

# Slating & Tiling

## TIPS 58

### open inclined valleys 1 – design

It is possible to design a pitched roof without any inclined valleys, yet due to dormer windows or complicated building shapes, many pitched roofs do contain them. Therefore, their design must ensure that they can cope with the amount of water flow that they will encounter during the life of the roof.

An open valley is a gutter between two roof slopes that are not parallel to each other, and is inclined from a ridge or top edge abutment to an eaves or other low-level feature. They are mainly used between roof slopes covered with interlocking tiles/slates or with double lap plain tiles/double lap slates where the rafter pitches and batten gauge of the two adjacent roof slopes are different and cannot be coursed around from one roof slope to the other.

#### Research

In 1990, Brunel University conducted research into the effects of rainwater on inclined valleys, to determine the minimum open channel widths. The results were published by the Lead Sheet Association and were subsequently incorporated into BS5534: The code of practice for slating and tiling.

The research found that the ability of the open valley channel to collect water and drain it away safely will depend on the volume of rainfall, the true pitch of the valley, and the area of the roof served by the inclined valley.

The higher the rainfall, the shallower the true valley pitch, and the greater the roof area served by the valley, the wider the open channel will need to be (and in turn, this will determine the width of the material that forms the valley liner).

#### Rainfall rate

The capacity of inclined valley gutters, like internal, parapet wall and back gutters, has to cope with the anticipated worst-case conditions in the UK.

For inclined valleys on permanent buildings, the design rainfall rate is considered to be 225mm/hr. However, a severe deluge of rain is unlikely to last one hour, so the intensity during a short burst can be

Maximum rainfall occurs when there is no wind, therefore the highest recorded deluge conditions tend to be on the eastern side of the UK, rather than wind-driven rain that is more common in the west. The more wind there is, the lower the volume of rain. Eventually, when the wind reaches a high enough speed, there will be no rain.

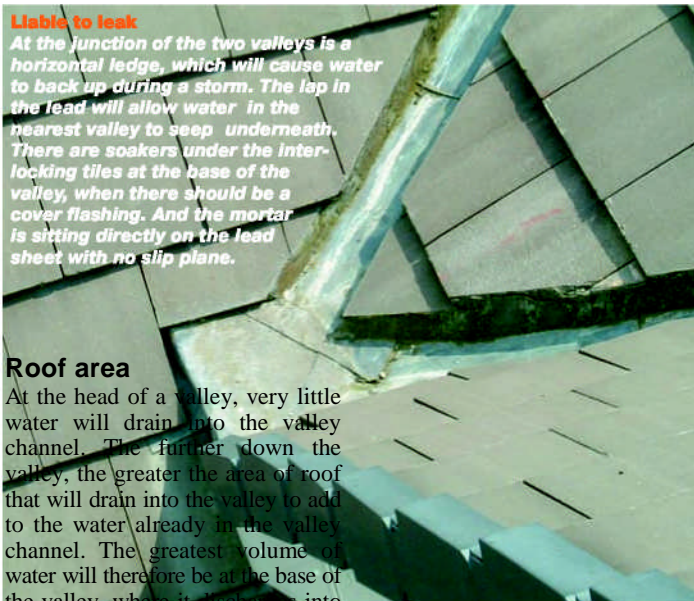
Gutters that are fixed to the perimeter of a roof are designed to cope with a lower rainfall rate than those for inclined and internal gutters, because once an external gutter reaches its maximum capacity, it will overflow outside of the building fabric, with little or no longterm effect; unlike an internal or inclined valley, where water could find its way down through the building fabric into the habitable rooms.

Water running off each roof pitch into the open valley channel should flow at the same rate, equalising into the centre of the channel. If the pitch on one side is steeper than the other, or the volume of water flowing off one roof slope is greater than the other, the faster/greater volume will wash over the centre line of the valley. If the volume/flow is great enough, the water running off one slope can wash in under the roof tiles/slates on the other.

#### True valley pitch

All inclined valleys have a true pitch that is less than the rafter pitch. If the two roof slopes have the same rafter pitch, are at right angles to each other, and the valley line bisects the angle, the difference is approximately 5°. If the plan angle between the two roof slopes is greater than 90°, the difference will be less than 5°. If the plan angle is less than 90°, the difference will be more than 5°.

The steeper the true pitch of the valley, the quicker the water will drain out of the open channel and the greater volume it can collect. The shallower the true valley pitch, the wider it will need to be to drain away the same capacity of water.



**Liable to leak**  
At the junction of the two valleys is a horizontal ledge, which will cause water to back up during a storm. The lap in the lead will allow water in the nearest valley to seep underneath. There are soakers under the interlocking tiles at the base of the valley, when there should be a cover flashing. And the mortar is sitting directly on the lead sheet with no slip plane.

#### Roof area

At the head of a valley, very little water will drain into the valley channel. The further down the valley, the greater the area of roof that will drain into the valley to add to the water already in the valley channel. The greatest volume of water will therefore be at the base of the valley, where it discharges into the eaves gutter, or back onto the roof. The longer the valley, the greater the area of roof that will drain into the valley.

As rain falls vertically during a deluge, the area of rain falling on a roof slope is measured as the horizontal area rather than the slope area of the roof. This makes calculating the roof area for maximum rainfall from a roof plan easy.

For simplicity, the British Standard recommendations have two categories: up to 25m<sup>2</sup> and between 25m<sup>2</sup> and 100m<sup>2</sup>. If high-level roofs drain down onto low-level roofs then they should be added into the calculation. It is the total roof area above the valley outlet that is required. At present, there are no recommendations for roof areas greater than 100m<sup>2</sup>. For this situation, the cross-sectional area could be increased in line with the additional roof area draining into the valley, or additional roof areas should be drained away separately to reduce the water volume draining into the valley.

Regardless of the material used

Rafter pitch	0m <sup>2</sup> -25m <sup>2</sup> on plan	25m <sup>2</sup> -100m <sup>2</sup> on plan
12.5° - 17°	150mm	250mm
17.5° - 22°	125mm	200mm
22.5° - 29.5°	100mm	150mm
30° - 34.5°	100mm	125mm
30°+	100mm	100mm

Table showing the recommended width of the open valley measured between the cut edges of the tiles/slates for a 225mm/hr rainfall rate:

to line the valley gutter, the open channel width should be the same.

#### Tips

- Avoid draining rainwater off high-level roofs onto low-level roofs, especially if they drain back into an inclined valley.
- If there are vertical walls, the water running off them must be included.
- For roof areas over 100m<sup>2</sup> there are no recommendations, therefore either the cross-sectional area should be raised proportionally, or measures should be taken to reduce the roof area below 100m<sup>2</sup>.

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