Construction Notes - No 5 valley (Part 2)

In a series of articles on interlocking concrete roof tiles, experts from the **Concrete Tile Manufacturers Association** have pooled their knowledge. This Construction Note discusses GRP valley trough units.

Inclined valley

An inclined valley is the junction between two roof slopes at an internal corner. In most instances the angle of the internal corner will be 90 degrees on plan, but it could be any angle up to 179 degrees. The true valley pitch is always slightly less than the rafter pitches. This is important when specifying the lap of the valley sheet trough.

The pitch range for the valley trough unit is generally quoted as rafter pitch, not true pitch. The manufacturer should be consulted for the pitch range of their valley trough.

Valley width

Regardless of the construction of the valley, the open width of the valley trough, measured between the cut faces of the adjacent roof tile or slates, is a function of the quantity of rainwater flowing off the roof into the valley trough. This will vary with the area of roof that drains into the valley trough, the pitch of the roof and the anticipated rainfall rate. For the worst case, once in 50 years, the rainfall rate should be 225mm per hour. Depending upon these three design factors, so the width of the valley may vary from 100mm to 250mm.

Because the preformed valley units are only available in one width suitable for 100 to 125mm wide, there will be a restriction on the area of roof and rafter pitch draining into the inclined valley (see Table A). Therefore designers should take account of this and may need to specify a metal valley or purpose-made unit where the open width of the valley needs to be greater than 125mm.

Structure

To allow for the valley construction to be formed between the underside of the tiles and the top of the rafters, it is essential that the water-resistant layer of the valley is supported on timber boards **(A)** that are set between the rafters. The top surface of the support board needs to be flush with the top of the rafters and supported on noggins **(B).**

The width of the support board needs to be wider than the GRP valley trough units by 100mm to allow the ends of the tile battens to rest on the support board by 50mm on either side, and be nail fixed to the support board. The support boards should be stiff enough to resist the weight of a tiler standing on the valley trough. Depending upon the rafter spacing, it is normal to use 18 to 20mm plywood or softwood boarding.

At the bottom of the inclined valley the support boards should run to the back of the fascia boards, rather than flatten out and discharge over the fascia boards. This will require the fascia boards to be cut down by approximately 50mm for the width of the valley. The location of the gutters will need to be adjusted. If the trough is flexed to go over the fascia boards the corrugations on the edge of the units can sometimes kick up the eaves tiles on each side of the valley.

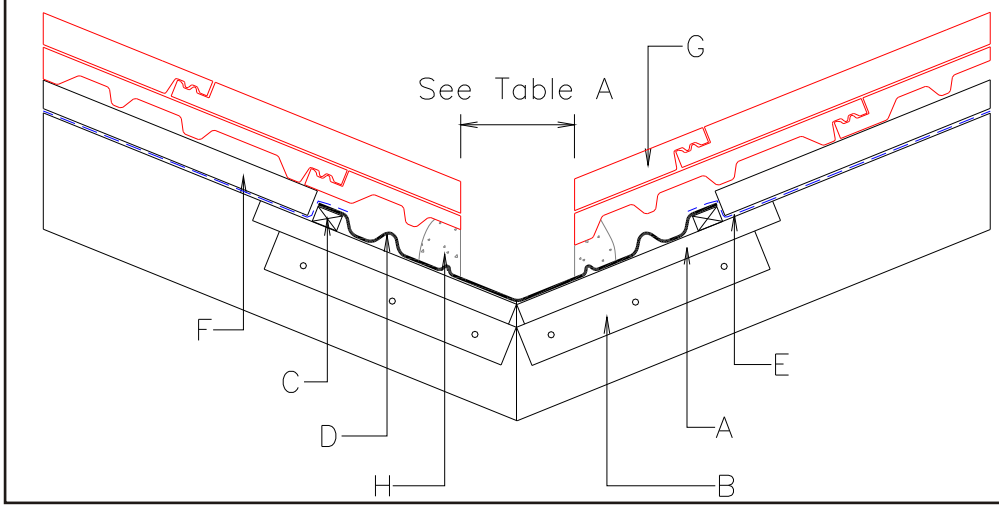
With most designs of GRP trough the edges will need supporting on valley battens **(C)**. The size of the valley battens should not be greater than that of the tile battens to ensure that the cut edge tiles do not kick up as they pass over the edges of the valley trough.

TABLE A

Roof pitch (degrees)	Width of valley gutters (mm) for rainfall rate 225mm/h draining	
	25m² and less on plan	over 25m² up to 100m² on plan
17½–22	125	–
22½–29½	100	–
30–34½	100	125
35+	100	100

See BS 6367: 1983

FIGURE 1: Valley with GRP lining



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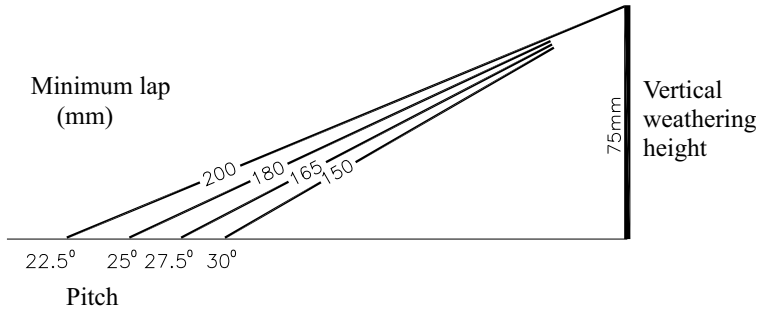
Valley trough unit
The GRP valley trough units **(D)** have a pre-formed cross section, are light in weight and come in lengths of up to 3 metres. The shape is usually ideal for valleys between equal rafter pitches of 30 degrees. For other rafter pitches the units will need to be fitted to suit.
If the rafter pitches on each side of the valley are within 5 to 15 degrees of each other, the valley unit will cope. For differences over 15 degrees the recommendations of the manufacturer should be sought, as water flowing from the steeper side can sometimes drive water onto the mortar bedding on the shallower side, although its effect will depend upon the design features of each individual valley trough.
Each valley unit will need to be nailed into the valley batten, through elongated holes, using 25mm long clout head nails, at between 0.3 and 1.0 metre intervals down both sides, depending upon the manufacturers recommendations. This is to allow for the overall expansion of the GRP.
The headlap between lengths of trough will depend upon the true pitch of the valley. At a true valley pitch of 30 degrees and steeper, the lap should be 150mm. At below 30 degrees the amount of lap will increase (see Table B).

Valley trough junctions
The top and bottom GRP unit of each valley will need cutting to a V-shape to follow the line of the ridge and gutters. At the eaves the valley should over-sail the gutters by 50mm.
Where two or more valleys meet, where there is a change of direction in the valley, or where the valley discharges back onto the roof, a lead saddle is needed to maintain a weather-tight junction. At the junction of two valleys and a ridge, as with a dormer, the ridge tile should stop on the edge of the valley.

Roof underlay
The roof underlay (E) should finish on the edge of the valley trough, on the valley batten. The valley trough units may be laid on an underlay provided the underlay id not bituminous BS 747 type 1F, as it is likely to glue itself to the underside of the trough in hot weather. The underlay, if glued to the valley trough unit, may be torn apart at the lap between the trough units by the thermal movement of the GRP.

TABLE 2: Minimum laps according to pitch



By finishing the underlay on the valley battens any water on the roof underlay will not drain under the valley.

Battens
Each tile batten **(F)** should be cut in line with the valley, approximately 10mm short of the valley battens, to allow any moisture on the underlay to drain down to the eaves uninterrupted. The 10mm space will help to prevent the underlay being punctured by the ends of the battens where it rises onto the valley battens.
Where the ends of the battens rest on the valley support board they should be nailed into the support board to prevent them from springing about, which makes nailing and clipping the tiles easier.

Tile cutting
The tiles, when laid on the battens, will need to be cut **(G)** to a rake to form the faces of the open valley width. The cut on each course of tiles will be different and will result in some pieces being very small. The use of half tiles, tile-and-a-half tiles or double tiles, where available, can help to alleviate this problem.
It is tempting to rough cut the tiles into position and then cut them in one pass of a disc cutter, but this practice is not advisable for the following reasons:

- It will be difficult to hold some of the smaller cuts whilst cutting them
- The resulting dust will settle all over the roof and valley and reduce the bond strength of the mortar
- Damage to the valley trough could occur if the disc cutter comes into contact with the GRP. Each piece of tile should be cut individually to a chalk line or board secured to indicate the sides of the open valley.

Mortar bedding
When all the tiles have been cut the pieces should be lifted out of the way while the mortar is laid. The mortar **(H)** should be 1:3 cement/sand ratio, stiff enough to stand up in a bed 50mm wide on the sanded strip without slumping. Each of the cut pieces of tile should be replaced and bedded into the mortar. Where the piece of tile hangs on a tile batten it should be nailed and/or clipped. The mortar will hold in place pieces of tile which are too small to hang on a batten. Avoid pointing up the valley or pushing mortar in under the tiles horizontally, as this will push mortar onto the tilt fillet and render it ineffective as a second line of defence.
The mortar should be flushed up to a smooth finish ensuring that the width at the bottom of the valley is no greater than that at the top of the tiles. Some systems exist which do not require mortar bedding and these should be checked with the valley trough manufacturer concerned.

Summary

- Water on the tiles and underlay flows towards a valley. Channel it down to the eaves.
- The maximum open valley width of 125mm will restrict when the valley trough unit can be used.
- Ensure the mortar and the weather-check, are properly formed and separated from each other.
- The most critical part of any inclined valley is where it discharges into the gutters and so adequate design precautions should be taken.

CTMA members are:

Cemex
Forticrete
Lafarge
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