

ENGLISH HERITAGE
PRACTICAL BUILDING CONSERVATION

ROOFING

ASHGATE

This chapter begins with a brief history of roof coverings used in England, and then summarises how roofs must work to protect the building. A general guide to their deterioration and assessment is followed by general principles for treatment, repair and ongoing care and maintenance. Finally, the differences between modern and traditional roofing practice are discussed in an excursus.

The roof is often the most striking and dramatic feature of any building, particularly if it is of some antiquity. The roof structure is also likely to be the oldest and least altered part of a historic building which can yield important information about its age and significance. The fact that so many historic roofs have survived for centuries is a testimony to the design, materials and skills used on traditional roofs, even though few would fully comply with modern practice. As well as the contribution that a historic roof makes to an individual building, equally important are the distinctive roofscapes of tile, slate, stone or thatch which are so vital to the unique character of many English regions, towns and villages.

Conserving historic roof coverings is often approached in a very different way to other elements of important fabric. This may be because so much more replacement is undertaken as compared to walling, for example, when a considerable number of decayed stones or bricks can be tolerated. Roofs have to be made watertight, which leaves no place for heavily eroded coverings; otherwise, eventually the whole building will be lost.

Despite this, there is still a great deal of thoughtful work that can be done to conserve historic roofs and the traditions behind them. Repair is still advocated, provided that a reasonable longevity without continual maintenance can be achieved. When the time comes to replace a roof, it is important to observe and record early detailing and replicate it if it has performed well and conditions have not markedly changed. Although it is tempting to use modern standards and guidance these may not be appropriate and can introduce bland uniformity as well as dilute regional distinctiveness. Perhaps the biggest challenge, though, is to improve the energy efficiency of roofs in ways that retain the building's character and significance but also ensure its longevity.

For the most prestigious buildings belonging to church, royalty or aristocracy, the material of choice was lead and, to a lesser extent, copper. Depending on the ownership and location of quarries or brickyards, stone, slates or tiles were also used. Oak or chestnut shingles were also very fashionable in the 14th century and were seen as less of a fire risk in urban areas than thatch. The London ordinance of 1212 prohibited the use of thatch on new buildings in the capital, and suggested shingles, slates, stone or tiles as an alternative. This regulation was gradually adopted in other towns, although not always rigorously applied.

Although the move away from thatch and, later, shingles meant a stronger roof structure was needed, even the heaviest stone slates were relatively common from the 16th century onwards, particularly where fissile stone could be sourced from delves (small quarries or delphs) which outcropped near the surface.

The Industrial Revolution vastly improved transport links. The advent of the canals and railways led to the rapid export of cheaper, lightweight Welsh slate and machine-made tiles around the country. This led to the closure of many stone quarries and reduced demand for handmade tiles.



Victorian terraced housing, London. As transport links with North Wales improved from the mid-19th century, Welsh slate found a ready market in new areas where the demand was growing rapidly for cheap materials for urban working- and middle-class housing.

ROOFING

GENERAL INTRODUCTION

HOW ROOFS WORK

A sound roof is essential for the protection of the building and its contents. It is the first defence against the weather, its primary function being to shed rainwater and snow, and to convey the runoff safely away from the building via weatherings and rainwater disposal systems. It must also deal with problems caused by internally generated moisture and wind-blown snow and rain which can occasionally enter a well-constructed roof. In addition, it must resist damage from other environmental factors, particularly wind, and the sunlight that causes thermal movements. The loading imposed on the roof coverings depends upon the direction of the wind, the topography of the surrounding area, the height and configuration of the roof, and turbulence, but the force can be considerable, particularly at the eaves, ridges and verges. Tiles are especially susceptible to wind damage.

Today, roofs must also satisfy modern demands, such as the expectation that it should not contribute to the spread of fire, should be an acoustic buffer and should reduce carbon dioxide emissions by minimising heat transfer out of or into a building. The latter is a requirement under the Building Regulations when a major renovation such as re-roofing is proposed. However, conservation principles still apply to any work, as does the requirement to ensure that energy efficiency measures do not have unintended consequences that could jeopardise the longevity or performance of the building. Most traditional buildings are built from permeable materials that are able to absorb moisture and release it freely by evaporation, both internally and externally; this is often described as the ability of the building to ‘breathe’. Provided the building is well maintained and adequately ventilated, the evaporation of moisture keeps dampness in the building fabric at levels where it will not cause decay or harm human health. Changes to this system that reduce airflow, such as the introduction of impermeable materials or components such as membranes, need to be handled carefully to avoid damage.

Thousands of historic buildings have survived for centuries despite changing weather patterns, dramatic storms and changes in the way buildings are used. If a roof eventually fails, water penetration will harm and may even destroy not just the finishes and internal decoration, but eventually the structure itself. Therefore, once a roof covering has deteriorated to the point where patch repairs are no longer economic, it will need to be replaced. **ENVIRONMENT BASICS**

The materials used for roof coverings are resistant to deterioration and decay if laid correctly, but regular inspection and maintenance of rainwater goods and occasional repair is nonetheless essential. These should all follow the usual principles of conservation: that is, be the minimum required to limit the rate of deterioration, be timely, and be carried out in a manner that does not harm the heritage values and significance of that building.

Many materials have been used for roofing in England and have given us diverse and beautiful roofscapes. But attractive as they are, their most important attribute is the ability to keep out water and, in this respect, size of the roofing unit – particularly width – is most significant. Size of the individual roofing materials and the way they overlap have most influenced how they have been used. The wider and longer the individual units, the fewer joints are needed and, on the whole, the lower the pitch of the roof can be.

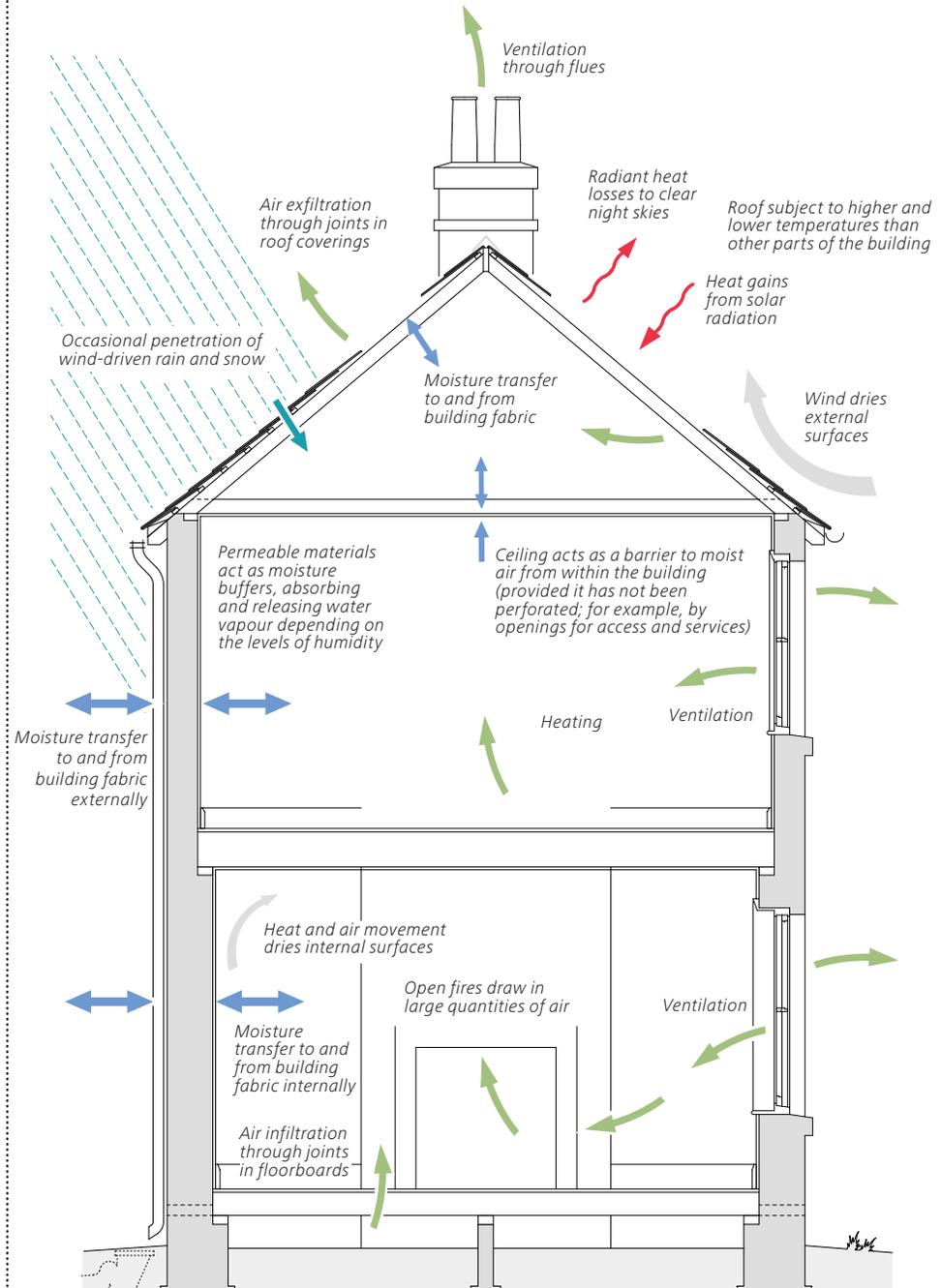
When first constructed, traditional solid-walled buildings tended to be well-ventilated. Heating and cooking by open-flued fires added tremendously to the ventilation rates. Consequently, moisture levels in the indoor air were often similar to those outside and building materials were air-dry. Roof spaces were often well-ventilated too (through gaps between slates and tiles), so although wind-blown rain and snow might occasionally enter, the moisture would soon evaporate.

During the 20th century, the situation changed substantially. Buildings became more airtight, open fires were replaced by stoves and central heating, and there was less emphasis on ventilation for health. Consequently, typical natural ventilation rates during the heating season may well have fallen from perhaps five or 10 air changes per hour to about one. In addition, more moisture was created internally by cooking, baths, showers, clothes washing and drying. The outcome has been a tendency for indoor moisture levels to increase. This in turn can lead to problems of condensation and decay in the roof, especially when insulation is also added. The consequences are discussed later in this chapter.

Traditional solid-wall construction also absorbs moisture (from rain, groundwater or human activity), and releases it both externally and internally. The internal evaporation is not taken account of in much modern guidance; and, consequently, ventilation rates recommended for modern buildings may not be sufficient for all traditional buildings.

AIR & MOISTURE MOVEMENT IN TRADITIONAL BUILDINGS

With simpler lifestyles and an absence of plumbing, less water vapour was generated internally, while ventilation rates would have been higher, particularly when fires were lit



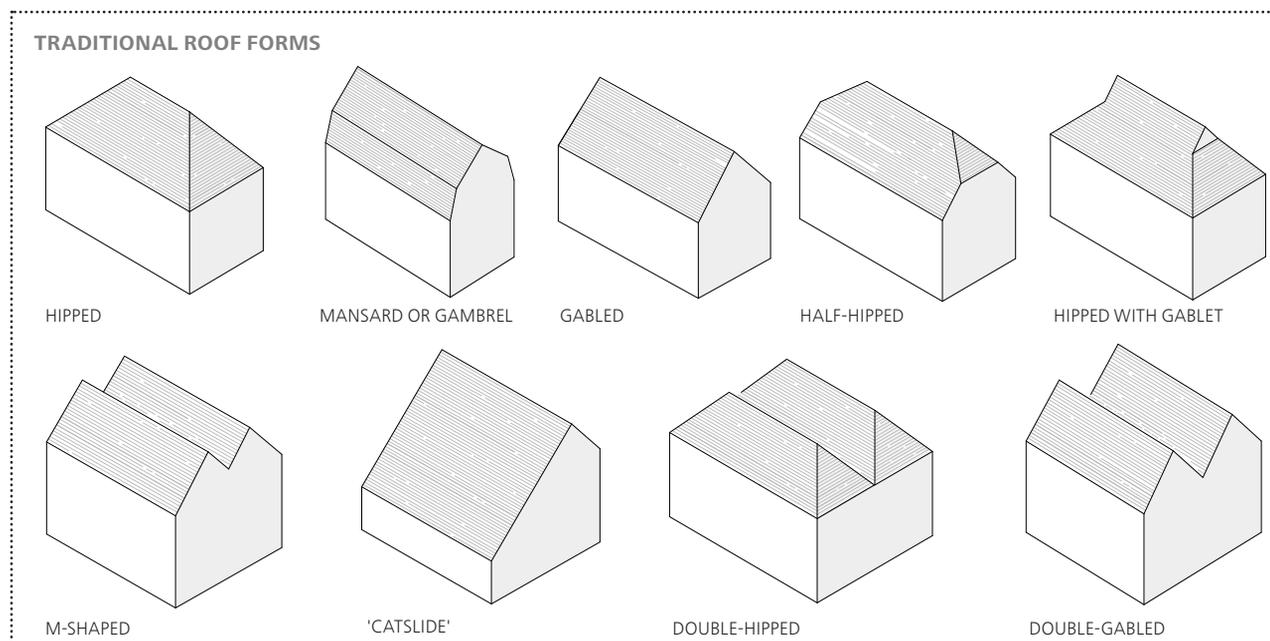
ROOFING

GENERAL INTRODUCTION

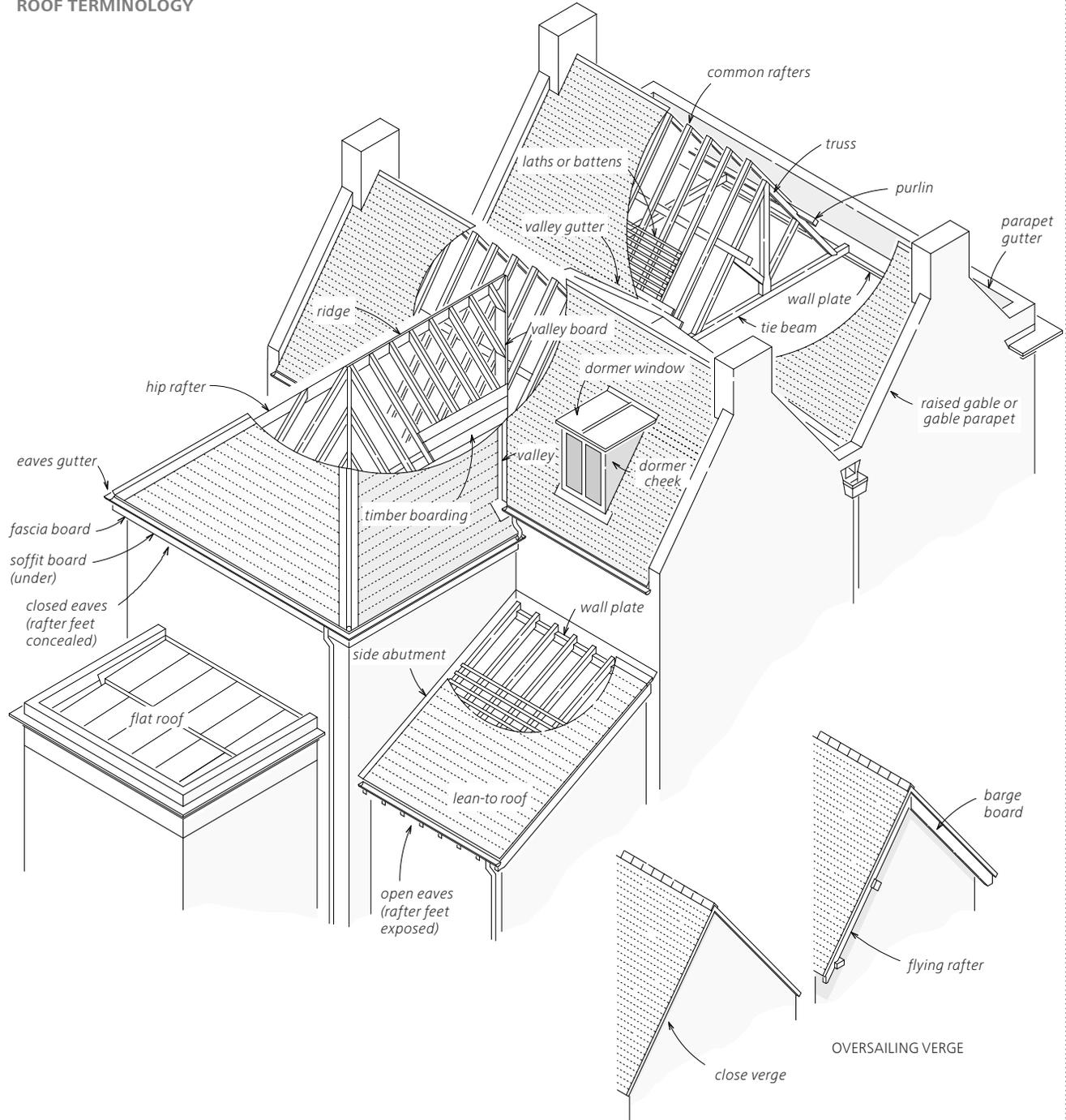
DESIGN OF TRADITIONAL ROOFS

Traditional roof designs evolved largely in response to local climatic conditions and the building materials and skills available, although they were also much influenced by local practice, regulations, wealth and fashion. Most roofs were pitched, as the objective was to shed water away from the structure as quickly as possible. The steeper the pitch, the more timber was needed to build the roof structure to span the space below. Most of the steepest pitched roofs in England survive in the east where, ironically, it is driest. Plentiful oak forests and a rich tradition in timber-framed building were significant reasons for this. In Devon and Cornwall, rainfall is much higher but there was a lack of good quality timber. Roof pitches are shallower, so local detailing has evolved to compensate. For example, west country straw-thatch was 'combed' to remove all the leaves and shoots, and fixed with all the butts pointing downwards to speed the passage of water from the roof. In many other parts of England, it was acceptable to use bruised straw, which retained much of the leaf and in which butts and ears of the straw were mixed up, because the steeper pitch of the roof compensated for reduced water-shedding properties of the material. West country slating also evolved to include detailing adapted to the local materials and climate. Slates were often very narrow, so, to prevent water ingress, they were triple-lapped. In more exposed locations, slates were also bedded in lime mortar to improve wind resistance and were often repaired by covering with a lime slurry coat; a temporary expedient that put off repairs but could eventually lead to the collapse of the roof.

Elsewhere, similar variations were apparent. In south Yorkshire, sandstone slates are laid at comparatively shallow pitches, as their size and laps are adequate to deal with the climate, but similar stone in Northumberland further north is pitched steeper because of the higher rainfall. Low pitches were only possible where the joints were protected from water ingress. Thus, pantiles had a particular advantage of being single-lapped and therefore imposed less loading, and only required a comparatively modest roof structure. True flat roofs (in practice, roofs with a very slight fall) were only possible with amorphous materials or continuously supported decking and a jointing system which sits above the area of water runoff.



ROOF TERMINOLOGY



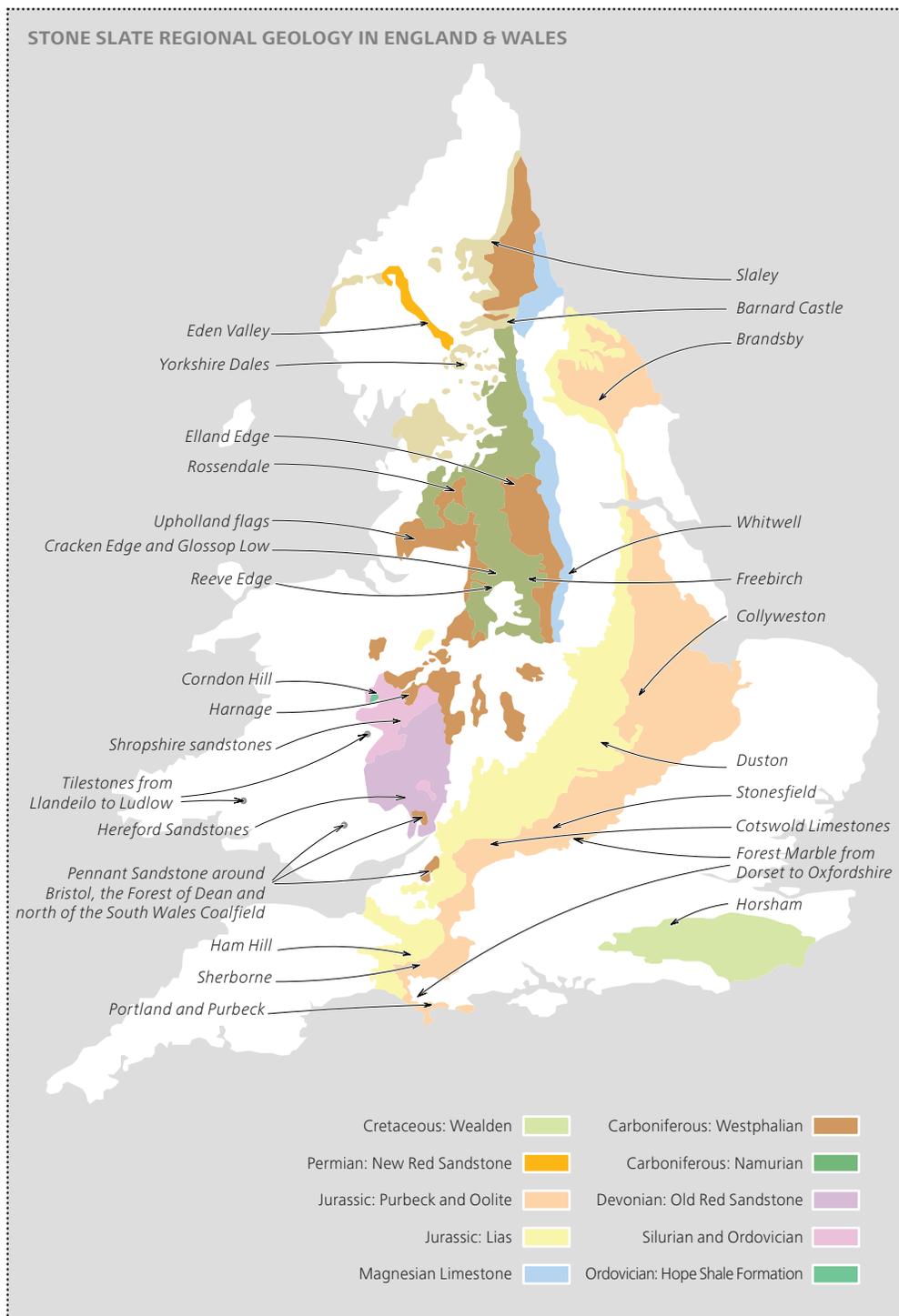
ROOFING

GENERAL INTRODUCTION

Stone slates were used wherever suitably fissile stone could be found. In England the few counties where there was no suitable rock are those roughly east of a line from Southampton to Scarborough, but excluding Sussex where Horsham stone is used. The table below lists the more important historical stone-slate sources. Some of the stones listed supplied a small and very local market compared to metamorphic slate. Shales and schists were used on a very limited scale, and there are none produced today. Present-day sources of stone slates are small operations, which tend to come and go as the rock becomes worked out. The list of **Further Reading** at the end of this chapter gives details of where to find information on current producers.

SOURCES OF STONE SLATES USED IN ENGLAND	
REGION OF USE	GEOLOGICAL SOURCES
Dorset and Somerset	Purbeck Limestone, Forest Marble, Upper & Lower Lias Limestone
Wiltshire, Gloucestershire, Oxfordshire	Purbeck, Corallian, Forest Marble, Hampen Marly Beds, Taynton and Trougham tilestones, Stonesfield Slate, Chipping Norton Limestone, Lower Fullers Earth Rock, Inferior Oolite, Marlstone
Northamptonshire, Rutland, Lincolnshire	Blisworth Limestone, Rutland Formation, Collyweston Slate, Duston stone (Northampton Sand Formation)
Surrey, Sussex, Kent	Horsham Stone, Charlwood Stone
Gloucestershire, Bristol region, South Wales	Pennant Sandstone, Tilestones (Murchison), Old Red Sandstone, Lower Lias Limestone
Welsh Marches including Gloucestershire, Herefordshire, Worcestershire, Shropshire	Old Red Sandstone, Tilestones (Murchison), Cheney Longville Flags, alternata limestone, Chatwall Sandstone, Harnage slates (Hoar Edge Grit), Grinshill Flagstones, Hope Shale (Corndon Hill)
Staffordshire, Cheshire, Derbyshire, Lancashire, Yorkshire, County Durham, Northumberland	Carboniferous Millstone Grit and Coal Measures sandstones
East Derbyshire, Nottinghamshire	Magnesian Limestone
North Yorkshire	Carboniferous Millstone Grit and Coal Measures sandstones, Jurassic limestones, Brandsby & Boltby slates
Cumbria	Carboniferous Millstone Grit and Coal Measures sandstones, Permian (New Red) Sandstone

Geological formations important for stone slates in England and Wales, and some historic locations of production and use.



ROOFING

ROOF COVERINGS: SLATES & STONE SLATES



REPAIR

GUIDANCE

The main source of technical advice for slating is *BS 5534:2003 Code of practice for slating and tiling*. This deals thoroughly with tally-slate roofing, but random slating is not covered in any detail, and there is no advice specifically for stone roofing. As with all British Standards, the guidance is conservative and consequently may be at variance with the construction of an existing historic roof. In most cases this will be obvious: for example, there may be an absence of an underlay. Where there are differences, the first question to ask is whether changing existing details to conform to modern practice would confer significant technical advantage. If the answer to that is 'no', then any change that significantly alters the historic integrity or the character of the roof is unlikely to be justified.

The latest edition of *BS 5534* should always be checked in relation to head/side laps, to confirm that slate manufacturers' and importers' guidance is accurate, up-to-date and appropriate for the specific roof and its environment.

In the case of stone slate or random slate roofs, it will usually be wise to seek the advice of an expert to decide whether adopting modern practices would provide significant benefits. On the whole, if traditional techniques have performed well, then these should be replicated in repair.

LOCALISED REPAIR

Slate and stone-slate roofs can be maintained for a long time by regularly inspecting them and carrying out minor works such as replacing slipped slates. Top-fixed slates can be swung to one side (although torching may make this difficult) to allow access for re-fixing slipped slates, and any displaced torching renewed if it is accessible.

If the slates are tightly head-nailed there is a risk that the heads will break as the slates are swung aside, so a slate ripper should be used to pull out or cut the nail. Replacement slates can then be fixed with tingles or hidden fixings. Tingles are often made of lead strips nailed to the batten and folded up over the tail of the slate, but they are liable to become unrolled by heating and cooling or by the weight of snow. Allowing an extra length of lead and folding it back down onto the slate below can help, but it is better to use a substantial copper strip – about 1 or 2 mm-thick – which is not so prone to this problem. A variety of hidden fixings are available.

Re-fixing with lead tingles is not suitable for large or heavy slates. Substantial copper strip is better, but the best option may be a strong non-corroding wire hooked under the tail of the slate. If the underside is accessible, similar wire can also be used to re-fix individual slates by tying them to the battens.

Collyweston slates being re-laid to form a laced valley, at Apethorpe Hall, Northamptonshire.

Moulding a Tile by Hand

These pictures were taken at the Bulmer Brick & Tile Co on the Essex-Suffolk border. The processes and their names vary from region to region.

1. The tile-maker works at a bench, with prepared clay in a heap to one side, and the mould in front. The mould comprises a wooden base or stock, which is fixed to the bench, and a loose wooden frame placed over it. The frame is slightly larger than the required size of the tile, to allow for shrinkage. Fine sand is lightly sprinkled into the mould to help release the finished tile and provide a textured appearance (the face of the tile is on the underside). A handful of stiff clay is taken from the pile and rolled into a 'warp' (also known as a wedge, clod or clop).

2. The clay is thrown into the mould.

3. The clay is compressed into the corners of the frame. Although this work looks straightforward, it has resulted in many tilers suffering from repetitive strain injury, which is a principal reason why many of these operations are now mechanised.

4, 5. Excess clay is cut or struck off with a bow and the surplus lifted off.

6. A steel or wet timber strike is used to give the underside of the tile a smooth finish.



7. Sand is evenly thrown across the tile to ensure that the tiles do not stick together when stacked.

8. The frame is lifted away from the stock.

9. For peg tiles, a stick or a metal spike is used to make the holes. Historically, pegs were usually tapered, but they varied in shape and size from square to round, and were anything from 6-mm to 16-mm wide. Behind the tiler is the bearing-off barrow, which is used to wheel the wet tiles to the drying sheds.

10. The soft tiles are transferred to a wooden pallet to dry to a 'green' state so that they can then be stacked. Stacking the green tiles must be done with great care. Nibbed tiles must be placed alternately so as not to damage the nib. The top tile in the stack dries first, and as shrinkage takes place the tile will try to bend, giving it a natural camber. It is then taken off to expose the next tile, so that too developed a camber.

11. Some clays shrink on drying by up to 12%. When they are leather-hard they are placed on a curved board and beaten to give each tile the correct camber, so that on the roof they fit edge-to-edge to avoid capillary draw. Other tile-makers place their 'leather hard' tiles onto long, slatted cambered-shaped racks so that they adopt that shape. Pating to shape is then normally confined to hips and ridges placed over a wooden horse. Gault clays only shrink by 10% and are not normally beaten.

12. The tiles are stacked on their ends to continue drying. When dry, they are fired in a kiln to vitrify the clay, and permanently fix their shape and size.



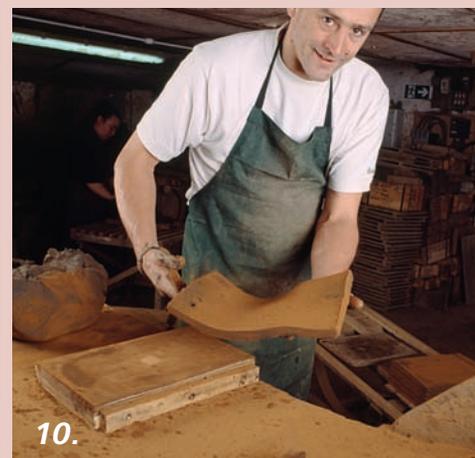
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ROOFING

ROOF COVERINGS: CLAY PLAIN TILES

JOINTS

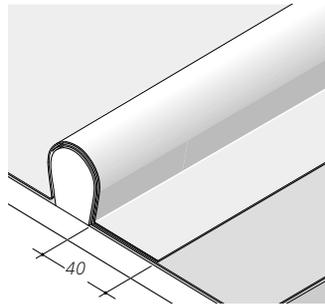
A variety of different systems have been used at joints on lead roofs. Laps were traditional, although drips are much more common today. For most vertical joints, hollow rolls were used exclusively on gentle pitches until the beginning of the 20th century and standing seams were used on very steep pitches. Both have performed well. Wood-cored rolls were introduced in the late 19th century for a number of reasons, including the suggestion that they allowed the non-specialist plumber to lay lead roofs.

Roofs with hollow rolls may have survived so well because of the fixing methods used. Widely spaced copper clips within hollow-roll joints on both sides of the sheet ensure an even distribution of stresses, and no holes are made through the lead. By contrast, the undercloak to a wood-cored roll was traditionally nailed along its length before being covered by the overcloak, which would have been simply dressed down on the other side. This type of over-fixing could restrict thermal movement, and result in fatigue cracks or thermal ripples in the lead sheet across the roofing bays.

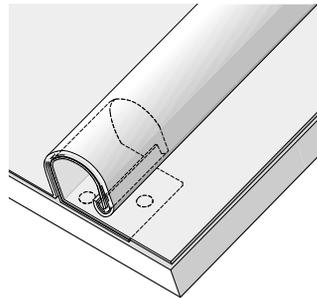
Another factor that affects the life of wood-cored roll joints is the amount of bossing used to form the joints. If done excessively particularly at roll ends (nosings), it can thin the lead sheet, resulting in premature fatigue cracking. However, hollow rolls on some roofs have also been known to crack at the point where they were turned down at the roof edge, both along and across the roll, which may be due to the size of the hollow roll that was formed.

TYPES OF LEAD JOINTS

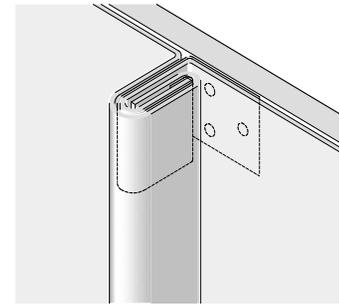
WOOD-CORED ROLL



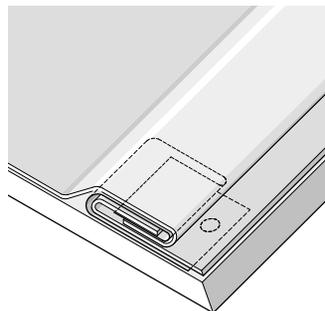
HOLLOW ROLL



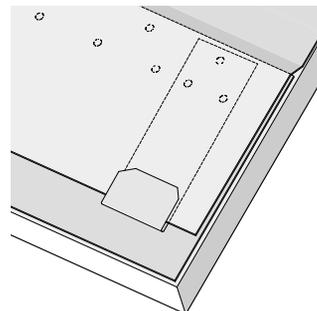
STANDING SEAM



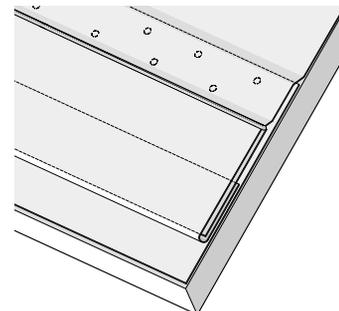
WELT



LAP WITH CLIPS ON FREE EDGE



LAP WITH CONTINUOUS WELDED CLIP



For vertical joints in lead sheets, hollow or wood-cored rolls, standing seams or welts can be used. For joints across the fall, laps or drips are used. Cross welts are not used for horizontal joints in lead.

Medieval oak boards on the north nave triforium roof, Salisbury Cathedral, Wiltshire.

At Salisbury Cathedral, the north nave triforium is 200-m long, and extends from the west front to the tower crossing. Beneath the lead are oak boards measuring 12–20-mm thick and 100–150-mm wide. Most of the roofs of the cathedral were rebuilt during the mid-18th century, and although the north nave triforium roof was only subject to minor repairs, it was assumed that most of the boards had been replaced at that time. However, when re-leading was being undertaken in 2003–5, tree-ring dating (dendrochronology) confirmed that the oak for the boards was felled in 1251–52, and therefore they dated from the original construction in the mid-13th century. Their survival for over 750 years suggests that boarding on other buildings may be considerably older than the lead they support. In the case of medieval buildings that were re-roofed in the 18th or 19th century, it should not be assumed that original boards were replaced at the same time. The medieval boards at Salisbury were over-boarded with new softwood boarding, laid diagonally, to support the lead, during the repairs of 2003–5.



DECKING

Hardwoods, especially oak, were used on older or more important buildings, or those where the decking forms the ceiling of the room below. The most popular deck for lead roofs has been softwood boarding, especially since the 16th century when it was increasingly imported from the Baltic and Scandinavia. This timber was often very slow-grown Scots pine (*Pinus sylvestris*), which has proved to be remarkably effective under the lead and contributed to its longevity. The boarding readily absorbs moisture which then evaporates in warmer conditions, effectively buffering the lead from possible outbreaks of underside corrosion caused by leaks from on top, or excessive moisture coming from below.

UNDERLAYS

Underlays were rare before the late Victorian period. Inodorous felts and reinforced papers were introduced on flatter pitches to provide a slip-layer, allowing the sheets to expand and contract freely, and overcome problems caused by uneven decking or projecting fixings.

A variety of materials have been used throughout the 20th century, including impermeable underlays with bituminous surfaces, vapour-control layers, geotextiles and fleeces, all of which were designed to deal with particular conditions.

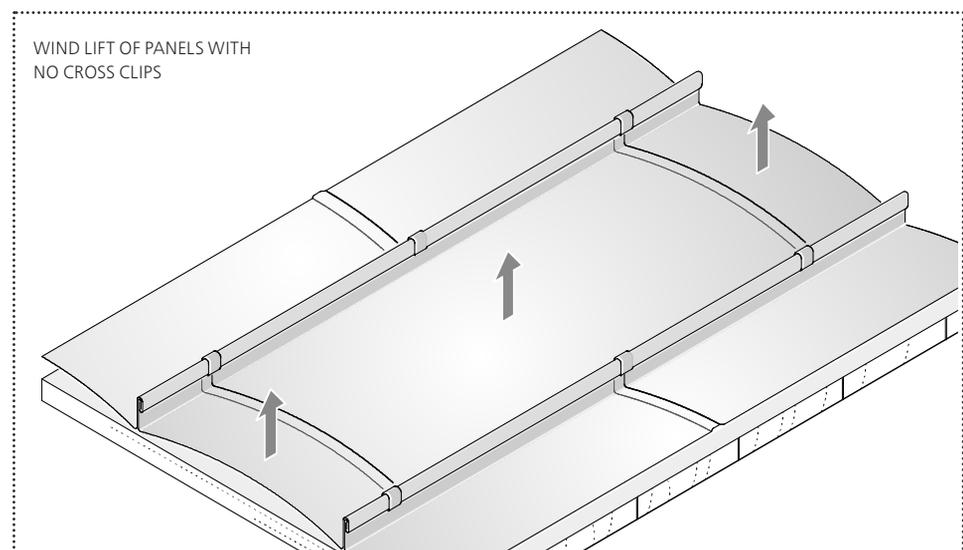
MECHANICAL DAMAGE

Wind damage is a major cause of failure. Strong winds can produce highly variable air pressure across a roof. Where turbulence creates negative pressure above part of a copper roof, the internal pressure may force a copper sheet off the roof. This exposes adjacent sheets to the wind which may lift them from beneath, so once one sheet is removed, adjacent sheets frequently follow. Wind can also initiate vibration of the copper on the substrate, which causes a loud drumming noise within the building.

Copper can also suffer damage as a result of flexing due to wind loading or thermal movement. When copper sheet is deformed it undergoes changes to its crystal structure, known as 'work hardening'. Repeated movement makes it very brittle and can eventually lead to cracking. 'Star cracking' is a characteristic failing in copper sheet, caused by repeated flexing of a sheet due to wind or thermal movement, and is normally confined to localised areas, usually the verge, ridge or eaves. Failure to repair star cracks results in their enlargement, and the risk of water ingress into the roof and wind damage. Long sheets of copper may buckle due to thermal movement if they are too long, and this can also eventually lead to cracking.

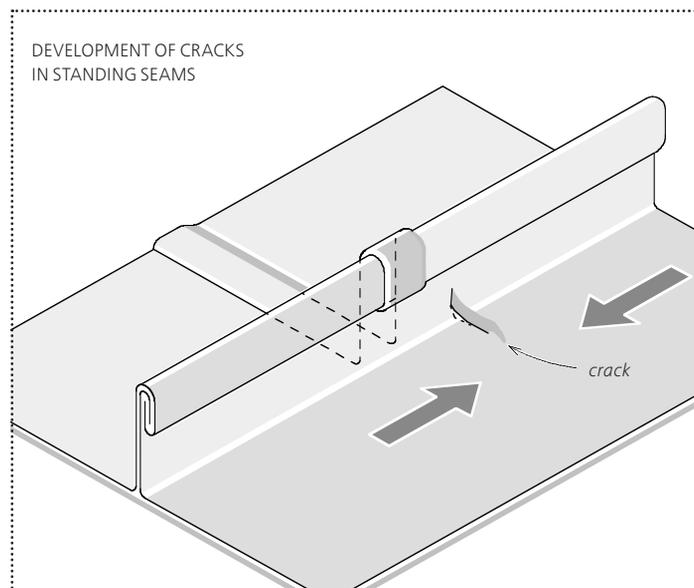
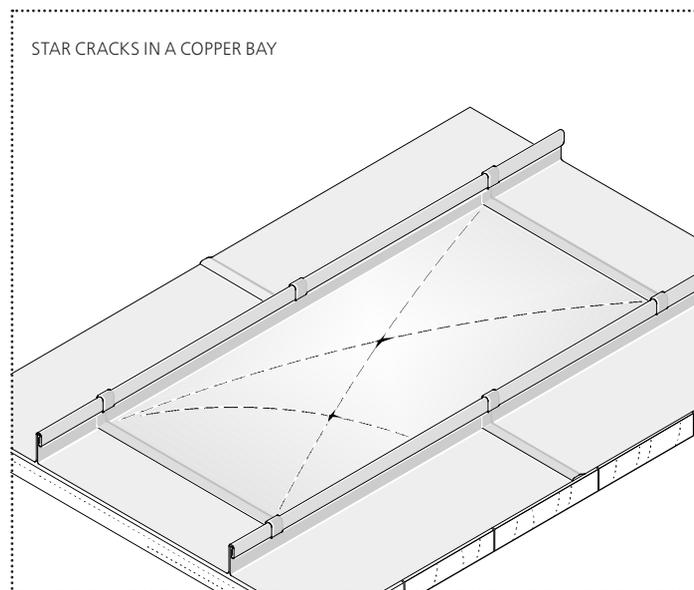
Work hardening of copper also occurs due to folding the sheet to form seams and joints. Work-hardened joints are more susceptible to cracking due to thermal or wind movement, especially as the copper ages. Cracking of welts and seams due to age hardening, especially when three or more sheets are folded together, is also a major cause of failure. Annealing (heating) copper relieves this inherent stress, and is usually required to avoid cracking when seams or joints are opened up.

Copper roofs are also susceptible to mechanical damage caused by tools or scaffolding being dropped on them, or by people walking across them and squashing the standing seams.



Wind damage to standing-seam copper panels

Wind lift can cause drumming of the sheet on the substrate, and can create stress in the copper that may lead to the formation of cracks.



Top: Wind loading or thermal stress can cause a rectangular copper sheet, which is securely fixed at the edge to flex along the lines of folds which tend to be diagonal. Where the lines cross, additional stresses result in the star crack.

Bottom: Cracks in a standing seam. Where a number of copper sheets have been folded over to form a seam, the area is subject to work hardening. The sheets are restrained by copper clips fixed to the decking and may not have room to expand laterally when subject to solar heating. This can create stress in the joint, eventually resulting in cracking. It is fairly normal to find this sort of problem on roofs over about 70 years old.

FIXINGS

For fixing copper sheet direct to the substrate, the traditional method of copper nails is still recommended. Stainless-steel nails and brass screws are also used today, as neither suffers from galvanic corrosion with the copper sheet. Stainless-steel clips are also used between copper roofing details and the substrate to enable expansion and contraction to freely occur.

DETAILING

On most historic buildings, traditional sheet sizes, joints and detailing should be replicated. Unless there was an inherent fault in the design that contributed to deterioration, traditional copper roofing should not be replaced with the long-strip system.

Left: Traditionally, copper sheet was dressed by hand to form the seams, but nowadays the edges of the sheets are often pre-formed in the workshop using a profiling machine. However, for complicated shapes the seams must be hand-formed on site.

Right: For traditional copper roofing, the seams must be finished by hand, as, in most cases, they need to accommodate the cross welts. For long-strip copper roofing, which does not have cross welts, an on-site seaming machine can complete the joint.



Standards & Advice

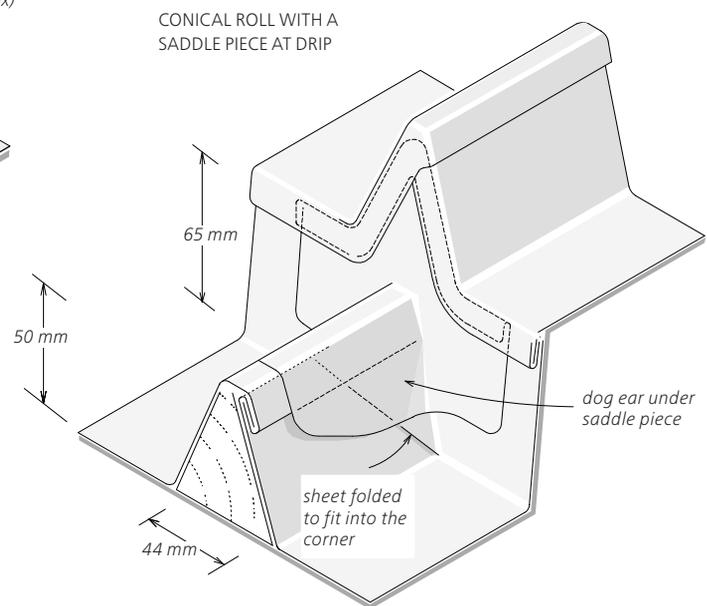
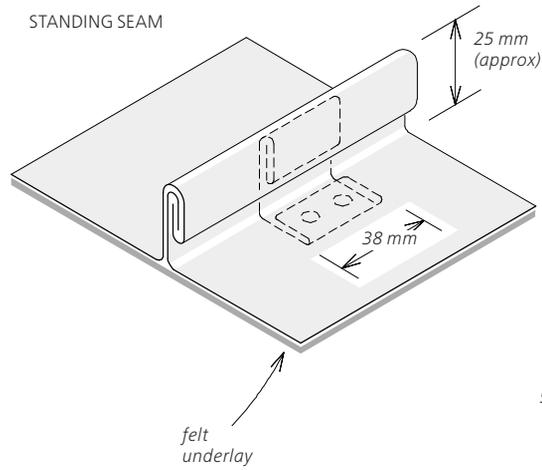
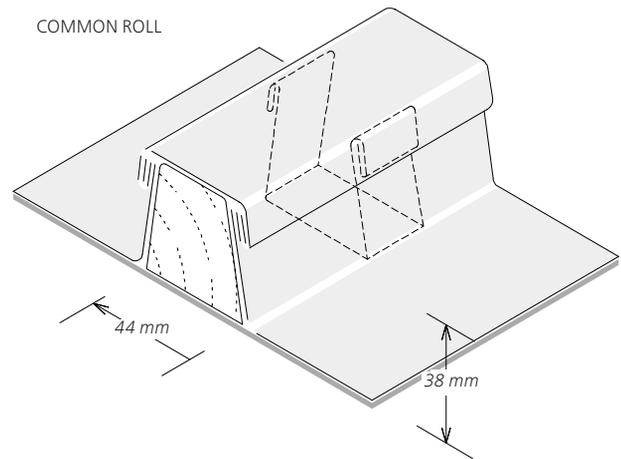
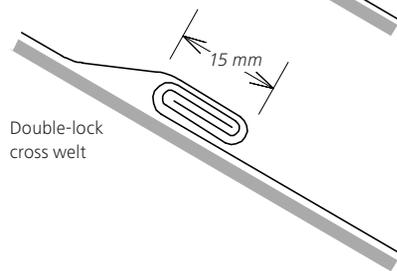
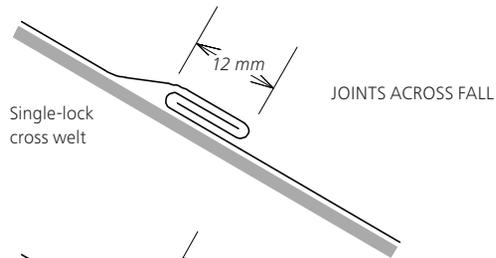
MODERN COPPER ROOFS

Modern strip and sheet has a copper content of 99.9 %, but in past centuries it may have been much less pure. The oxygen-free C106 modern roofing metal gives typical lifetimes of 80 to 120 years. For traditional roofs, the softer (quarter-hard) fully annealed C104-106 (with a hardness of 45-60 VPN) is used, and for modern long-strip roofs a harder (half-hard) C101 or C102 grade (with a hardness of 95 to 105 VPN) is used. It is difficult to form quarter-hard copper in a machine. Copper for roofing is governed by *BS EN 1172:2011. Copper and copper alloys. Sheet and strip for building purposes.*

FITTINGS & FIXINGS

Existing copper clips and continuous fixing strips should not be re-used as they will have been subject to age-hardening. Replacement fittings should be made to the sizes recommended by the British Standard, and all nails and screws should also be new and to the approved type. Fittings and fixings are governed by *CP 143-12:1970 Code of practice for sheet roof and wall coverings. Copper.*

TRADITIONAL JOINT SYSTEMS FOR COPPER



ASSESSMENT

Before beginning any treatment or repair, it is important to inspect and evaluate the current condition of the corrugated cover and the supporting structure, and to assess how effectively the roof has performed to date. Particular attention needs to be given to individual components, especially those in vulnerable areas such as connections, bolts, rivets and so on. There are some useful extra steps that should be followed to look for corrosion.

Since good records of corrugated-iron and steel roofs are comparatively rare, it is very useful to identify all the components and their condition, and the sequence of the original assembly.

MATERIAL IDENTIFICATION

As previously described, the generic term ‘corrugated iron’ includes both wrought iron and mild (carbon) steel, together with many different types of metallic or polymer-coated steel roofs. If identification is needed, then sampling should take place in an area where it will not damage the function of the roof; for example, in the undercloak of a corrugation or in an area of already damaged sheet. Samples should then be sent to an appropriate laboratory (a metals laboratory for the substrate or a polymer laboratory for the coating). The nature of the coating will also be extremely important.

WHAT TO LOOK FOR WHEN INSPECTING IRON & STEEL ROOFS

	DESCRIPTION & CAUSE	LIKELY OUTCOME
	<p>DISCOLOURATION OF COATING Exposure to ultraviolet light and/or poor-quality coating</p>	<p>Coating will eventually fail, allowing corrosion to start</p>

WHAT TO LOOK FOR WHEN INSPECTING IRON & STEEL ROOFS

	DESCRIPTION & CAUSE	LIKELY OUTCOME
	<p>RED COLOURATION ON SHEET SURFACES</p> <p>Deterioration of polymer or zinc coating, and corrosion of ferrous substrate</p>	<p>Need to clean up and repair coating or replace sheets, depending upon availability</p>
	<p>HOLES PENETRATING THE SHEETS</p> <p>Widespread corrosion due to total failure of the coating</p>	<p>If damage is localised, patch repair may be possible</p> <p>If damage is more extensive, replacement of sheets may be the only option</p>

ROOFING

ROOF COVERINGS: IRON & STEEL

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