Fibre cement roof sheeting is manufactured in South Africa by Everite under the brand name Nutec.

Common profiles are:

- Big Six – this profile mimics the previously commonly used asbestos cement profile
- Victorian – corrugated

Nutec Big Six and Victorian profile sheets are durable lightweight sheets. Nutec sheets are supplied in their natural grey colour. The sheeting can be painted with a 100% acrylic PVA paint after installation. Painting, although not essential, will further enhance the durability of the product, especially in highly polluted areas or chemical abrasive applications. In areas with high fungal growth, paint will reduce the frequency of routine maintenance. Paint can be applied by brush, roller or spray gun.
Nutec fibre cement sheets do not contain asbestos fibre and are therefore excluded from the Asbestos Regulations of 2001, which forms part of the Act No. 85: Occupational Health and Safety.

Nutec sheets do not pose any adverse effects on the environment. Off-cuts and dust created during sitework may be disposed of on any non-hazardous waste landfill site. Nutec sheets have excellent thermal insulation properties.

**Asbestos cement roof sheeting**

Asbestos cement roof sheeting is commonly one of two profiles:

- Big Six corrugated sheeting
- Rib profile sheeting (also known as Canadian profile). This sheeting typically has a rounded rib with a broad flat section.

![Canadian profile asbestos roof sheeting](image)

Many South African property owners are unaware that they have a legal obligation in terms of the Asbestos Regulations to conduct asbestos surveys on their properties at least every two years, and to maintain their asbestos in a good, safe condition. Asbestos Regulations, 2001 – (Government Notice. R: 155 Occupational Health and Safety Act, 1993)
Asbestos fibre cement roofing is generally safe when new, as the fibres are encapsulated within the cement substrate. Over time, weathering aggravated by the growth of moss and algae erodes the cement surface and may expose asbestos fibres. Mechanical damage to asbestos products will also expose asbestos fibres.

From a practical point of view property owners should remove all damaged or badly weathered asbestos sheeting and should keep well-painted asbestos sheeting which is still in good condition. Property inspectors should advise affected homeowners accordingly.

**Plastic and fibre glass sheeting**

Plastic and fibre glass roof sheeting can be installed like any other roof sheeting – same principals. Polycarbonate is an excellent material for roofing purposes where light transmission and appearance are high priorities. Major features include:

- Shatterproof
- Flexible
- Transmits up to 90% of available light
- Built-in protection against harmful UV rays to both sides
- Fire resistant
- Good insulation – similar to sealed unit double glazing

**Note...**

*This sheeting is suitable for conservatories, patios, carport roofs, and for roofing sheds or workshops to allow daylight in.*
Installing roof sheeting

There are several basic principles involved in the proper installation of roof sheeting:

- The side overlap must always face away from the direction of the prevailing wind and rain (weatherside). This means that the installation of the roof sheeting is in the opposite direction of the prevailing rain-bringing winds.
- Avoid end laps wherever possible by using longer sheets. Where multiple sheets are necessary on a run – start at the bottom (furthest from the weather) and work to the top (apex) and then go back to the bottom.
- Use a line or a chalk line to align the fasteners over the purlins. Don't over-drive or under-drive, the fasteners.
- Most sheets should be fixed at every fourth corrugation, and every second corrugation at gutters, ridging and overlaps.

Thicker sheeting (fibre cement) is mitered at alternate top and bottom corners, in order to eliminate excessive thickness where the corners of four sheets overlap.
Concrete tiles

Concrete tiles come in a wide variety of profiles. The most common is the Double Roman (below). Concrete tiles have a number of common features: The lugs (which hook over the battens); the inter-locking side grooves; the weather ridges near the bottom of the underside; and the nail holes.

Battens

This is usually square pinetimber measuring 38X38 mm. Battens are nailed to the tops of the trusses (rafters), and batten joints must meet over the rafter.

Tiling Bond

Tiles are to be laid “straight-bond” in even courses. The Marseille profile is the only exception to this rule and is laid “broken-bond”.

Cutting of tiles

Battens should be spaced equidistant from each other by correctly setting out the roof prior to commencing the tiling. Any cutting of tiles should be done at the apex of the roof. This means that any cutting is done on the top course of tiles, directly below the ridge capping.
Eaves

The bottom edge of the first course of tiles should overhang the fascia board sufficiently to allow rain water to discharge efficiently into the gutter. This first course of tile is raised with a “tilting batten” to bring the eaves course of tiles into the same plane as the following courses.

Verges

Verges (at gable ends) should have equal overhangs at each end of the roof and should be finished with purpose-made verge tiles. (Also known as barge or roll tiles.)

Tile rows

In most instances rows can be laid without cutting tiles. When cut tiles are required to complete a row, always ensure that the surface area of each cut tile exceeds half the tile area. Two cut tiles containing the nail hole provide a superior finish to a row, rather than a single quarter tile at the end of a row without any provision for fixing. Tiles must be laid loose and not tight against each other, to allow for thermal movement.

Valleys

Open valley: a non-corrodible valley gutter at least 200mm wide should be constructed between two counter battens. The tiles on each side of the valley should be neatly cut to alignment, to project over the side welt by at least 50mm. The cut tiles should be supported and well-fixed to the timber.

Closed valley: As above, except that the tiles should be cut in a manner to allow a neat butt-joint at the valley centre. Home inspectors will quickly realize that South African roofers often make a mess of cutting the valley tiles, and the end result is a crooked edge to the valley, which is neither “open” nor “closed” but which will be prone to blocking.
**Abutments and chimneys**

A suitable flashing material should be used to seal the junctions at abutments and chimneys.

Where concealed gutters are necessary, the tiles should be neatly cut to approximately 40mm from the abutment. In all other instances, tiles should be cut to fit as close as is practical to abutments.

An apron flashing must be used where the roof slope falls below the abutment. Conversely, where the slope falls above the abutment, back-gutters must be installed.

**Mechanical fixing**

Tiles must be nailed and/or clipped to resist wind uplift in accordance with the National Building Regulations, and the manufacturer's recommendations. At roof perimeters, abutments and intersections, the overhanging or abutting tiles, plus two tiles in from that tile, should be fixed. Where houses are built in areas of severe weather, then three rows of tiles along the perimeter, and every second tile elsewhere, should be mechanically fixed. Severe conditions include locations 300m from the coast, lake shores or estuaries and crests of steep hills, ridges and escarpments.
Mechanical fixing fasteners

In coastal areas (aluminum alloy serrated clout nails) of the correct length to suit the profile; inland regions (electroplated serrated clout nails); non-corrodible "storm clips" should always be used where specified.

**Mortar:** All bedding mortar on ridge capping should consist of three parts coarse sand, to one part Portland cement, suitably pigmented to match the colour of the tiles. All butt-joints should be solid bedded and the capping tiles should be wet prior to installation, to prevent the mortar from drying too rapidly and cracking. Cracked and dislodged ridge capping mortar is a very common problem observed by home inspectors on tiled roofs in South Africa. This problem will lead to roof leaks if not corrected.
The shingle style concrete tile (bottom right in the illustration above) has no inter-locking sides and requires a waterproof underlay (malthoid). The other three concrete tiles in this illustration interlock on the sides and also have holes for fixing nails. Typically the bottom to runs (along the eaves) and the top two (below the ridges) would be mechanically fixed. The rest of the tiles would be held in place by the weight of the tiles on top.

The illustration above shows tiling detail over the eaves. Notice the tilting batten on the edge of the roof. This tilting batten (38X50mm) is thicker than the other battens (38X38mm) and is designed so that the bottom row of tiles is in the same plane as the rest of the roof. Notice also the undertile membrane which extends over the fascia board and into the gutter. Many roofs are deficient in this respect in that the undertile membrane is cut short, and ends over short of the gutter. This can result in water penetrating the top of the wall.

Tile underlay

An under tile membrane, when properly laid, provides a highly effective impermeable barrier against the ingress of wind-driven rain and dust.

The NBR says it is therefore advisable to provide underlay’s on all tiled and slatted roofs irrespective of the roof pitch, if ceilings are not installed so as to minimize the effect of wind-blown dust entering through the tiles. NHBRC 3.7.4.2 says undertile membranes are mandatory for all new tiled roofs in South Africa’s coastal areas. Under tile membranes are also compulsory for inland tiled roofs, having a pitch of between 17.5 deg. and 26 deg. or greater than 45 deg. Under tile membranes are optional elsewhere.

An under tile membrane can substantially lower pressures inside the roof cavity and so reduce the risk of wind uplift of the tiles on the leeward side of the roof.
Under tile membranes must be SABS approved. In older tiled roofs (circa 1980) home inspectors will sometimes encounter a non-SABS approved yellow membrane which will very often have become very brittle and perished and could be hanging in tatters. A lot of this inferior underlay, made from recycled plastic, was imported into South Africa in the 1980s.

The under tile membrane must be draped (not stretched tight) horizontally between rafters and battens with 150mm minimum overlaps, and carried well into the gutters. NHBRC 3.7.4.2.4. The under tile membrane should be installed to drain into eaves gutters, or run down the face of the fascia. Water must not pond on the membrane. At open eaves, the membrane must extend approximately 20mm over the beam filling on the exterior wall. At closed eaves, the membrane must over sail the fascia by at least 20mm. Very low pitched tiled roofs may need the installation of anti-ponding boards to support the membrane.

A strip of under tile membrane, at least 600mm wide, should be placed at hips so as to overlap each side for its full length. A similar strip should be laid for the full length of each valley ensuring that the opposing slopes overlap the edges. All under tile membrane is to be nailed to the rafters, with a minimum of non-corrodible dour nails.
Clay Tiles

Clay tiles have similar features and installation procedures as concrete tiles, and are also normally installed with a straight bond. One fairly common clay tile encountered on many older South African roofs is the imported Marseilles profile clay tile. Local versions of this tile are now available. As distinct from most other tiles (clay and concrete) which are laid straight bond, the Marseilles tile is always laid broken bond.

Marseilles clay tile

Fibre cement slates

Fibre cement slates (earlier versions are asbestos cement slates) measure 610 X 406mm and are laid broken bond with a very large overlap. These are installed as follows:

Copper, aluminum or galvanised (40mm) clout nails are used to secure the slates. Slates are pre-drilled with three holes. The two holes on the side of the slate are for nailing the slate to the batten, while the third hole at the bottom centre is for the disc rivet.

The top of slates should not extend above the centre line of the battens, as this will interfere with the nailing of the next row of slates.

A double soaker (Malthoid underlay) is used to waterproof ridges where the tops of the slates butt together. Malthoid is a waterproofing material consisting of bitumen impregnated felt – 2 or 3 ply Malthoid is commonly used for roofing.
As fibre cement slates weather over the years, the slates tend to start absorbing some moisture, which may eventually lead to curling at the corners and compromised waterproofing. Painting will delay this process.

Natural slates

Natural slate are laid broken bond and are usually nailed to battens over a waterproof underlay of 2 or 3 ply Malthoid. A double soaker of Malthoid is inserted over the ridges where the slates abut. The UV rays of the sun make the Malthoid brittle over time and some roofers counter this by installing additional strips of Malthoid between the slates. Mazista is a common trade name for natural roofing slates in South Africa.
Natural slates should be laid with a head lap of about 75mm – depending on the size of the slate. Each slate should overlap the slates on the two courses below. This is called the “head lap” because the top of the slate is known as the “head” and the head of the slate is being overlapped by the slate two courses above. Standard head laps are 75 mm – lower pitches may require a head lap of 100 mm or more.

The triple layer of slate together with the broken bond ensures that the exposed side laps are under-laid by slate. This means that if the head laps are sufficient and the roofer doing the slating is skilled, then it is feasible to dispense with the malthoid underlay and still have a weather-proof slate roof. Older slate roofs were often successfully installed without underlay and the home inspector will sometimes come across such roofs.
To install a slate roof, firstly an under-eave slate is nailed to the first (or tilting) batten, with the head of the slate resting on the second batten, and with a 50mm overhang into the gutter. Full slates are then centre-nailed to the second batten, and thereafter proceed upwards to the ridge. Best practice is to use 50mm aluminum or copper clout nails. Galvanised nails are acceptable inland.

Natural slate roofs are extremely heavy and the design of the timber roof members must take this weight into account.

**Metal tiles**

The most common metal tile in South Africa is the epoxy coated Harvey tile which became very popular some decades ago for refurbishing existing metal sheeted, or fibre cement slated roofing. New battens were simply nailed on top of the existing roof sheeting and the Harvey sheets (which closely resemble concrete tiles) were then attached to the new battens. Because of the lightweight nature of Harvey tiles, it is normally not necessary to strengthen the timber structure of sheeted roofs before fixing the Harvey tiles on top.

Harvey tiles are available with either a galvanised mild steel substrate, or with an alu-zinc coated mild steel substrate for additional corrosion resistance. Harvey tiles carry a 30 year manufacturer’s guarantee, if properly installed.
Shingles

Originally roof shingles were made from wood, mostly cedar and wooden roof shingles may still be encountered on a few older homes in South Africa.

Modern bituminous (asphalt) shingles are now growing in popularity in South Africa and provide versatile and lightweight roofing solutions for architects. These shingles are normally installed on top of a particleboard or plywood substrate.

These bituminous roof shingles offer designers great flexibility because they are lightweight and are available in different shapes and colours. The product is very durable if correctly installed.

Bituminous shingles can be coated with grit, or copper flakes. One product has an impregnated fiberglass core, imbedded with ceramic granules. Shingles provide a colour fast, weather resistant, maintenance free and aesthetically pleasing roof. One system combines a self-adhesive waterproofing underlay, which protects eaves, rakes, ridges and valleys from ingress of moisture.

Thatch

Thatch roofing is probably the oldest type of roofing. Grass, being a natural material, blends in well with the environment and has a natural beauty. Suitable thatching grass is easily obtainable. Thatch roofs are both practical and aesthetically pleasing – thatch acts as an insulator, keeping a home cool in summer and warm in winter.
The National Building Regulations specify the minimum thickness of thatched roofs as follows:

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<th>Type of Thatching</th>
<th>Stem diameter</th>
<th>Thickness (mm)</th>
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<td>Fine thatching grass or reed</td>
<td>1.2 to 2.5</td>
<td>175</td>
</tr>
<tr>
<td>Coarse thatching grass or reed</td>
<td>2.5 to 4</td>
<td>200</td>
</tr>
<tr>
<td>Water reed</td>
<td>1 to 7</td>
<td>300</td>
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A thatch roof should be maintained by replacing the top layer of grass every 10-12 years. Leaves and other organic matter should be regularly removed to prevent the thatch from rotting.

The most commonly used South African grass is Tamboekie grass (in the rural areas). Natal thatching grass has a finer texture, when laid, than the grass found in Mpumalanga and the Northern Province, and is often preferred for this reason.

The stalks of thatching grass are normally hollow and about 3 mm thick. Cape dekriet stalks, however, are solid and about 3-4 mm thick.

After the grass has been cut and loosely bundled, each bundle is shaken vigorously to dislodge all loose material. The bundles are then cleaned by passing a sickle through them, working from top to bottom. This removes the remaining leaf growth from the lower two-thirds of the stalks.

The grass is then regrouped into bundles about one to 1.5 m long, and between 75 and 100 mm in diameter. These bundles are each tied with a thong or twisted grass or with twine.

The thatch bundles are stitched to the roof battens. The bottom layer of the thatch roof, visible from the inside, is known as the spray layer (spreilaag) and usually consists of a layer of selected reed, cleaned thatching stems or Cape thatching reed, spread evenly on the roof battens to a thickness of about 5 to 8 mm (enough to conceal the top layer). This imparts an aesthetic appearance to the inside of the roof covering.

Thatching is then started at one verge. The grass is used in bundles, as it was cut, and laid on the roof with the butt end at the lowest end. As each bundle is laid on the roof, the thatcher cuts through the twisted grass or twine that secures it. He places the first bundle
on the corner, at an angle of at least 45°, thus exposing the butt end at the eaves and starting at the verge (barge).

As the thatcher works the course towards the opposite corner, the bundles are laid parallel to the rafters. Each bundle in the first course, at the eaves level, is secured to the second Batten with tar-treated sisal twine (thatching twine) at 75 mm intervals. Subsequent courses are secured by sways (compaction rods) being laid on top of the bundles and secured to the roof batten below with thatching twine at 75 mm intervals.

**Warning...**

As an alternative to the traditional method, some thatchers prefer to stitch each bundle directly onto the thatching battens, not using any sways. This method of fixing, however, creates an uneven surface that can negatively affect the density, performance and the durability of the thatch.

On thatched roofs, mortar is often used for ridge capping and for head and side wall flashing.

**Fire issues with thatch**

Thatch burns easily, and lightning poses a serious risk to thatched roofs in most parts of South Africa. The fire resistance of a thatch roof can be improved by using fire retarded timber and thatch. This means that the thatch has been treated on both sides with an approved fire retardant. A fire resistant membrane laid between the spray layer and thatch will also act as a fire retardant. These fire-protective membranes restrict the free flow of oxygen to the fire.

The effect of lightning should never be underestimated in the construction of thatch roofs. If wire has been used for the compaction of any thatch roof, the installation of a certified lightning protection system that conforms to the requirements stipulated in SABS 03:1985 (Code of Practice for protection of structures against lightning) is especially important and is a requirement.
A lightning conductor is a steel pole bolted to a base, set into a 1 cu. m. frame and placed 1 m. away from the home. Copper wire is used to earth the pole. The length of the pole must not be less than 15 m and not more than 24 m. Poles longer than 24 m. are too susceptible to wind resistance.

**Synthetic thatch**

Look-alike synthetic thatch tiles (fibre thatch) are now available and can be fixed over existing thatch (or other roof coverings). These plastic tiles are fire retarded and more durable than natural thatch - which needs to be re-combed and layered every few years. One South African manufacturer of fibre thatch tiles offers a 25-year guarantee on their product.

Fibre thatch tiles in Mpumalanga. The natural thatch can be seen in the eave soffit.

**Before you take the online test, please…**

Make sure that you are thoroughly familiar with the material in this module before completing the online test. The more familiar you make yourself with the information presented in this Module the better you will be as a professional home inspector. Review thoroughly all areas of this module before and during the open book online test.