



MATERIALS FOR ROOFING THAT ARE USED OR CONSIDERED AS ALTERNATIVES TO LEAD.

Advice from the Church Buildings Council

Introduction

For a great many roofing applications lead is, and remains, the most appropriate roofing material for appearance, performance, ease of installation and lifespan.

It is part of the heritage of our built environment. However, replacing like with like is not always realistic after lead has been stolen.

The high incidence of lead theft has led the Church Buildings Council to revisit its view of alternative materials for roofs.

It is essential that you talk to your DAC Secretary, Archdeacon and insurer when the theft is discovered. They will be able to guide you

through the process of making the building watertight and subsequently replacing the stolen material.

A change in roofing material will require local authority planning consent if the building is listed or in a conservation area.

The material that is most often used to replace a traditional church roof after a theft when the continued use of lead is not realistic is terne-coated stainless steel on account of its appearance and performance on traditional buildings. It has received broad support around the country, weathers well, and can have a lifetime of more than 50 years.

The Church Buildings Council considers that this is the material most likely to be substituted for lead for roofing when replacement of lead is not viable.

Careful detailing of stainless steel is required to maintain the character of the building. There are concerns about its appearance on prominent roofs, but these are less relevant where its use is proposed for low-lying roofs, such as aisles and extensions, and when the roof is not readily visible from ground level, for example when it is behind a parapet.

The greater the architectural sensitivity of a building the more important it is that any alternative replacement





material matches that of the stolen roof.

Many of the alternative materials described below will only work effectively and be durable if they are laid over a suitable substrate. The success of any replacement roofing will depend on an accurate and detailed specification of work.

It is therefore necessary that you consult an architect or surveyor before any work is commissioned. In addition to the appearance of the roof the architect will consider how to deaden the sound of rain on a rigid metal roof and how to avoid problems with condensation beneath the roofing material that can arise from a change from lead.

A change in material may necessitate a change in the detailing of the rainwater disposal, parapets and flashing. Your architect or surveyor will be able to advise you over the relative costs of materials, including the installation and likely lifespan. They will also be able to advise on any gains, for example better thermal insulation, you may be able to achieve at the same time.

The inclusion or exclusion of a particular trade name cannot be understood to indicate an endorsement of the product on the part of the Church Buildings Council.

Terne-coated Stainless Steel

Terne coating confers a lead patina appearance to the steel surface and so can be used as a substitute for solid lead sheet roofing to buildings such as churches. It is 'stainless steel continuously hot dip coated with a lead-tin alloy'.

The normal stainless steel 'substrate' strip thicknesses range from 0.4 to 0.8 mm in BS EN 502. These have a specified minimum coating mass of 20 gm/m² for hot-dipped terne coatings or 10 gm/m² for tin coatings. They are laid on timber substrates, usually with underlays to reduce noise. Standing or batten-roll jointing systems are most common.

These strip materials are much lighter than traditional lead roofing systems and so can result in lighter support structure. 'Creep' of the cladding will not occur as it may do with lead sheeting and so should be more stable. Terne-coated sheet should also be more difficult to remove once installed and so less likely to be stolen. A fuller technical description is available from the British Stainless Steel Association.¹

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<http://www.bssa.org.uk/topics.php?article=115>

Terne-coated stainless steel weathers quickly to a generally uniform pale grey similar to lead. It is widely considered the best alternative roofing material on shallow-pitched or flat roofs.

It is noisy in inclement weather (rain and hail) partly due to the stiffness of the metal which can result in a 'drumming' effect, although this can be mitigated with underlay, and may be subject to technical problems concerning underside corrosion. Long-strip applications can reduce the number of steps in a roof, but detailing must allow room for thermal expansion. The appearance of 'rolls' is more angular than lead.

Stainless steel

'Stainless' is a term coined early in the development of these steels for cutlery applications. It was adopted as a generic name for these steels and now covers a wide range of steel types and grades for corrosion or oxidation resistant applications.

Stainless steel will tend to retain the polished silver appearance over a long period, although the European Stainless Steel Development Association suggests that the weathering and oxidation of the material will give a grey patina sufficiently quickly for the oxidized appearance to be





achieved in a reasonable length of time.² A dull matt appearance can be achieved on the material in the production process. The European Stainless Steel Development Association claims that malleability is good, even in low temperatures.³ It is, though, generally considered less workable than lead where especially detailed forming is required. It is noisy in inclement weather, although this can be mitigated with underlay.

Problems with corrosion have been identified in areas that are not washed by rain, and this can be arrested by the application of a coating.⁴

Copper

Copper weathers to the characteristic green patina over a period of 30 to 60 years. It is durable and malleable. The price of Copper is currently similar to that of lead and the experience of the insurance industry is that copper continues to be attractive to thieves and includes the theft of lightning conductors, in

addition to roofs.⁵ The distinctive appearance of copper makes it less likely as an alternative to lead, especially in a highly visible roof. It can be noisy in inclement weather, although this can be mitigated with underlay. Copper can be vulnerable to underside corrosion if not detailed correctly.

Copper is incompatible with some materials including iron and acidic oak. It is not durable in marine environments.

Zinc

Zinc weathers to a dull grey, normally over a short period of time. Pre-weathered and patinated finishes are also available. Zinc sheet is used extensively in the building industry for roofing, flashing and weathering applications. Architectural alloys generally contain copper and titanium and are produced in the form of sheet, strip, plate and rods and are used as such, or cut and formed to desired shapes, such as gutters, cornices and pipes.⁶

It can be noisy in inclement weather, although this can be mitigated with underlay. There is a corrosion problem with

zinc when it is in contact with other metals.

Aluminium

Aluminium can be formed into intricate, stable and lightweight structures and even thin structures do not warp. Aluminium allows a high degree of prefabrication with a variety of finishes before components reach the site.⁷

Pre-painting is based on a Physical Vapour Deposition (PVD) formulation and therefore has excellent colour retention characteristics. The material is not traditionally associated with heritage buildings and the provision of an appropriate profile, in addition to colour finish, may need careful detailing. Aluminium will react with other metals, and must not be installed adjacent to them.

Non-metal alternatives

Although the use of slates or tiles may occasionally be appropriate instead of lead, in general the use of non-metal alternatives is not recommended, especially for large roof areas. They can be especially unsuitable for buildings with traditionally

² http://www.euro-inox.org/pdf/build/roofing/Roofing_EN.pdf

³ http://www.euro-inox.org/pdf/build/roofing/RoofingTe ch_EN.pdf

⁴ There is example of this in CFCE 185 Item 4.1 (Bradford Cathedral)

⁵ For example the *Daily Telegraph* of 7 February 2011 reported on the increase of copper thefts.

⁶ <http://www.zincworld.org/sheet.html>

⁷ <http://www.world-aluminium.org/About+Aluminium/Applications+and+Products/Building+and+Constructions>





constructed roofs as a substrate suitable for lead will not be a good one for non-metal substitutes. On some occasions they may be used as an interim measure, whilst funds are raised for a more permanent roof. Their chief use is for flashing.

EPDM (Ethylene Propylene Diene Monomer)

EPDM is a high-density rubber sheet membrane that is very durable. It is considered to be the most water resistant of all types of rubber. Since EPM or EPDM rubber does not crack outdoors, it is widely used for seals in buildings. Excellent resistance to heat, oxidation, ozone and weather ageing have led to increased demand for this rubber.⁸ EPDM is widely used in secular buildings.

It is good for flat roofs or low pitches and has long life and can be restored. It has lower embodied energy than other roof membranes and so is considered ecofriendly. Fire-retardant EPDM products are available, and these should be used when EPDM is the appropriate material.

⁸ <http://www.industrialrubbergoods.com/ethylene-propylene-diene-monomer.html>

Other membranes considered for roofing include Alwitra Evalon,⁹ which is a single-ply polymeric membrane manufactured from VET-Terpolymer with a polyester fleece backing. It is fully compatible with bitumen and all types of insulation board, including polystyrene EPS, XPS and cellular glass, although these will not all be appropriate for church roofs.

Evalon® V can be loose laid and ballasted, mechanically fastened or fully adhered with either cold or hot applied adhesive: laps are homogeneously welded with heat or solvent welding agents.¹⁰ The guaranteed life of 20 years is short compared to metal, and most applications illustrated by the manufacturer are for flat roofs.

Another example, Sarnafil, is marketed for replacing metal roofs.¹¹ It is a Flexible Polyolefine (FPO) single-ply membrane with a 200 g/m²

⁹ <http://www.ribaproductselector.com/Docs/8/12898/external/COL212898.pdf?ac=>

¹⁰ <http://www.ribaproductselector.com/Product.aspx?ci=12898&pr=Alwitra-EvalonV>

¹¹ http://gbr.sika.com/en/solutions_products/02/02a011/02a011sa13/02a011sa13ssa07/refurbishment_ofmetalroofs.html

polyester fleece laminated to the underside, designed to be fully adhered to the substrate. It is certified by BBA to have a life expectancy in excess of 25 years. Sarnafil TG7 Felt can be adhered to timber, concrete or suitable thermal insulation boards. Installation is carried out by Sarnafil contractors.¹²

Alwitra also manufacture a membrane (Evalon V) that incorporates solar panels and is shown applied to steeply pitched roofs in the product literature.¹³ They require a fire-resistant substrate, which will require a change in the design of a traditional roof.

The illustrated appearance with light-coloured borders around the near-black solar cells would change the appearance from a traditional lead roof. Roofkrete is a flat-roof membrane that does not use petrochemical products in its formulation, and it is claimed to be exceptionally stable. It can be coloured to the client's specification and is guaranteed for 30 years.¹⁴

¹² <http://www.ribaproductselector.com/Product.aspx?ci=6549&pr=SikaSarnafil-SarnafilTG76Felt>

¹³ <http://www.ribaproductselector.com/Docs/8/12898/external/COL112898.pdf?ac=>

¹⁴ http://www.roofkrete.co.uk/html/explanation_.html





Bituminous Felt

Bituminous felt is the cheapest available alternative, but widely considered to have a limited lifespan. It may sometimes be acceptable on fairly modern or unlisted structures, but is not suitable as a permanent solution for historic buildings.

Felt roofing products are available in a wide variety of grades. A traditional roof may not always be a suitable substrate, especially if the product is designed to dissipate water vapour at the perimeter of the roof. An example of this is the Bituminous roofing membrane Isola Mestertekk.¹⁵

Asphalt

Mastic asphalt roofing can be applied to form a continuous waterproof covering over flat, sloped or curved surfaces and can be worked around pipes, roof lights and other projections. It is applied hot in liquid form, and needs to be protected with solar reflective coatings, chippings or slabs.

Dedicated walkways must be provided to prevent damage to the material, and the roof inspected at least annually and ideally in the autumn and the spring.

¹⁵ <http://www.triton-chemicals.co.uk/pdf/mestertekkDataSheet.pdf>

Mastic asphalt can be laid on most types of rigid sub-structures such as concrete, timber and metal decking. Furthermore, thermal insulation materials can be easily laid as part of a mastic asphalt roofing specification to give any required U-value.

Buildings Research Establishment (BRE) Digest 144 gave a lifespan of 50 to 60 years for a properly designed and laid asphalt roof.¹⁶ This document, much cited by the industry, has been withdrawn and not replaced.

Fibre Glass/GRP

Fibre glass as a roofing material will not puncture or tear and has a lifespan over 30 years. It is available with an anti-slip finish, and any colour. Most examples of use are on flat roofs, or very gentle slopes, and for gulleys and flashings.

Non-lead flashing

Various non-lead flashings are available. Ubiflex is manufactured by coating both sides of an aluminium mesh reinforcement with a mixture of modified bitumen and additives. The underside of the product is finished with a kraft

¹⁶ http://www.masticasphaltcouncil.co.uk/pdf/mac_general_information.pdf

paper and film backing. Colour granules are added to the surface, the material cooled and rolled into the required lengths.

It can be used in all traditional lead applications to provide a weatherproof junction at features such as change of direction and materials.

Ubiflex flashing is 80% lighter and up to 50% quicker to install than lead. It is compatible with all structural components, common building materials, pitched and flat roofing, including metal sheeting. Ubiflex has no scrap value so makes the ideal lead alternative.

It is available in a range of sizes and colours with a range of fixing accessories.¹⁷ Other proprietary names for similar materials include Masterform, which has a life expectancy of 30 years and Rapid Flashing, the latter with a polymer base with aluminium insert.¹⁸

Metal flashing alternatives include Ubbink and Aluflex. Aluflex is a solvent lacquer-coated aluminium sheet with adhesive butyl backing,

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<http://www.barbourproductsearch.info/ubbink-ubiflex-flashing-file002081.pdf>

¹⁸

<http://www.monier.co.uk/products/product-catalogue/product-range/product/rapid-flashing-1.html>





available in lead-grey finish. It has a life expectancy of at least 30 years. ZinFlash is a soft zinc sheet said to be suitable for all applications where lead would be used for flashing.

Alto lead is another lead-substitute for flashings, guaranteed for 15 years, with life expectancy over 20 years.

The manufacturer claims that, as it does not look like lead, thieves are less likely to try to remove it.¹⁹

Plastic coatings

Liquid plastic coatings are available with a variety of trade names, for example Decothane, and the material is available in various grades with a range of working life from 10 to 25 years.²⁰

Most of the applications shown are on flat or gently pitched roofs.

The material will not work on a traditional boarded roof, unless a plywood (or other appropriate) substrate is provided, and any resulting issues for interstitial condensation addressed.

¹⁹

<http://www.mercurybuildingproducts.com/Assets/Downloads/altolead.pdf>

²⁰ <http://www.liquidplastics.co.uk/files/pdf/Roofing%20Pages.pdf>

Replacing the material requires the substrate to be replaced.

Fixing Systems

Systems for fixing lead to make it more difficult to remove from roofs have been developed in response to the rise in lead theft.

One system, LedLok, has been approved by English Heritage for use in a number of church installations.²¹

It secures the lead using a flush fixing that matches the lead of the surrounding roof and allows for thermal movement of the metal.

The fixings only secure the lead close to them, leaving the rest of the roof still removable, but with difficulty.

Rainwater Goods

Plastic rainwater goods will only rarely be suitable for use on churches.

Alternative materials to lead that are less attractive to thieves are available.

²¹ 'LedLok heritage fixing', *EASA Journal* (Spring 2011), p. 23. Product information is available at www.ledlok.co.uk

Cast iron

Cast iron is a traditional material for rainwater goods and is used to replace lead. It has a long life if it is well maintained.

Powder-coated aluminium

Powder-coated aluminium is sometimes used as an alternative to cast iron for rainwater goods, but must not be used near them.

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