

TECHNICAL NOTE No. 43

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Roofs

Historical Note

The roof has been an essential element of every habitable building since building began. It is also one of the largest and therefore one of the most costly elements. In all but the most prestigious of buildings, the materials used have been those most easily obtained locally. This principle has only been superseded since the development of modern transport. The available materials locally were thatch, timber shingles and split slate or stone; clay tiles have been made locally but never on a large scale and so the number of tiled buildings in Northern Ireland is small. All these traditional materials require a pitch to be water-proof and so, except where an owner has been wealthy enough to afford large areas of lead, all roofs until the recent advent of manufactured sheet materials have been always been pitched, with lead used to waterproof junctions and other difficult areas.

The supporting roof structures are generally timber although there are some 19th century examples of cast-iron. From the period of the Plantation onwards native timber became more and more scarce. The size of scantlings reduces until legislation and constructional handbooks codified and standardised timber sizes. The simplest of roofs were the trunks and larger limbs of trees spanning as purlins between supporting cross walls with the lighter members set at right angles to support the roof covering. The fixing of slates required more accuracy than thatch and so sawn timbers had to be used, with battens. Early slates were held by a wooden peg, usually oak, which was simply lodged over the batten. The weight of subsequent slate courses kept each slate in place and the complete roof would be finally wind and weather proofed by plastering (torching) the joints on the inside (also known as parging). Later the general availability of nails led to the use of sarking (boarding) as a bed for the slates. In this way slating material of a variety of sizes could be used together without the problems of gauging and setting the individual battens.

Until the latter end of the 18th century, nails were individually forged from iron which made them relatively expensive. The next development was to cut, shear or cast nails and in modern times the steel wire nail has become almost universal. However, steel nails even when they are protected by a coating of zinc (galvanised) have a much shorter life than the slates which they secure. During the 19th century wrought or cast-iron nails were used, today these are not available and the British Standard lists copper, aluminium or silicon-bronze as being the best choice for a lasting job. Environment and Heritage Service will not accept steel nails for grant-aided repairs.

The general availability of iron in the form of nails, belts and straps also revolutionised timber roof frames. The joining of timbers was simplified and pegs were completely replaced by the new material. There are rare surviving examples of pegged roof construction and these are of the greatest historical interest and importance. For this

reason they should always be repaired rather than replaced by a modern frame. Some late 19th century slating is decorative with banding of different colours and the tails of the slates are sometimes cut to form a pattern.

Raised gables are a strong characteristic of many Ulster roofs. It has the practical advantage of giving the verge of the roof protection against high winds. This is especially valuable in conjunction with thatch or pegged slates. It was developed as a decorative feature and used widely into the early years of the 19th century.

Eaves details in buildings of masonry construction were usually corbelled; here the last course at the head of the wall is set slightly forward of the main wall face to protect the end of the rafters and to give a bed for the tail for the first course of slates (see note 7). Alternatively the wall was carried up to form a parapet containing a secret gutter behind it. Variations from these two forms made their appearance during the Regency Period when deep over-hangs became the fashion and were sometimes beautifully decorated with fretted and carved wooded fascias. The utilitarian boxed-eaves and verges of modern standard construction are not suitable substitutes and can very badly disfigure older buildings. The ridge is also a characteristic detail. Dressed stone of lead rolls and sometimes cast-iron were used until standard earthenware products became generally available. In the late 19th century decorative crestings became the fashion.

Faults and Repair

Neglect of a faulty roof will quickly lead to damage in every other building element.

(a) Thatch (see also technical note 6):

Faults – the first signs of failure are normally at the junction to chimneys and gables and along ridges. If not attended to, these faults will gradually get worse often aggravated by birds and vermin.

Symptoms – the early stages are identified from outside; leaks follow with water running down the inner face of the nearest walls often discoloured with material from the scraws which underlie the thatch.

Repair – inspect the roof every year and stitch in new material where faults are beginning to show. With regular maintenance a full topping out may only be necessary twice in a generation. After many such toppings the thatch will get too heavy for the supporting timbers. It will then be necessary to strip back to the scraws and rethatch. If the surface of the thatch is changed the relation to chimneys and protective gables must be checked. Periodically it will be necessary to raise both to provide a weather-proof junction.

(b) Slates and Tiles

Faults – most common is the failure of the nails securing the slates to the battens.

Pegged slates are now very rare. Failure in such roofs often takes the form of large sections of the roof slipping in one mass with slates, battens and torching all moving together. Roofs built without the use of felt sarking, are well ventilated so that while the damp is kept out, decay in the timbers is unusual. Frost will sometimes break up the surface of slates and tiles especially where there are accumulations of mosses and lichens which hold the water. Water will enter roofs because of the failure of flaunchings and flashings. This is discussed together with the problems of flat roofs.

Symptoms – slipped slates will not always let in water at first. If they fall clear of the roof they will be obvious enough but they may simply lodge in the guttering or behind

chimneys. Regular inspections of older roofs are therefore important. If damp patches are apparent inside they are not necessarily an indication of where the roof failure is located. Water can travel considerable distances before it is seen. Because any water that gets in will run down the inner slope of the framework it is the rafter feet and the wall plate that are most vulnerable to resulting decay.

Repair - individual slipped slates can be pinned up but if this problem becomes a regular occurrence the only satisfactory repair is to strip and reslate. On a building of historic importance as much of the original material as is possible should be reused. The builder must be told that this is the intention right from the start so that careful stripping and storage can be organised. Before reslating the timber frame must be checked for decay and affected members replaced. The aim should be repair by splicing in new timber not complete replacement. Modern timber is much less durable than historic timber.

If new timber is to be used, it is advisable to choose material that has been chemically treated against decay. The supplier can provide a certificate confirming that the treatment meets the British Standard. Additional sarking with modern roofing felt is a wise precaution. The slating battens will almost certainly need to be renewed and should also be pre-treated against decay. To give reasonable life expectancy to the new roof the British Standard recommendation in the choice of slating nails must be followed, ie, use aluminium, copper or silicon-bronze nails not the zinc plated steel nails which most builders will use if not instructed to the contrary. All metal flashings and their supporting structures should also be checked and replaced where decayed. A new roof will not be ventilated in the same way as the old now that sarking felt has been fitted and so it may be necessary to ventilate the roof spaces by other means; for example, by using ventilators on the ridge or by breaking into disused chimney flues the accumulation of stagnant pockets of humid warm air can be avoided and prevent new outbreaks of fungal attack.

There are countless proprietary dressings being advertised to waterproof decaying slate and tiled roofs. Most have a very short life expectancy and render the slates unfit for reuse when eventually stripping is the only option left. They are therefore never recommended by the Department for use on historic buildings.

(c) Lead, Copper and Zinc:

Faults – most failures are for the following reasons:

1. the sheet has been punctured perhaps by a falling slate;
2. corrosion by acids either from atmospheric pollution (this may be locally generated from a chimney on the building itself) or from organic growths;
3. crystallisation (sometimes called metal fatigue) caused by the poor design of fixings or the location and form of joints;
4. failure of the supporting structure.

Symptoms – in all cases water will get into the building. The place where it shows inside is not a reliable indication of the location of the failure. Inspection of the roof covering will reveal the reason:

1. the failure will usually be an obvious gash;
2. the surface will be powdering and discoloured; if a finger is run across the surface an

uneven ridged texture will be apparent. It is quite possible that no holes will be observed.

3. the surface will be cracked and the sheet may have puckered into a ridge;

4. there will be apparent ponding away from outlets.

Repair –

1. replacement sections can be welded over the gash;

2. the affected area will have to be taken up and replaced. Organic growth can often be prevented by fitting copper strips higher up the roof which will cause a toxic wash. If this is not possible then sacrificial flashings must be fitted; these are additional flashings which will take the full force of the destructive run-off and protect the main flashing below;

3. The affected section must be taken up and the area redesigned to prevent a similar build up of stresses in the future;

4. The affected section must be taken up and the supporting structure repaired; it may be possible to reuse the old metal sheeting.

5. Consideration should be given to providing overflow pipes if problems have resulted from blocking up of down-pipe exits at parapets.

In all repairs do not use solder. It is not a long-term repair and welding is much more reliable. Have regard to the health and safety implications of the material and its use. Do not reduce the thickness (code) of the sheets unless the frequency of joints is altered to meet the changed thermal movement.

The metal sheet must be free to allow movement. This is facilitated by fitting an isolating membrane. The material used must remain stable and not become sticky in the very high temperatures which build up under the metal sheeting.

It may be decided to replace lead with a modern synthetic sheeting. If this is the case bear in mind that the rest of the roof if in good repair is likely to have a trouble free life span up to 100 years, and so the choice of synthetic sheet should be from those products which have been given independent ageing tests (Agrément Board or similar) and found to have an expected life of at least 20 to 25 years. It is wasteful to use materials like mineral felt which will have to be replaced long before the other adjoining roofing material so causing needless disruption of sound slates, nails and battens. Environment and Heritage Service discourages this course of action.

It is advisable to check the condition of any roof once a year. The inspection could be made to coincide with regular clearing out of the rainwater drainage system. After any roof repair the rainwater system should always be checked to ensure that it has not been blocked with rubbish from the works.

Notes of the Preparation of Contract Specifications

(a) Preparation and Stripping

Areas to be worked on should be identified – a location drawing may be useful both for identification and record purposes.

Stripping – if slates are to be stripped carefully and kept for reuse this must be clearly stated and a place for storage identified.

Condition of timbers – in many roofs it is impossible to be sure of the extent of decay in timbers until the roof covering is stripped. When this stage is reached the consultant or owner should inspect the stripped work and decide in detail what is to be done.

(b) Reconstruction

Straw for thatch – if the thatcher is not providing a complete service, it may be necessary to find straw in advance and buy it in. If the owner is providing materials this should be specified, as should any required attendance by a builder, eg, for transport or scaffolding.

Slating – any requirement to reuse existing slates or to buy in new or second-hand materials must all be specified. The delivery period for the supply of new slates can be considerable; in such cases advance purchase may be advisable. Any size grading in the new work must be specified. The choices are to place all of one size on each slope or to grade them on every slope from the smallest at the ridge to the largest at the eaves. The decision can depend on the location of the building and whether it stands on its own or is in a group or terrace where matching with its neighbours is important. State if the roof is to be sarked with felt or close boarding or be torched with plaster. The details at gable, eaves and ridge must all be drawn or described in words because the modern equivalents which many buildings may use, if not otherwise directed, will seriously erode the historic authenticity of the building.

This description should include, where required, the colouring of mortar for setting the ridge so as to tone in with slates. Methods to be used for the ventilation and insulation of roof cavities should be included. Describe the slating nails, the size of battens, the type of preservative treatment and the methods to be employed for repairing structural members. Indicate when the builder must contact the consultant or owner for a decision and when he can use his own discretion.

Flashings and flats – if a modern synthetic material is to be used make sure that the manufacturer's advisory literature is available to the operatives on site. The documents referred to should be named in the specification. Where metal is used – the gauge of the sheet; the type of the joints, both mechanical and physical (eg, standing seam and lead weld); the method of fixing; supporting structures; isolating membranes; the minimum fall; the choice of sacrificial flashings or copper strips as protection against acid attack – must all be described. If there are any design failures in the old roof or the form is to be remodelled for practical reasons then a drawing will be necessary. Include a requirement that when the work is finally complete a check is made to ensure that the rainwater discharge system is working and not choked with debris.

Technical References

British Standards

BS 5534-1:1997 – Slating and Tiling

BSCP 143 – Lead, Zinc and Copper

PREN 1995-1-1 Eurocode 5. Design of Timber Structures

BS 5268-2:2002 Structural use of timber

BS 5268-4.1:1978 – Chemical Treatment and Fire Protection of Timber

BS 5250:2002 – Control of Condensation

DOE Advisory Leaflet
No 42 – Woodworm
No 46 – Leadburning

Lead Sheet Association – Lead Sheet in Buildings, Volumes 1-3
NB: The Lead Development Association provides an advisory service at a small cost which will give technical advice on specific problems. They also provide very good explanations of current best practice in their publication series.

Period Houses, A Conservation Guidance Manual. Dublin Civic Trust 2001.
Chapter 8 Roofs and Roof Coverings.

Advisory Organisations:

Copper Development Association – www.cda.org.uk Tel: 014422275700

Lead Development Association – 34 Berkeley Square, London, W1X 6AJ Tel:
02074996636

Zinc Information Centre – 56 Victoria Road, Sutton Coalfield West Midlands B72 1SY
Tel: 01213621201

Timber Research and Development Association – Stocking Lane, Hughenden Valley,
High
Wycombe, Buckinghamshire, BP14 4NP

Rubber and Plastics Research Association – Shawbury, Shrewsbury, Shropshire, SY4
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