Slating & Tiling

TIPS 62

slate pitches and head-laps

In 2003, BS5534: *the code of practice for slating and tiling* was revised, with a new method for determining the minimum rafter pitch and head-laps for the various sizes of double-lap slate. Some slate suppliers were slow to take up the new method, and still use the figures from the old 'angle of creep' method for their recommendations.

The new method included in BS5534:2003 is in the form of five Formulas and two Tables of factors, which make it less user-friendly than the old table of pitches and laps used in the previous editions of BS5534, but the results are far more accurate.

Theory

Water can migrate by capillary action up between two slates that lay together. The surface area of the slate that the water will spread over will depend on the true angle of the slates and the size of the gap between them. Smooth slates that are in close contact are more vulnerable than rough slates.

The shape of the area of the water contact will be in the form of a compound curve and not a straight line, as in the old 'angle of creep' method. Water will seep in sideways from the side-lap and up from the leading edge of the slates above. This will produce a fairly defined area within which nail holes and the edges of the slate should not occur.

The steeper the pitch, the smaller the area of water between the slates will be. The wider the slates, the less risk of water reaching the nail holes. Therefore, a slate that is wider and shorter can perform better than a longer and thinner one. The ratio of 2:1 (500mm x 250mm) does not perform as well as a slate with a ratio of 1.5:1 (460mm x 305mm) at low pitches.

The further the nail holes are from the side-lap of the slates above, the better. However, the nail holes have to be 25mm-30mm in from the edge of the slate to ensure the slate around the nail has sufficient strength. If the side-lap of the slate above is off centre, or if the slates are re-holed closer to the centre of the slate, or if the side-lap gap is more than 5mm, the performance of the slate will be affected. In theory, slates that are hook-fixed with no nail holes should perform better, but there is a risk of water tracking up the slate hook. The notes to Table 5 state that the minimum pitch for hooked slates is 25° (and below 30° the hooks should be crimped).

Practice

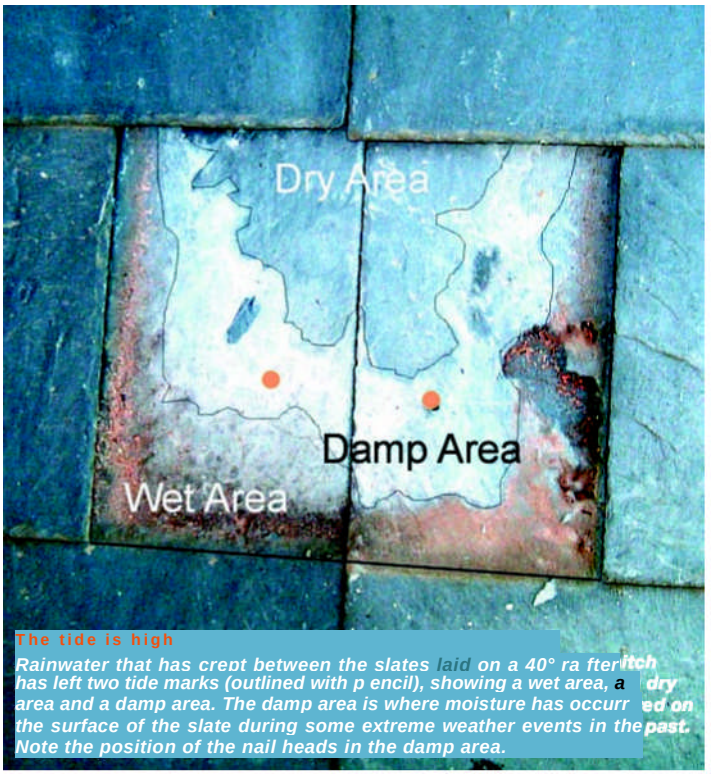
The calculation method in BS5534 begins by determining the head-lap for a given rafter pitch between 20° and 45° relative to the two driving rain exposure categories above or below 56.5l/m^2 per spell, with a minimum lap at any pitch above 45° of 54mm below, and 69mm above, the 56.5l/m^2 per spell requirement, by using Formula 2 and Table 4 for the value of C.

The figure of 56.5l/m^2 per spell is taken from the 'moderate and severe exposure' diagram in BS8104:1992 and the BRE report: *thermal insulation – avoiding the risks.* This would infer that the anticipated driving rain will be the same in the Outer Hebrides as in Sussex. The band above 56.5l/m^2 per spell is very wide and could be sub-divided for more accurate results. Also, the driving rain diagram only applies to ridge heights of up to 12m, therefore buildings more than 12m high should refer to *BS6399-2: the code of practice for wind loads.*

Where the slates are short or thick, and the true slate pitch is reduced by more than 3°, the new true slate pitch should be determined using Formula 6. The result of the calculation from Formula 2 is not defined as the minimum head-lap, as it is presumed that there is no need for a greater or lesser head-lap than the figure calculated. The head-laps for the higher driving rain conditions are greater than for below, so there would appear to be justification for allowing greater head-laps, but there is no easy way of determining what the increased head-lap should be.

Having determined the head-lap, the effective side-lap is calculated using Formula 3 and Table 5 for the value of El, and uses the results from Formula 2. The results are then used with the distance of the nail hole from the edge of the slate in Formula 4 to determine the minimum width of slate. This assumes that the side-lap gap is not greater than 5mm – which, with some slates, it will be.

Having done all this, the results only apply to slate roofs that are below 30°, where the rafter length is greater than 9m at below – and greater than 6m for above – the 56.5l/m^2 per spell driving rain figure. Finally, the nail hole gauge is determined by using the results of Formula 2 and Formula 5.



The tide is high

Rainwater that has crept between the slates laid on a 40° rafter pitch has left two tide marks (outlined with pencil), showing a wet area, a dry area and a damp area. The damp area is where moisture has occurred on the surface of the slate during some extreme weather events in the past. Note the position of the nail heads in the damp area.

Inconsistencies

These calculations produce some unusual results. For 255mm x 510mm slates, the calculations allow them to be laid to a minimum pitch of 20° with a 143mm head-lap when the rain exposure is in excess of 56.5l/m^2 per spell, but should only be used at a minimum head-lap of 25°, with a head-lap of 91mm at less than 56.5l/m^2 per spell. Meanwhile, 250mm x 500mm slates can only be laid to a minimum rafter pitch of 27.5° where the rainfall is in excess of 56l/m^2 per spell with a 106mm head-lap. Logically, if a greater head-lap were used up to a maximum of one third of the length of the slate, the minimum rafter pitch should come down.

The other result of the calculation is that slates 150mm wide should never be used under 45° and slates 180mm wide should only be used in locations where the driving rain exposure figure is less than 56.5l/m^2 per spell; when traditionally in some locations they have been used at 30° rafter pitch, fixed with slate hooks, with no problems.

Tips

- Pitches and laps recommended by the slate suppliers should be adhered to, as they often form the basis of any guarantee.
- Try to keep the side-lap as big as possible by keeping the sidelap gap as small as possible, and centred on the slate below.
- Do not attempt to guess the head-lap for any given pitch, especially below 30° rafter pitch.

Compiled by Chris Thomas FIoR
The Tiled Roofing Consultancy
2 Ridlands Grove, Limpsfield Chart,
Oxted, Surrey, RH8 0ST
tel: 01883 724 774
Email:
chris.thomas@thetiledroofingconsultancy.com

To view previous Slating & Tiling Tips, go to www.thetiledroofingconsultancy.com