

DEPARTMENT OF SCIENTIFIC AND INDUSTRIAL RESEARCH
BUILDING RESEARCH STATION

NOTE NO. IC 17 (1964)

REPORT OF AN INVESTIGATION OF THE RILEY SYSTEM
OF ROOF SLATING

SUMMARY

The Riley system of roof slating is an adaptation of an old method and has been designed to make use of small size slates. A greater area of each slate is exposed, thus reducing the number of slates required per square.

Some idea of the behaviour of the system in excluding rain has been obtained by the inspection of the roofs of two buildings in Anglesey, these being the only roofs on which this system has been used to date. Experience of the system is therefore somewhat limited.

The use of the Riley system for simple roofs should be satisfactory subject to the following conditions:

- (i) The rafters must be accurately spaced and covered with a good quality durable underlay.
- (ii) The slates must be cut to close tolerances and the holes correctly positioned.
- (iii) A minimum lap of 4 in. should be provided for the main slates.
- (iv) A high standard of workmanship and supervision is necessary.

Because of the limited experience with this form of roofing its use, other than on trial roofs, should, for the time being, be restricted to 30° minimum pitch.

Replacement of broken slates will be more difficult than with ordinary slating. No cost comparisons have been made with traditional slating.

In Confidence

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Introduction

At the request of the Welsh Office and Office for Wales of the Ministry of Housing and Local Government, Cathays Park, Cardiff, an investigation has been made by the Building Research Station of the Riley system of roof slating.

This method of slating devised by Mr. R. Riley, Managing Director of Caernarvon Crown Slate Quarries Ltd. is, in principle, the same as that described as 'patent slating' in 'The New Practical Builder' dated 1823. The 'patent slating' was apparently not satisfactory and there would be no reason to think that the Riley method would be any more satisfactory except for the fact that more suitable materials are now available in place of putty for sealing the joints between the slates and underlays are now required for slated and tiled roofs as an additional safeguard against the risk of rain and snow penetration and to increase the thermal insulation of the roof space.

A house at Llangefni, Anglesey had been roofed with the Riley method and provision was made for the method to be used in the re-roofing of some out-buildings at the Coastguard Station at Cemaes Bay, Anglesey.

This report is based on an examination of these buildings. It describes and comments upon the method of laying and fixing and the behaviour in use of the Riley system.

No comparisons have been made with traditional slating as regards costs.

The Riley systems of slating

In general the Riley system employs slates of two sizes, i.e. 16 in. by 10 in. and 14 in. by $4\frac{1}{2}$ in. The use of ordinary slating battens is dispensed with in the case of new roofs, though they may be required for the re-roofing of existing buildings if the spacing of the rafters is not uniform.

The main courses of 16 in. by 10 in. slates are laid, butt jointed, across the roof and directly on the rafters. It is important that the rafters are accurately spaced at 16 in. centres as the main courses of slates are fixed by nails, 3 in. from the top of each slate to consecutive rafters.

These nails hold the first course in position, form an anchorage for the tail of the slate course above and allow for a 3 in. lap.

This arrangement leaves vertical butt joints directly over each rafter. The butt joint may be sealed with a suitable mastic, sealing compound or strip prior to being covered by successive layers of cover slates, usually 14 in. long and $4\frac{1}{2}$ in. wide. Each cover slate is fixed by one or preferably two nails. These cover slates provide a 7 in. lap, i.e. two thicknesses of slate over the rafter areas and cover the nails used for the fixing of both horizontal and vertical slates.

In addition to nail fixing the cover slates may be bedded in mastic or any suitable sealing compound or strip.

The verge is finished with a course of vertical damp course cover slates and a course of these slates laid horizontally, from rafter to rafter, may be used as an underslate to complete the eaves detail.

At Llangefni the roof was covered with bitumen felt before the slates were laid, while at Cemaes Bay polythene sheeting was used in place of bitumen felt in order to facilitate observation of any rain or snow that might have been blown through the gaps in the slates. Since the re-roofing of the outbuildings at Cemaes Bay was in the nature of an experimental trial, two types of mastic and an adhesive tape were used for the sealing of the cover slates.

Visits of Inspection

On the 6th May 1960 an officer of the Building Research Station visited a new house named 'Rhyd yr Aerar' at Llangefni, Anglesey, where the slating of the roof, using the Riley method, had been almost completed. Subsequently on the 18th January 1961, the officer visited the Coastguard Station at Cemaes Bay, Anglesey, to see some outbuildings then being re-roofed with the Riley method.

A further visit to these buildings was made on the 22nd July 1964 to ascertain how the roofs had behaved in practice and to endeavour to assess the value of the Riley method of slating.

Mr. Wyn Jones, owner of the house, did the roofing work himself. He is a Youth Officer employed by the County Council and had had no previous experience of building.

The roof of the outbuildings at Cemaes Bay formed part of a Ministry of Public Building and Works contract and the work, carried out by a building contractor, was supervised by the Ministry's District Surveyor.

At Llangefni a good quality roofing felt was laid over the rafters prior to the fixing of the 16 in. by 10 in. horizontal courses of slates with a 3 in. head lap. The butt joints, which vary in width according to the cost and trim of the slates, were filled with mastic and then covered by small slates each held in position, near the head, by one nail. It is understood that the verge cover slates were bedded in mastic without nail fixing.

A few defects have arisen due, possibly, to lack of skill in roof slating. At the time of the inspection in July 1964 about one dozen cover slates had been displaced on the west face roof enabling rainwater to find its way to the felt underlay. This underlay should have discharged any water into the gutter at eaves level but insufficient care in nailing the 16 in. by 10 in. horizontal slates has, in one place, allowed water to penetrate into the roof space via a puncture or tear in the roofing felt.

At Cemaes Bay the outbuildings have three separate roofs. The slating follows the Riley system but for the purposes of the trials, a different sealing technique was used on each roof. In one case sealing of the cover slates was made with Sylglas, in the second with ordinary bitumen compound and in the third with two strips of Secomastic.

Polythene sheet was placed over the purlins which are carried by the gable and separating walls. Timber battens at 16 in. centres were fixed across these purlins from eaves to ridge to simulate ordinary rafters. The 16 in. by 10 in. slates were then nailed to these 'rafters' with a 4 in. head lap. Finally the cover slates were fixed with two nails, one about an inch from the head of the slate and the other nail about two inches below the top nail, with each vertical joint sealed in accordance with the sealing techniques already mentioned.

The condition of the roofs of the outbuildings at the time of the inspection was good. No rain penetration was apparent, the slates had remained firmly in position and the timber roof members appeared to be dry.

The Station's officer reported that many of the slates, laid in conventional manner on the Coastguard Station, had been dislodged and broken during last winter's gales.

Efficiency

The Riley system of roof slating depends upon more than usually accurate rafter spacing and slate sizing. On rafters 2 in. wide the slates will have a maximum bearing of 1 in. and correspondingly less for narrow rafters. The positioning of the nailing holes will need considerable care to ensure that on the one hand the nail hole is not too near the edge of the rafter and on the other hand the edge of the slate is not split off. The use of a gauge for accurate spacing of the rafters is almost essential. If difficulties arise in the positioning of nail holes it might be worthwhile considering the Scottish method of checking the edge of the slate instead of holing it.

Although the minimum safe head lap is usually 3 in., the 4 in. head lap used at Cemaes Bay provides greater safety and is likely to be more effective in keeping water out. In view of the limited experience it is suggested that the minimum pitch of roofs to be covered with the Riley system should be 30°.

The use of battens, preferably pressure impregnated, would provide a better bearing for the slates and overcome the need of accuracy of rafter spacing. More than usual care is needed to avoid damaging the slates unless battens are used.

The provision of an underlay of bitumen felt, polythene sheet or similar waterproof material should prevent any rain that may be blown underneath the slates or through the butt joint fixing on the rafters or battens from entering the roof itself. The original method used linseed oil putty for sealing the butt joint; the Riley method uses the newer types of non-hardening mastic available in various forms and these should provide a more durable seal whether used in the butt joint or as a sealer/bedder for the cover slates.

Some difficulty may be experienced in carrying out repairs as the replacement of broken and cracked slates will not be easy.

Conclusions

This report is based upon the inspection of two small roofing jobs only and is, therefore, somewhat limited in value.

The use of the Riley system which should, in view of the limited experience, be limited for the time being to roofs with a minimum pitch of 30° should be satisfactory subject to the following conditions:

- (i) The rafters must be accurately spaced and covered with a good quality durable underlay.
- (ii) The slates must be cut to close tolerances and the nails correctly positioned.
- (iii) A minimum lap of 4 in. should be provided for the main slates.

The success of the system depends largely upon the workmanship and supervision. Replacement of broken slates will be more difficult than with traditional slating.