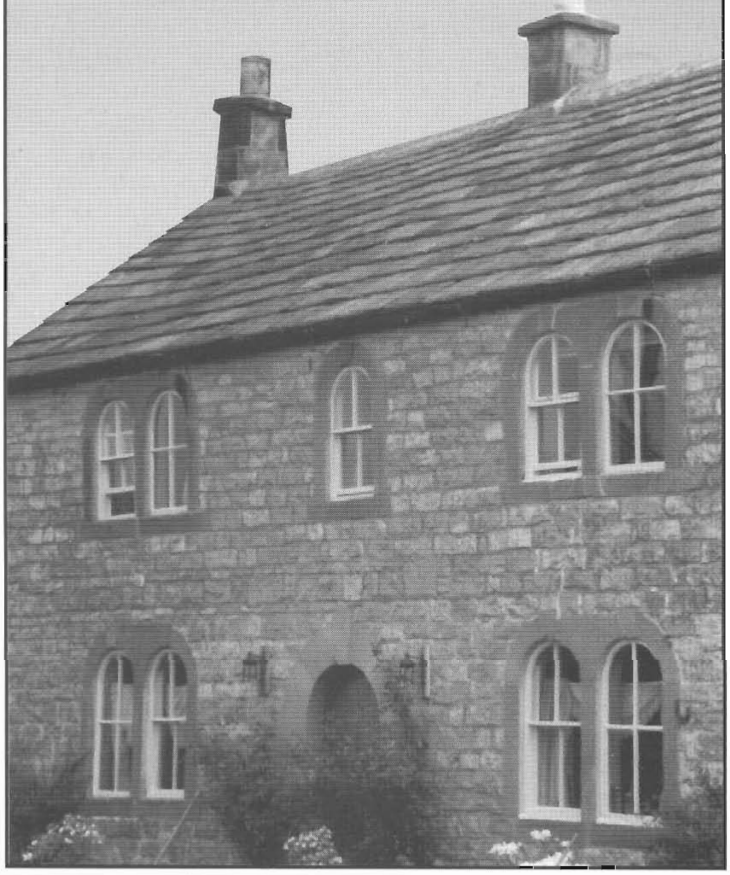
Derbyshire Stone Slate Roofs

General Guidance for Owners of Historic Buildings



DERBYSHIRE County Council
Caring for your Environment

PEAK NATIONAL PARK

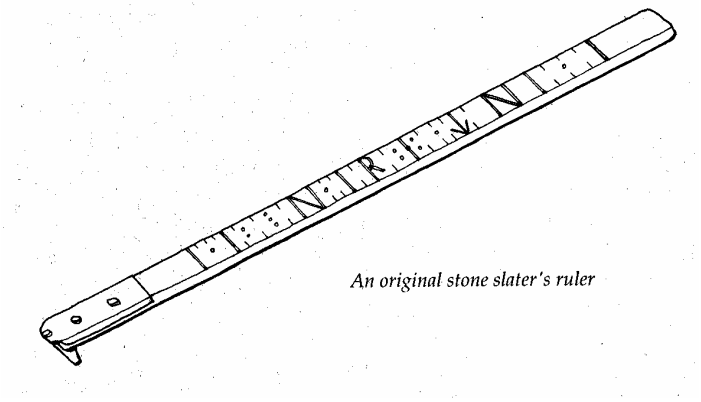
TRADITIONAL STONE ROOFING

DERBYSHIRE STONE SLATE ROOFS

GUIDANCE FOR THE OWNERS OF HISTORIC BUILDINGS

INTRODUCTION

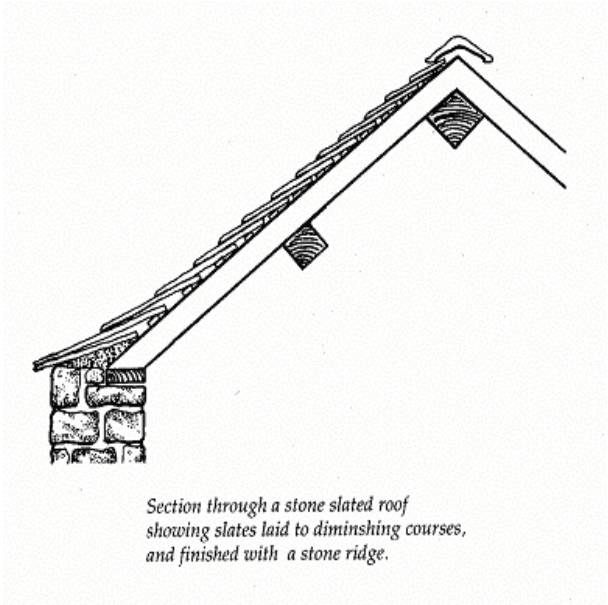
Of the many Forms of roof coverings found on traditional buildings in Derbyshire, the "stone slates found in the northern half of the County are perhaps the most distinctive, both visually and architecturally. Alec Clifton-Taylor, in 'The Pattern of English Building' has succinctly defined their quality by describing their effect on a roof as 'complete visual harmony with the architecture of the buildings on which they are placed'. This harmony rests to a large degree on the fact that both the stone roofing slates and the stone from which the buildings are constructed are obtained from the same geological formations, so that in composition and colour there is often a close similarity. Stone slates have a long history of use in Derbyshire, for the family name 'Stonethacker' was known in Chesterfield during the fourteenth and fifteenth centuries, and the durability of the material is proved by the survival of many roof coverings dating to the eighteenth and nineteenth centuries. It seems likely that the earliest use of stone slates would have been on the great houses, but during the seventeenth and eighteenth centuries, stone slates began to be used on quite modest buildings.



An original stone slater's ruler

As with thatch, stone roofs have been replaced by lighter, more regular roofing materials since the early nineteenth century, which saw development of mass produced uniform roof coverings. Welsh slate, pantiles, plain tiles and more recently concrete and asbestos roof coverings lave replaced stone roofs throughout Derbyshire, often with an accompanying degradation of the character and appearance of the building. Part of the reason for this decline may relate to practical considerations of maintenance and repair with a declining number of craftsmen capable of laying a stone roof. Another reason s that in Derbyshire there are no longer any stone quarries producing roofing stone. Added to these reasons is the cost factor which is ever present in the building trades today. There exists therefore a situation where a large number of stone roofs survive in an area with a few craftsmen, and even fewer suppliers of stone slates.

Unless stone roots in the County are properly repaired and maintained, their numbers must inevitably decline, and the County will be the poorer, for such roofs are not only important historically and architecturally to an understanding of the building traditions of Derbyshire, but they are also important visual components in many urban and rural settings. Their loss would seriously affect the appearance of many towns and villages throughout Derbyshire and the manner of their laying is a craft tradition of considerable importance. It demands not only a high standard of workmanship, but also an understanding of the variable characteristics of the material, with which the roofer is working. This publication has been prepared to document this craft tradition and to assist those involved in the repair and maintenance of stone roofs in ascertaining whether such works are necessary and, if so, whether they are being carried out correctly.



Section through a stone slated roof showing slates laid to diminishing courses, and finished with a stone ridge.

CHARACTERISTICS OF STONE SLATES AND THEIR SOURCES

Stone slates, also known as Grey Slates and stone flags, are obtained from stone deposits so formed as to allow the splitting of the stone along the bedding planes into thin sheets capable of being used for roof coverings. These stones, which are generally sandstones, split or laminate quite easily along straight lines, giving a fairly smooth faced finish which facilitates their use as roofing materials by allowing one slate to be bedded upon another quite evenly.

The stone deposits from which these slates are obtained are the Coal Measure sandstones or the Millstone grits. It is not always clear whence the slates for a particular roof have been obtained but it is likely that with an early roof a local source would have been sought, whilst at a later date, with the development of transportation systems to serve industries, the movement of building materials over larger distances was facilitated. Derbyshire had an enormous variety of stone slate quarries, from those on the Staffordshire border, across the County to Sutton Scarsdale, up into Holmesfield, and further north to Glossop. The quarries producing stone slates in Derbyshire c1800 were listed by John Fareyin his 'General view of the Agriculture ~and Minerals in Derbyshire' and this is a good basic guide to the areas whence stone slates were obtained. As well as the established quarries producing slates, it is quite likely that local sources, if of a suitable quality, would have been utilised. Outcrops, or quarries producing other kinds of stone would have been likely sources, if a particularly useful bed of stone was revealed during the working of a quarry. The roof covering of Whitwell Hall, in the north-east of the County forms an interesting example in this respect. Roofing slates, stripped and re-laid during the re-roofing exercise, were thought to be of the Cotswold limestone type -so rough hewn and irregular were they in appearance. When the inner faces were revealed however they were found to be yellowy pink in colour and of a gritty texture. However, Farey mentions a quarry in Whitwell, known as 'Bakestone Moor', producing a granular, yellow limestone. The place name 'Bakestone Moor' still survives and indicates that a stone capable of being split and shaped to form flat, thin bakestones was available in Whitwell. It would seem therefore that the stone was also capable of being used for roofing slates, for the slates of the Hall correspond to Farey's description of the stone won from the Whitwell quarry.

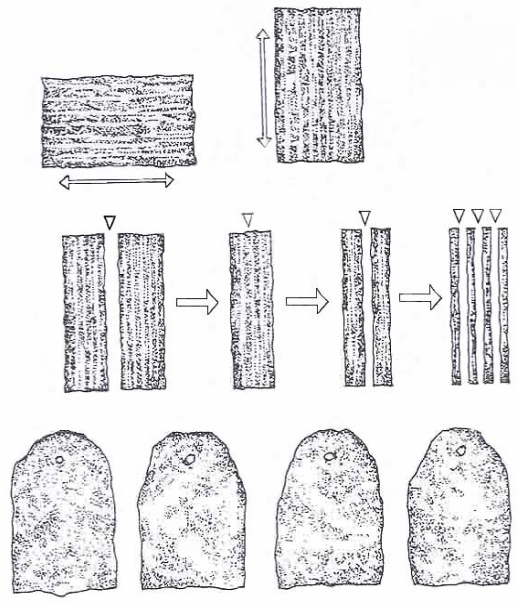
As well as there being a variety of sources there were a variety of qualities of stone slates. The slates from the most northern parts of the County tend to laminate cleanly, and have an even textured appearance. These slates are also quite hard and have good weather resisting properties. However, stone slates obtained from the Freebirch quarry in Brampton, found on many of the roofs around Chesterfield, did not split so evenly as the northern slates, for the laminations were uneven and gave the slates a scalloped appearance. The weathering properties of such stone were not as good as the smoother slates, possibly because their texture allowed greater scope for water penetration and lamination through frost action. The unevenness of Freebirch stone was so marked in some instances that the face of the slate had to be hand dressed to smooth it off, to make it suitable for roofing purposes. The stone slates from the Reeve Edge quarries in Staffordshire, sometimes found in Derbyshire, are extremely hard and strong and apparently difficult to re-hole when this is necessary. Thus, in a county of considerable geological variety there are a large number of sandstones which are suitable for roofing purposes but which have different characteristics which will affect the way in which they are dressed and the way in which they perform their function as a roof covering. Thus, when repairs are carried out it may not be possible to mix stones of different origin in the same roof pitch, so it becomes important to identify the stone which makes up the roof covering. The use of stone slates, or 'thackstones' as they were sometimes known, made certain demands on the building on which they were laid. The weight of the slates required stout rafters and purlins to support them and also meant that steep pitches were unusual because the oak pegs by which the slates were usually hung would split or slip if the roof pitch were too steep. The size and thickness of the slates meant that, in the main, roofs tended to be plain, rather than interrupted by dormers, or hips, because of the complication caused by the need to dress the stone slates to accommodate such features. In addition, features such as swept and laced valleys which were possible when using thin stone slates of the southern counties or plain tiles, are not generally found on the stone slate roofs of Derbyshire.

There are, however, exceptions to these generalisations perhaps the most startling being the Gazebo roof at The Manor, New Brampton, which is covered with stone slates, laid to fishscale pattern in diminishing courses, a feat made more remarkable by the fact that the roof is ogee-shaped and completely hipped, curved stone ridges having been fitted to the hips. Features such as dormers and internal valleys could be incorporated into stone slate roofs but they posed particular problems for the roofer in providing weatherproof junctions to those areas where the roofline was interrupted.

Traditional shape of a stone slate.

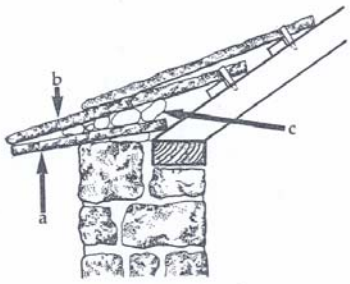
THE WINNING & PREPARATION OF STONE SLATES

Stone slates were obtained from the quarry face, where blocks of suitable stone were removed and then split in half and in half again and so on, until a number of slate sized sections were obtained. This process, known as 'middlin' was the extent of the quarry operation. The slates were then handed over to a slate knapper, or slate striker, a specialist craftsman who travelled from quarry to quarry unless a quarry was producing a sufficient number of slates to keep a striker fully occupied. The slate striker worked at a 'banker', a vertical stone having a slightly round top with a chamfered edge. The rough slates were squared off of random sized on the banker, the shape being marked on with a large square, and surplus stone being removed with a heavy sharp-edged hammer. The slates when cut were stacked vertically with horizontal slates laid on the piles to protect the edges. When the slater received the slates they were sorted to size using a Slater's'" s rule or 'Wippet stick' as it was known in the north of England. The rule was marked off in a series of gradations, three inches separating one size from another and various names such as 'Batchelors', 'Becks' ('Sketchens' and 'Fairwells' given to the main sizes and each main size having further sub-divisions such as 'longs' and 'shorts' or 'scants' and so on.



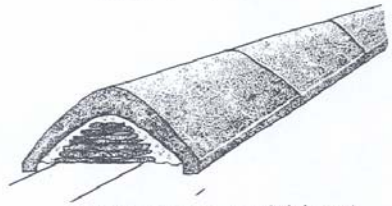
The process of splitting fissle stone to form slates

ORIGINAL TECHNIQUES



Eaves detail of stone slate roof
a. 'Counter or undereaves slate
b. House course
c. Stone wedges

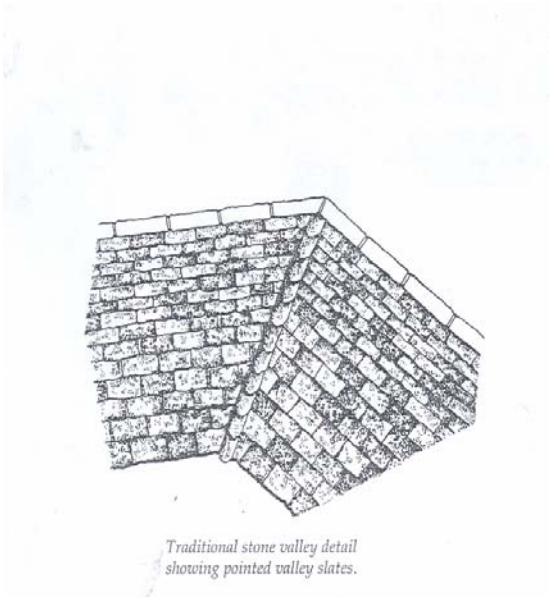
Detail of stone ridge, showing means of supporting the joints.



Stone ridge tiles showing the method of support.

The stone slates were laid in diminishing courses with large eaves slates several feet wide down to the courses near the ridge, which were considerably smaller. The slates were hung by means of oak pegs, driven into holes in the heads of the slates, made by using a pointed pick- end. The slates were hung on riven oak laths, except where a peg hole coincided with a rafter position in which case the slate was nailed, using a large 'sprag' or round headed nail. At the eaves, an under-eaves slate sometimes known as a 'cussome' or a 'counter' was bedded directly onto a wall and the 'house course', or first course, of slates laid onto that with the tails meeting. However, in order for the house course to bed closely on the counter slate, stone wedges were inserted between the two slates, a divide which gave additional support at the centre of the house course slate and which supplemented the action of the cussome. Successive courses would then be at the correct pitch. The large eaves slates and cussomes projected up to 6" beyond the face of the wall and gave a substantial overhang for the discharge of rainwater, prior to the use of guttering.

At the ridge, the roof was finished with ridge stones cut from the solid with pick and chisel or, later, sawn. Farey makes reference to 'Coburn Quarry' on South Winfield Park where 'Ridging Stones, a substitute for Ridge Tiles, are prepared. They are sawn out like an angular 'trough', whilst at 'Mansfield, Nottinghamshire and at Kinder in Glossop, they are hewn out for rough buildings'. Sometimes the ridges were bedded on mortar; sometimes they were laid dry; but in other instances the joint between two ridge stones was bedded onto a small pile of broken slate, with mortar, to



Traditional stone valley detail showing pointed valley slates.

give the area some support. The ridge stones varied in size and angle, according to the pitch of the roof. On a gabled building, unless the wall was finished with coping stones, the stone slates were carried onto, and sometimes beyond, the line of the outer stonework, but obviously copings would have made a more satisfactory finish.

Roof valley were a particular problem on stone slate roofs, as it was particularly difficult to achieve a swept or laced valley as was possible with thin Cotswolds limestone slates or. plain tiles and which meant that the coursing of the stone covering was not drastically interrupted. In Derbyshire, and in the Pennines, the valleys were formed by laying stout boards in the valley space to provide support for chevron ended valley slates which were laid to form a stone valley. The edge slates of the two intersecting roof slopes were mitred to the required shape, and the valley was so constructed as to allow the coursing to continue from one slope to the other, although the valley course was set below the other courses and was partly oversailed by the edge slates of the adjacent roofs.

EAVES SLATING & TORCHING

In many parts of the County, there are roofs with a variety of roofing materials, usually a combination which includes stone slates at the eaves. Whilst it may be possible that the eaves-courses are the vestiges of an earlier stone roof, it is clear from reading Fare that stone slate eaves courses were a recognised feature of roofs in many areas, and that stone was used in conjunction with thatch and tile. He records "At Coburn Quarry, in South Winfield Park, a strong sort of Eaves Slate for thatched buildings, near a yard high, are sold at 1s per yard run. At Mansfield (Chesterfield) Quarry, N Nottinghamshire, a sort of Eaves Slate, 20 to 24 inches high are prepared for tiled Buildings".

The use of eaves slates offered certain advantages in different situations. Farey mentions their use in thatched buildings, stating that the use of stone eaves slates on low farm buildings prevented farm animals from feeding on the thatch at eaves level, whilst elsewhere, he states that stone eaves slates provided a firm surface against which to place ladders. The use of the heavy eaves course meant that there was less likelihood of the roof covering being lifted by the 'wind, and it was possible to achieve a considerable overhang for the discharge of rainwater prior to the use of guttering. The use of stone eaves persisted well into the nineteenth century, as indicated by the roof of the engine house to Seldom Seen colliery near Eckington which has a pantile covering with several courses of stone slates at the eaves, and by the fact that stone eaves slates are often used on Welsh slated roofs.

In the days before waterproof felting was generally available various devices were adopted to make stone slates, which were laid on open battened roofs, more water and weatherproof. One of the earliest methods was to drive moss between the joints on a stone roof, an operation known quite understandably as 'mossing'. C F Innocent, in his 'History of English Building Construction' records the death of a mosser who fell from the roof of Bubnell House, near Chatsworth n 1708, whilst an entry in the accounts of Shibden Hall near Halifax reads 'to Michael Hodgeson, in full, for moss, 6 shillings. Agreed with M(ichael) H(odgeson) to moss the house and laith for 40 shillings, including 6 shillings for moss - so 34 shillings due for mossing only. The moss was driven into the joints with a mossing iron.

Another means of weatherproofing was the process of 'torching' or 'tiering'. Torching was a mixture of sand and slaked lime, to which beaten cow hair was added. This mixture was applied to the underside of the slated roof, the quantity depending on whether the roof was single, doubt or fully torched. Single and double torching means that the mortar was applied at either the top or the top and bottom of the laths, whilst full torching means that the space between the laths was fully filled. The torching not only acted as a means of preventing rain and snow from penetrating the roof, it also cemented the wooden pegs firmly in position, thus preventing them from twisting and moving. The effectiveness of the torching depending largely on the correct mix of lime, sand and cowhair being used and on the way it was applied. If areas were missed the covering internally would be penetrated by the weather, and if the torching were to intrude too far into the lap, water could soak up through the torching and into the roof void through capillary action.

The benefits of torching have, in recent years, been eclipsed by the general utilisation of bituminous roofing felt by the building trade.

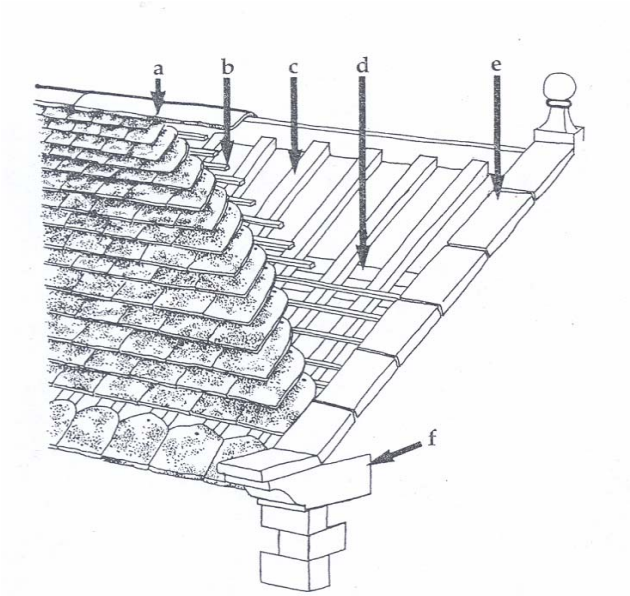
DEFECTS IN STONE ROOFS

Many of the defects visible in old stone roofs are attributable to the method of laying the roof rather than the deterioration of the roofing material. The most common failures occur in the wooden pegs, which shrink and dry out with age, and allow the slate to slip, and in the laths which tend to give under the weight of the stone slates. In many instances the roofing timbers have bent under the weight of the rootb'l1t this deflection usually occurred early in the life of the roof and unless the timber is cracked or badly infested with Death Watch beetle or dry rot there should be no cause for alarm. In many older buildings there is a considerable margin of safety provided by timbers whose thickness is far in excess of the requirements asked of them. If the laths and pegs have generally failed throughout the roof then there is no alternative to re-roofing.

Other signs of a defective roof covering are areas of bitumen painted onto the stone slates, the presence of a bitumen impregnated fabric covering over the entire roof, and the external pointing of stone slates with cement mortar. This is indicative of water penetration and would imply that the original mossing or "'torching has failed completely. The bituminous covering is most unfortunate, as it blurs the outline of the stone slate and renders their-use impossible in all but hidden locations. Like external rendering, a damaged bituminous covering can help to trap water inside the roof covering, making the effect of a small fault far more damaging because it cannot be seen and its effects will not be fully realised until serious damage occurs.

"See 'Eaves slating & torching' on page 4.

RE-ROOFING A STONE SLATE ROOF



The components of a stone slate roof (with eaves course exposed and second course omitted to show lap).
a. stone ridge
b. laths or battens
c. spars
d. purlin
e. coping
f. kneeler.

If a stone roof needs attention it is advisable to consult a specialist-roofing contractor who is familiar with stone roofing techniques. This is important, because the principles which apply to Welsh slating and plain tiling do not necessarily apply to stone roofing. If, in his opinion, the roof has to be recovered then there is no way of knowing what the full cost will be until the roof has been stripped and it is generally advisable to obtain a quotation for the replacement of the roof covering so that the upper price limit for the job can be established. When the roof is stripped it "fill be possible not only to determine the amount of damage to the roofing timbers and the amount of replacement necessary but also the number of slates which can be re-used in the covering of the roof. Even the most experienced roofing contractor cannot accurately determine the amount of damage to the slates until they are on the ground and can be examined. Then the amount of cracked, damaged and spalled slates can be determined and the number of replacement slates estimated.

Not all of the damaged slates are to be rejected for, if they are not cracked or laminated throughout their length, they can be redressed to form a slate for a smaller course. Stone slates become unusable when they are too seriously laminated or when they become too thin at a particular point, usually around the area of tbe peghole, for there a hole has been made in the central part of the stone and permitted weathering from that point inwards. Variations in temperature, vibration and chemical attack can all cause stone slates to perish, and it is important to weed out all defective slates before being re-used on a roof.

INSPECTION AND REPAIR OF ROOF TIMBERS

Having stripped and examined the roof the slater will be able to advise as to how many roof timbers are capable of being re-used. At this point it should be possible to determine how much replacement is needed. Roofing timbers should be carefully examined and the cause of any decay determined. The two principal enemies of older roofing timbers are dry rot, which is a fungal attack, and wood boring insects such as furniture beetle (woodworm) and Death Watch Beetle. If a roof has been affected by dry rot then the affected areas have to be removed and new impregnated timber inserted. Death Watch beetle and woodworm can be treated in situ if the infestation is not too serious but if the structural stability of the roof is prejudiced by the decay of timberwork then that timber should be replaced. The presence of woodworm in an old oak roof, however, is not necessarily serious for the beetle generally attacks softwood and the sapwood of hardwoods leaving the heartwood structurally sound. Thus decay and infestation maybe confined to the outer skin of the timber only and all that is necessary is to clear away the decayed 'frass' and apply timber-preserving fluids. Too many original roof structures of historic buildings are lost through over- zealous replacement of timber. A simple prodding operation with a penknife will soon show whether a timber is severely worm eaten or not. If there is some doubt as to whether the infestation is serious or not or some doubt as to the cause of the decay then a specialist opinion should be sought from one of the many companies operating in this field. Estimates are usually free and it is advisable to obtain comparative estimates for the work as there are enormous differences in price and the most expensive job will not necessarily be the best. As it is sometimes difficult to determine whether the infestation has been eliminated it is advisable to employ a company who offer a guarantee for their work.

The stone slater will be able to begin his work once the repairs to the timber work have been completed. The roof will have to be felted over the backs of the roofing spars and the supply of stone slates organised. Great care must be taken in the selection of replacement slates as they should match those existing where possible, for there are considerable variations in size and texture and in weathering properties and it is not practicable to mix stones of widely differing characteristics on the same roof pitch. Again the advice of a specialist stone roofing contractor is preferable since he should have some knowledge of the properties of the roofing materials in the area, and should also have stocks of stone slate or at least know where these maybe obtained.

SOURCES OF REPLACEMENT SLATE

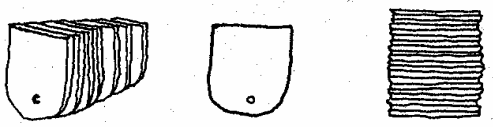
There is now no production of traditional stone slates from quarry sources in the Pennine uplands. Sawn, rather than riven slabs are available, but this product has a fundamentally different character. The only source of traditional stone slates for repairs, re-slating or roofing new buildings is reclaimed slates. Such slates are usually obtained from Yorkshire and Lancashire, although some small amounts of Derbyshire slates, such as Freebirch types are sometimes available. It is to be regretted that replacement stone slates may only be obtained as a result of the destruction of other buildings and, as the supply of slates dwindles as it inevitably must, then the temptation may arise to demolish unprotected buildings in order to obtain supplies of scarce building materials. It will obviously be necessary in the future to re-open quarries for the production of such slates again, if the stone roofs are to be maintained. In the meantime the supplies of second-hand slates should be carefully husbanded.

RE-ROOFING, SETTING OUT AND SORTING

The stone roofer, having obtained the necessary amount of replacement slates, can then begin the most important part of the re-roofing operation, namely the sorting, grading and laying out of the stone slates in courses on the ground. The importance of this operation cannot be overstressed because it will determine the courses and graduations of the roof covering. It is a mistake to begin the recovering until this has been done, for the roofer will not know whether he has a sufficient supply of suitable sizes in which to work.

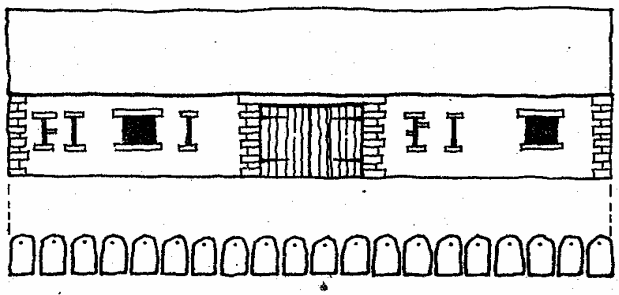
The slates are first sorted to length, using a slater's rule, and standing the slates vertically on their heads (ie, pegholes to the floor). When using a second-hand slate, slates are measured from the peghole to the tail of the slate. When this sorting operation has been carried out the slater will measure the length of the eaves course required on the slope he proposes to work on. This can be done with a tape or a knotted line. He will then go to the stack of the largest slates and measure each slate for width using the tape or string until he determines that there are a sufficient number of the largest slates to cover the length of the eaves course. The slater should then allow for breakages and include three or four extra slates in each Course. If there are insufficient slates of the largest size for the eaves course then the whole stack are dressed down or re-holed to the next size, which becomes the eaves course size. Unless there is a readily available stock of slates from which extra slates can be obtained, the process of re-dressing is unavoidable.

During the sorting operation any damaged slates should be removed and placed by the banker for re-dressing. Slates which are badly laminated should be rejected outright but those with broken comers or with split heads can be re-used if re-dressed. The slater nowadays will generally use a metal plate, stood upright as a banker. With the general use of power tools, the art of dressing stone slates by hand has declined and some contractors choose to use disc cutters to re-cut and trim stone slates. Whilst this is a quick job, it is relatively unskilled and moreover gives the cut slates very even, straight cut edges rather than the irregular, roughly chamfered appearance of a hand-dressed slate. The skilled slater can dress slates quickly and accurately, and with a greater degree of control than is possible with a large powered cutter. Inevitably the question of machine cut or hand dressed slates devolves down to the two questions of cost and aesthetics. Hand cut looks better but may cost more.



Stone slates, stacked for grading to thickness.

When the slates have been graded for size they should then be graded for thickness, a process which is facilitated if the slates are standing on their heads. The thickness of slate can then be observed and sorting into thick, medium and thin can then take place, so that as the slater works along the length of a course he uses the trucks then the mediums, then the thins to prevent unevenness throughout the course.



Measurement of the building, to ensure that the largest slates are sufficient to form the eaves course.

The importance of thorough and careful sorting of slate on the ground cannot be overstated. It is not possible to sort properly":on a scaffold, as there is insufficient room to stack the material safely.

SETTING OUT LATHS

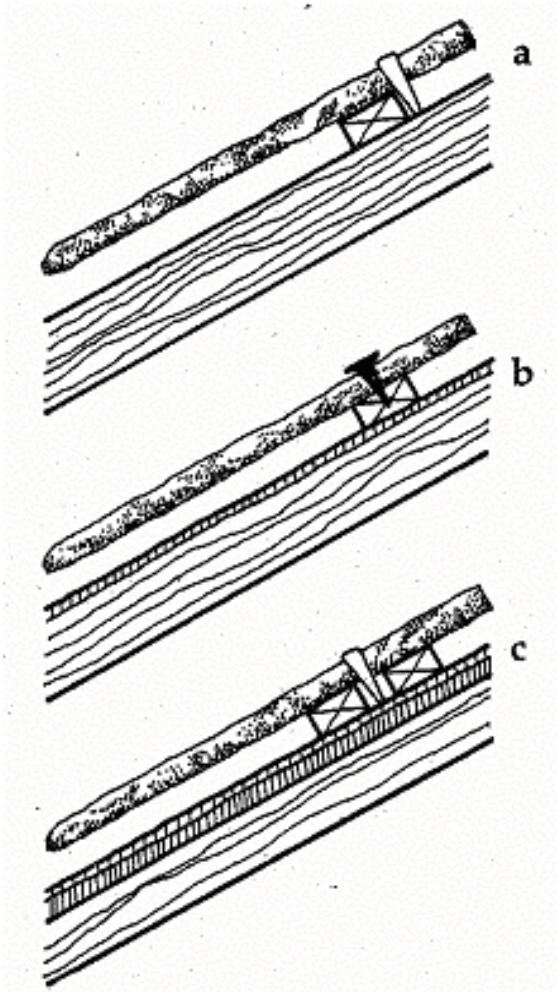
See Appendix 2 at end of document.

RE-SLATING; METHODS OF FIXING

As has been shown, stone slates were traditionally hung using oak pegs, although other materials, notably animal bones, were used and there are even references to stones being bedded in mortar rather than hung. Today, with the use of bituminous felt, the pegging of slates is impracticable, unless the roof is counter battened -that is, battens laid onto the backs of the spars, over the top of the felt, prior to the slating battens being fixed. This gives sufficient depth in which the pegs carrying the slates can be accommodated without harming the felt. The use of pegs is obviously the most acceptable method of hanging slates from a traditional viewpoint but there are the disadvantages of shrinkage, twisting and slipping associated with the use of wooden pegs, and there is a school of thought which contends that unless torching is used in conjunction with pegging it will not be possible to ensure that the pegs are secured.

The problem of shrinkage and slipping can be partly overcome by using double battens, one above the other, to prevent vertical movement of the peg. A lighter batten is nailed above the peg carrying batten with sufficient space left for the wooden peg to be driven between the two. However, the cost of having the oak pegs cut and the two sets of extra timber laid prior to the slating taking place may deter all but the most enthusiastic owner from employing the traditional form of slate hanging. In general modern stone slaters will nail the slates to the battens, using copper or alloy nails which are strong yet light. Galvanised nails should not be used for when they are being hammered the coating may be damaged allowing water to penetrate and begin the process of rusting which under the great weight of the roofing slate may cause the nail to shear. In some cases where the eaves courses are especially large, double nailing is advisable in the same way as double pegging was formerly employed on eaves courses. More recently, an alloy peg has been produced to allow the slate to be hung rather than nailed.

Care must be taken as work progresses to ensure that there is an even and regular diminution of slate size as the courses ascend the roof slope, and that the lap and gauge is carefully maintained. Each slate should overlap an underlying vertical joint by at least three inches, care being taken to ensure that the lap is at least the minimum amount throughout tl\e whole length of the slate. The measurement of the three inches should be taken from the edge of the slate, in line with the peghole which, being situated at the narrow end of the slate, will ensure that the minimum lap is achieved. The peghole may sometimes be off centre, depending upon where the most suitable position for the peghole was, but even so, the measurement should be taken from that point.



Methods of fixing stone slates:
a. pegged slate on single batten.
b. nailed slate.
c. pegged slate, using double battens.

The final courses of slates, nearest the ridge are bedded, rather than nailed, and then the stone ridges are laid. They can be supported in the manner described earlier.

SMALL SCALE REPAIR WORK

As with all roofs, faults occur with stone roof coverings which do not necessitate the stripping of the roof but which can be rectified by local repair. The breakage or slippage of a single slate, or a small area of slating will require the refixing of the replacement slates in the affected areas. If a single slate has slipped, the adjacent slates can beraised and wedged to allow the slate to be removed. When this has been done, the area uncovered should be thoroughly cleaned to remove all dust, moss etc, together with the slate, if it is to be refixed.. If the slate is to be re-used, it should be examined to determine whether it is suitable for re-use. If it is not, a replacement of equal size and thickness should be sought so as to ensure that the materials used for repair are compatible.

When the slate has been cleaned down, it can be refixed by bedding the slate in mortar on the slates at either side below. On no account should the slate be bedded at, and under, the tail, as the mortar attracts moisture through capillary action, and the repair will appear obvious and unsightly from the ground.

If a number of slates need replacement, it should be possible to refix to the laths except in the case of the last slate to be fixed:, which has to be bedded, as described above, after cleaning down the area to be repaired. On no account should cracked or broken slates be re-used, nor should slates be reversed or hung from the tail.

THE RETENTION OF ORIGINAL DETAILS

Derbyshire stone roofs are important features of architectural and historic interest, and it is therefore important to ensure that their quality is not dissipated by over-zealous renewal. However, in some instances, traditional details are incompatible with the requirements of a modern roof covering. Details such as stone valleys, iron brackets contribute to the special character of the roof, whilst modern alternatives, such as plastic guttering, fascia and barge boards impair its quality.
Care must be taken therefore to ensure that the repairs to the roof are carried out in a manner which will ensure the preservation of original detail and thus the special character of the roof. With certain components, such as wooden guttering, there is no problem, as this is still readily available. With other details, such as eaves slates, some complication may be caused by the need to use two different materials on the roof, but this should cause the competent roofing contractor no problem, and the use of stone slates at the eaves may be advantageous, as has been shown. However, a conflict of interests will arise when a detail such as a stone valley has to be replaced or removed, for although such details are comparatively rare, the reason for their rarity may be partly attributed to the fact that they proved unsatisfactory, and were replaced by lead work when renewal became necessary. It is important to discuss with the replacement of replication of original detail with an experienced stone slater. An amended form f the stone slated valley can be laid, with plastic sheeting, felt and breather paper being cross-lapped over the valley board before the fixing pf laths and slates, but it is important that the slater sets the valley board in position, so that the levels of the slate courses on the flanking roof cal be aligned with the valley slates.

The appearance of a stone slate roof covering can alter dramatically if the number of courses, and the range of slate sizes change The number of courses on a roof slope can be counted, and repeated on the replacement covering if the range of course sizes, and the rate of diminution of course size is to be faithfully reproduced. If an original detail is to be replaced by a modern substitute, then an accurate record should be made of the original before it is lost.

APPENDIX 1

STONE SLATE QUARRIES IN DERBYSHIRE AREA CIRCA 1800
THE TAKEN FROM FAREY'S "A GENERAL VIEW OF THE AGRICULTURE AND MINERALS IN DERBYSHIRE"

SLATES - or Tile-stones: these, in the district where the lamellar stones abound, are mostly used instead of Tiles, or blue Slates for the Houses and Buildings. At Sheffield these white and grey Slates are exclusively used, and give the Town a novel appearance to a stranger approaching it by the Mansfield Road.

Most of the grey Slate of this district abounds with Mica in minute plates, forming layers at the joints where the stone most readily parts. In numerous instances these joints are remarkably plane and smooth, but in others the surface of the Slates are waved and curled in a very regular and curious manner: these waved Slates, although they are seldom so light or look so well on a House as the plan ones, are nevertheless found to last, and answer the best, in many situations. The following is a List of Slate Quarries or Delphs, viz

Abney in Hope, Shale Grit
Ashgate in Brampton, 7th Grit (waved)
Bakewell, E of the Town (Edge), Shale Grit
Bradwell, I m E, Shale Grit
Brampton N W (Three Birches, and Grange Bar) 6th Grit:
and W (Pudding-pie Hill), 5th Grit
Bugsworth in Glossop; 3rd Grit
Bull-bridge S of Crich, Shale Grit: by Cromford Canal
Calow in Chesterfield, Grit
Chinley (Churn), nearChapel-en-le~Frith, 2nd Grit: Peak
Forest Railway near
Chunall in Glossop, 1st Grit
Dronfield S (Hallows), 9th Grit
Eyam Woodlands (Wet Wivens), Shale Grit
Flash S, Staffordshire, 1st Grit
FullwoodS W, in Sheffield, Yorkshire (Brown-edge, and Fullwood-head), 3rd Grit
Gleadless, SSE of Sheffield, Yorkshire, 8th Grit
Glossop N E (Low, and Charles Lane), 1st Grit
Goytes-clough, S of Goyte-bridge, Cheshire, 2nd Grit
Grindon N W, Staffordshire, bastard Shale Limestone Hanley in North Winfield, 4th Grit
Harston S, in Matlock (White Tor), Shale Grit
Hathersage E (Cam Height), Shale Grit
Hayfield (White Knowle), Shale Grit Heage N E, 5th Grit
Loco-lane S, in North Winfield, Grit
Longnor, 113m N W, Staffordshire, Shale Grit
Macclesfield Common (Tags Nose), Cheshire, 4th Grit Mansfield S W, Notts, yellow lime
Matlock W, 1st Grit
Nether Padley N E (Sof the Robin Hood), 2nd Grit
New Mills in Glossop, 3rd Grit
Penistone S W, Yorkshire (Hartcliff), 4th Grit Pentrich Common N W, Gritstone
Pott Shrigley N E (Bakestone-dale), Cheshire, 3rd Grit
Gainow Chapel, Cheshire, N (Brown Brow), 3rd Grit; and W (Kerredge), 4th Grit
Raworth in Glossop, 4th Grit
Stanage, N W of Wingerworth, 3rd Grit
Stoke in Hope, Shale Grit
Sutton in Scarsdale W (Wood-Nook Lane), 11th Grit
Swithland, E of Charnwood Forest, Leicestershire, blue slate
Tansley 5 W, in Matlock, 1st Grit
Tapton S E, near Brimington, 5th Grit Thornsett in Glossop, 3rd Grit
Unthank W, near Holmsfield, 4th Grit
Walton WSW, in Chesterfield (Slate-pit Dale), 4th Grit Whitfield in Glo~sop, 1st Grit
Whittington N (Swineslait), 9th Grit (waved) Whittle in Glossop (Crowther), 3rd Grit
Wincle Chapel N E, Cheshire (Dane-head, and Blackclough), 3rd Grit
At Glossop (Low) Quarry, Slate is sold, in quantity sufficient to do a rood of slating, or 44 square yards, at 52s: in the Town, the same sell at 64s: at Goytes-clough Quarry, Cheshire, 60s per Rood.

At Coburn Quarry, in South-Winfield Park, a strong sort of Eaves-Slates for thatched buildings, near a yard high, are sold at Is per yard run. At Mansfield (Chesterfield) Quarry, Nott's, a sort of Eaves-Slates, 20 to 24 inches high, are prepared for tiled buildings.

Some thin lamellar Gritstones of this class, which are found capable of withstanding high degrees of heat, without melting or falling to pieces, are formed into round plates about an ineh thick, and 9 or 10 inches diameter, called Pye-stones, Pot-stones, or Lump-stones, and are sold to the Iron Forges for heating their Balls oj scraps upon, for the Tilt Hammer: these are prepared a1 the Quarries, in Bradfield, Yorkshire N N E (Spout, house), and (Swathwick) from the 1st Grit: in BrimingtoI1 W (Wild ens Mill), 8th Grit; Stanage N W ofWingerworth, 3rd Grit; Walkley in Sheffield, Yorkshire (Bank), 3rd Grit, and Whittington W (near Sheepbridge), 9th Grit, &c.

Larger stones of the same nature are also prepared, for the purposes of baking Oak Cakes upon, called Bake. stones, which are either thin and round to be used on z hanging Trevet, from the pot-hood over the fire, as is common in the cottages; or larger and square, for setting on the top of a stove, similar to an Ironing Stove in the south of England. Bake-stones are made in Ashover Beeley, Birchover (Moor) near Winster, Rowlee ~ (Crookston Peat-Pits), &c. At the last mentioned place the round Bake-stones are hewn out of small loose block1 of the 1st Grit, laying at bottom of the peat.

At Coburn Quarry, in South Winfield Park, Ridging. stones, a substitute for Ridge-Tiles, are prepared; the) are sawn out like an angular trough, which usually span~ 11 inches, and are sold at 20d per yard run. At Pentricl Common QUarry, similar ones are prepared. At Mansfield (Chesterfield) Quarry, Notts, and at Kinder in Glossop they are hewn out, for rough buildings. At Wickersle) Quarry, Yorkshire, Ridging-stones are sold at 8d to 14c per yard run, according to the work on them. At Harthill, Yorkshire, at 12d per yard run.

APPENDIX 2

A SUGGESTED METHODOLOGY FOR STONE SLATING

1. Stripping

A record is to be made of the number of courses on each slope, the various lengths of slates and any special details. The existing stone slates are to be carefully removed together with all lead flashings and ridge stones and carefully lowered to the ground. The slates are then to be carefully sorted as described below, those which are damaged being separately stacked for possible re-use after redressing. All badly laminated slates are to be rejected.

NB: All British bats and their roosts are protected under the Wildlife and Countryside Act 1981. It is illegal for anyone without a license to disturb, injure or kill intentionally a wild bat or to damage or obstruct access to any place that a bat uses for shelter or protection. Where bats or their roosts are likely to be affected, the Governments Statutory Nature Conservation Organisations (SNCOs) must be consulted before work begins. They can be contacted directly or through the Local Authorities and the Peak District National Park office. The law need not make life difficult for roofing contractors or property owners who find bats or evidence of their presence. Some timber preservative chemicals are highly toxic to bats and these must be avoided.

2. Leadwork

When lead flashings are removed, the client/owner is to be credited with the weight of the salvaged metal, but lead in good condition may be re-used. New leadwork is to conform to British Standard 1178, using Code 4 for soakers and Code 5 (minimum) for flashings, valleys and gutters. Depending on the size and design of the gutters thicker lead may be advisable. In any case new leadwork should always be laid in accordance with the recommendations contained in "The Lead Sheet Manual", published by the Lead Development Association & the Lead Sheet Association.

3. Sorting

The sound slates are to be carefully cleaned, sorted to length and thickness and arranged in stacks for each course, the slates being stacked vertically on their heads, (ie peg holes downwards). The length of each slate should be measured from the peghole to the tail and sorting to length should precede sorting to thickness. Each stack of slates thus sorted will constitute one course of stone slates.

The number of slates required for the eaves course can be established by measuring the length of the building and then checking this dimension against the combined widths of the longest slates. By this method it can be determined whether or not there is a sufficient number of the largest slates together with a number of spares to form the eaves course. If there are insufficient slates then those larger slates can be dressed down to the length of the next longest size, which will then become the eaves course. Where new matching slates are available the use of reclaimed slates from other sites should be discouraged. Dressing should preferably be done using a slater’s hammer over a steel 'banker' plate. Cutting by means of powered saws produces an unpleasantly harsh edge. The tails of slates dressed over the banker should have the traditional bevelled edges -a natural consequence of the hand-dressing action.

4. Timberwork

Roof timbers are to be cleaned down but not defrassed, so as to avoid unnecessary loss of original material, and all loose debris removed from the roof spaces. The timbers should then be inspected for active fungal decay and beetle attack. Original timbers should be retained if at all possible. Only those timbers which are so badly affected or damaged as to prejudice the structural soundness of the roof should be replaced, as the intention is not to regularise the appearance of the building, but to repair and preserve as much of the original timber as is practicable.
Replacement timber should be dried to a moisture content of between 15 and 20% and be of matching size and species to that being replaced. Softwoods should be pressure-impregnated with preservative before being brought onto site and any cut-ends or bored holes should be liberally treated with insecticide/fungicide before being built in.
Preservative treatment of existing timbers should be confined to areas obviously affected by active woodworm or fungal decay and in the interests of health and safety, the environment and wildlife, should avoid treatments which use lindane, pentachlorophenyl or tributyl tin oxide.
Only when a genuine need for timber treatment has been established should remedial work be carried out, with reference to legislation including the Control of Substances Hazardous to Health Regulations 1988, the Health & Safety at Work, etc, Act 1974 and the Control of Pesticides Regulations 1986.

5. Underfelt and Roof Space Ventilation

A suitable underslating felt or membrane may be fixed over the rafters of habitable buildings. In barns and other non-habitable buildings the underside of the slates should be 'torched' (see l below) in place of an underfelt or membrane.
The provision of adequate roof space ventilation to combat condensation needs to be considered when re-roofing habitable buildings, but proprietary (usually plastic) ventilators in the ~lopes of traditional roofs can be unsightly. Eaves and valley ventilators can usually be hidden and ventilation at ridges can be contrived by omitting some of the ridge bedding mortar and under-slating felt. The use of gable ventilation is preferred if possible.

When re-roofing a building in which the ceilings follow the plane of the rafters (i.e., there is no roof void), particular care needs to be taken in choosing and fitting an underslating membrane which will allow the passage of moisture vapour and ensure adequate ventilation of the voids.
N.B. Roofing underlays must comply with BS 747, types 1 F and 5U. Construction of roofs should accord with the requirements of Parts C4 and F2 of the Building Regulations and BS 5250, 1989, Control of Condensation in Buildings.

6. Battens and Fixings
The roof is to be battened with 50mm x 25mm preservative treated softwood battens, fixed with 63mm stainless steel nails, set out to suit the slate lengths.
The slates may be fixed using the traditional timber pegs, "hung" over the battens with the heads of the slates, and the gaps between them 'torched' from below using a hair-lime mortar. This makes the joints weatherproof and secures the pegs in case of shrinkage. Alternatively heavy-gauge round aluminium pegs can be used, but this will require drilling new holes in the slates to suit the gauge of the pegs. To avoid puncturing underlays, it will be necessary to use counter-battens fixed to the tops of the rafters, to which ~he slating battens are then fixed.
The use of understating felts and membranes makes torching impossible, but it is unwise to use wooden pegs without torching the underside of the slates. This is normally only likely to happen now on non- habitable buildings.
Slates can be nailed using heavy-gauge copper or aluminium nails, but not galvanised or plain wire nails. The longest slates may require more than one nail per hole, but there is then a danger of splitting the battens, unless great care is taken to centre the nails on the battens. Large slates need to have two separate holes and fixings.

7. Reslating
Reslating is to commence with the bedding in mortar of a row of short, wide slates on the wallhead, as the 'counter' or undereaves course, laid to a shallower pitch than the rest of the slates. The tails of this course and of the first or 'house' course above, must co-incide and should project a minimum of 75mm beyond the outer face of the wall, over the centre, line of the eaves gutter. The space between the counter and house courses should be packed with small stone wedges to assist support of the house course.

The roof is to be reslated using the sound slates previously removed from the roof, with deficiencies made up with new slates (where available) brought in, to match in type, texture, colour and thickness. The slates are to be brought up from the ground in the order into which they have been sorted and laid a complete course at a time, before starting on the next course. Slates must not be turned over as the bevelled tail-edge may then induce water under the lap.
The slates are to be fixed in regularly diminishing courses, preferably .using {he same number as previously. Each course of stone slates is to have a minimum head and side lap of 75mm measured from the peghole to ensure the roof covering will be waterproofed. The lap is to be increased to a minimum of 100mm for pitches of 300 or less. At pitches of less than 300 the weather tightness of the roof becomes questionable irrespective of the lap, The gauge of the battens is to be reduced where a course of shorter slates is laid, to ensure the minimum head lap.
The slates are to be laid, as far as possible, with the tail edges resting on the slates in the previous course. The slates are to be laid to avoid rocking on uneven surfaces and to avoid sudden changes in thickness from one slate to the next, and gaps between courses. Grading the slates from thick to thin, and vice-versa, in alternate courses helps avoid rocking. The use of mortar bedding to prevent rocking is inadvisable.

8. Valleys
Valley boards are to be renewed in butt-jointed preservative treated sawn softwood boards, with a non-bituminous isolating membrane below milled sheet leadwork.
Sloping valleys can be formed in the traditional manner using pointed, valley slates layed over stout wooden boards, in a chevron pattern. The edge slates of the two intersecting roof slopes are mitred to the required shape and course into the adjacent roof slopes. The valley should be at.1east 150mm wide to minimise the risk of blockages and to ease maintenance.

9. Ridges, Abutments and Verges
The stone ridges are to be re-laid, bedded in mortar and the joints carefully finished with a minimum of exposed mortar. The junction of the roof with the parapet walls and chimneys should normally be finished with lead soakers and flashings or such other traditional detail as exists. On slates with particularly rough surfaces a mortar fillet may be used where it 'would be difficult to" insert flashings and/or there are overhanging coping stones to protect the fillet. Where the width of the resulting fillet will be in excess of 60- 70mm the fillet should be reinforced with stainless steel expanded metal mesh and built-up in layers.
Verge slates should be bedded in mortar between the underside of the slates and the masonry as work progresses, and the edge struck off and stippled avoiding a hard-edged band of projecting mortar.

Original Text by Bob Hawkins 1977
Revised . 1992 & 1996
Heritage and Design Group
Environmental Services Department