HISTORIC ENVIRONMENT SCOTLAND | ÀRAINNEACHD EACHDRAIDHEIL ALBA

ADVISORY STANDARDS OF CONSERVATION AND REPAIR FOR THE HISTORIC BUILDING ENVIRONMENT IN SCOTLAND

1. INTRODUCTION

1.1 These Advisory Standards of Conservation and Resilience are intended to assist in the execution of works to historic and traditional buildings in Scotland. It is important that the scheme reflects the cautious, studied approach set out in various international conservation charters. In particular, the cultural significance of the building should not be compromised and the work should retain as much historic and original fabric as possible by minimising interventions. Works to the existing fabric should adopt the traditional materials, craft skills and construction techniques found in the original building.

Note that requirements for Repair Grant Funding, Scheduled Monument Consent, Listed Building Consent, Planning Permission and Building Warrant procedures are entirely separate systems. Works to underground services and to the wider external landscaping require assessment to retain significant archaeological features. This may also affect site facilities required to carry out the works. It should be understood that any proposals to alter any part of the building or affect its significance may require separate consent such as these noted and that these consents do not necessarily mean that the proposals qualify for grant funding. Under grant aided schemes a higher standard of work may be required.

In order to attract grant assistance from Historic Environment Scotland the applicant's Conservation Accredited professional adviser should develop proposals to the highest standards of conservation practice. It is equally important that the subsequent works on site are also administered to high standards. Management of the works to meet the requirements of the Health and Safety legislation and organisations such as SNH and SEPA is the responsibility of the applicant, his or her contractor(s) and professional advisor(s).

These Advisory Standards are intended to be a working document reviewed on a quinquennial basis.

1.2 This guidance develops some of the advice given in BS7913, Conservation of Historic Buildings, Historic Scotland and Managing Change literature. This guidance can also be used to guide the repair of unlisted or traditionally built structures where best practice is sought. This advice will seek to promote durable repairs that allow the

ongoing or new use of a building, maintaining asset value and the wider amenity benefits of the existing built environment.

1.3 Before this advice is followed, the approach by the owner and design team should adopt some basic principles that guide the repair and interventions in the building conservation sector. This begins with an understanding of the building history and significance, the behaviour of materials and their construction, their function and how the building currently functions and the implications of change. The cultural significance of the building should not be compromised and the work should retain as much historic and original fabric as possible by minimising interventions.

1.4 Repairs to the existing fabric should adopt the traditional materials, craft skills and construction techniques found in the original building. Where circumstances allow local materials should be used. In repair work an important consideration is matching the new material with the existing; incorrect selection of material, often for perceived reasons of improved durability and lower cost, will result in shorter life repairs and accelerated damage to existing fabric. The procurement of traditional materials such as stone, slate, suitably dimensioned timber, lead and iron work should be considered at an early stage.

1.5 The re-use of a building and the embodied energy is inherently sustainable and is supported by Scottish Government policy. The resilience and sustainability of a building needs to be considered in the widest sense; addressing reduction in operational energy alone, by the use of complex or high embodied energy systems and product, may not be sustainable in the long term. Most traditional materials are by their nature of low embodied energy and low toxicity and their use.

1.6 The opportunity may be taken to address energy efficiency and building resilience where this would not harm the significance of the building and is appropriate to condition of the building fabric. Consideration is to be given to enhancement of detailing to allow the building to better contend with extremes of weather and changing weather patterns. With a proper understanding of the principles for building ventilation and the use of appropriate materials the thermal performance of a historic or traditional structure can be improved considerably.

2.0 SCAFFOLDING

2.1 Scaffold Design

1. Design Proposals for scaffold should aim to minimise any added load onto a historic structure or fixings into historic fabric
2. When bracing scaffolding, avoid the use of damaging masonry anchors. Consider the use of ‘free-standing scaffold or self -supporting scaffold with kentledge, and make use of window openings, window jamb cramps, raking support or fixing into mortar joints that are sufficiently wide to prevent damage to adjacent stone arisses.

2.2 Scaffold Fixings

1. If anchors are required, they must not be fixed close to edges of carved decorative features.
2. A strategy for the insertion and removal of fixings should be devised before scaffolding is erected. Expanded ferrous anchor sockets left in masonry will cause staining and cracking as they rust and must be removed at the end of the work.

Consider rubber sleeved anchors which can be more easily withdrawn on completion of the works.

3.0 ROOF AND RAINWATER DISPOSAL

3.1 Roof Structure

1. Ensure the roof structure is sound. Where there are significant signs of movement in the roof structure, advice from an engineer experienced in the repair of historic structures may be required. When designing remedial structural repairs, adopt a minimum intervention approach and discuss the proposed repair with Historic Scotland.
2. Clear sarking of old nails and lift the lowest sarking boards to inspect the rafter ends and the wall plate. Where new sarking is required use butt jointed boards set with small gaps to permit ventilation.
3. Inspect timbers for rot, insect attack and structural weakness. Repair damaged timbers using new preservative treated timbers run to the original profile and treat rot or insect attack locally as required. Timbers should be spliced in-line rather than cheek bolted where appropriate to the structural design and the historic significance of the roof (see also 8.2 and 8.3 below).
4. Where possible, separate timber repairs from damp stonework with a DPC and allow for free ventilation where practicable.
5. Check the provision of ventilation to roof voids. If additional ventilation is required, locate discreetly and create using traditional materials e.g. lead. Bespoke solutions may be required.

3.2 Slating

1. Understand the original roof build-up and design the repair, including the use of underfelt where appropriate, to suit the site circumstances. Consider if modern underfelt is necessary as it may compromise ventilation, and cause requirement for additional purposed designed ventilation to the roof make-up and roof space. Dark coloured felt should be used where it would be visible at completion of works.
2. Where different types of slate have been used across building phases or ranges as part of the natural evolution, these characteristics are to be respected.
3. Re-slate using sound original slates recovered from the site together with matching slates brought in to make up the required number. Samples of slate to make up for broken or unsuitable slates should be agreed with Historic Scotland before purchase.
4. Slates to be laid to exactly match the original laying pattern using slates of the same shape as the originals. This includes number of courses and their sizing; a survey record of the original may be required.
5. Re-used slates should <u>not</u> be re-dressed as a matter of routine.
6. Slates should be fixed with non-ferrous nails of appropriate lengths to suit the roof details.
7. Replacement lead flashings, secret gutters, ridges and other weatherings to be lead as described below.
8. Mortar fillets at skews may be reinforced with expanded non-ferrous metal reinforcing lath and formed on top of code 4 soakers.
9. Where there is heavy moss growth it may be beneficial to consider the addition of copper strip.

3.3 Stone Slab Roofing

1. Record existing stone slab slating noting course heights, lap and peg fixing. Retaining all viable original fabric, re-grade slabs and make up differences in new stone slabs

which match the source, colour and texture of the original, respecting original peg and fixing details.
2. Re-fix using newly made seasoned timber pegs of matching species (traditionally oak).

3.4 Fired Clay Roof Tiles

1. Understand the original roof construction and repair the timber substructure - including replacement felt where appropriate.
2. Tiled roofs are normally laid on battens and counter battens (over roofing felt).
3. Replace broken or unsound tiles with new tiles of the same colour, profile, size and glaze (if relevant).

3.5 Leadwork

1. Consideration should be to be given to the retention and value of historic leadwork. Life expired and un-repairable weatherings and lead flat roofs should be renewed in new milled or cast lead as follows:
   - cupola astragal and rooflight cover flashings to be a minimum of code 5;
   - flashings, secret gutters, dormer cheeks etc to be code 6;
   - valleys to be minimum code 7;
   - short gutters or small areas of flat roofs without foot traffic may be minimum code 7;
   - ridges to be code 8 and fixed with clips of minimum code 8 lead, or terne-coated stainless steel.
2. Lead to be laid to follow the recommendations of the Lead Sheet Association but also with respect of the original leadwork aesthetic. Complex and details unique to the building should be drawn at a large scale sufficient to illustrate how these areas are to be constructed.
3. Flashings are to be inserted into raggles sufficiently deep to allow the raggle to be pointed with lime mortar; typically this would be to a depth twice the width of the raggle, and square cut. Existing raggles should be used wherever possible. Lead should be isolated from lime mortar by a protective coating such as masking tape or bituminous paint.
4. The use of sacrificial flashings where slating discharges into valleys and parapet gutters is encouraged.
5. On flat roofs, hollow roll joints should not automatically be replaced with wood cored roll joints, consideration should be given to the historical context, the roof pitch and any likely foot traffic.
6. Discreet dating of new repair work may be considered.

3.6 Other Metal Roofs

1. Repairs to zinc and copper roofs should replace metal trays by closely matching the original overall appearance but with details, gauge of metal sheet and underfelt as recommended by the IZA International Zinc Association, CDA Copper Development Association and Lead Sheet Association as appropriate.
2. Repairs to corrugated iron roofing or wall cladding materials should be with galvanised corrugated iron to the original profile and thickness and using fixings to match the original.
3. Ventilation as for other roof types should be considered respecting historic appearance and detail.

3.7 Asphalt

1. Where an asphalt roof covering is damaged and leaking this should be lifted and replaced with new asphalt laid in coats strictly in accordance with the instructions of the Mastic Asphalt Council. Sand dusted surface is preferred.
2. Lead over-flashings are to be detailed in accordance with the recommendations of the Lead Sheet Association.

3.8 Bitumen Felt Roof Covering

1. Where bitumen felt roof covering was the original and historically correct roof covering on a flat roof, modern equivalents such as single ply membranes may be considered. Perimeter details should remain broadly the same as for the felt original. Note, however, that these membranes will not be accepted as a replacement for roofs that were originally finished in lead, zinc, copper or mastic asphalt.

3.9 Thatch

1. There are many types of thatch and thatching techniques in Scotland and these roofs are now a scarce and highly valued historic resource. Repairing traditional thatched roofs requires the most careful investigation and consideration.
2. A search for archival visual or photographic evidence of the building and its thatched roof will be necessary before works are proposed.
3. Recording should include the building type, evidence of changes in the building use, primary and secondary roof structures including connections and changes in thatch type.
4. Archaeological trenching through the thatch may help to provide invaluable information on the make up of the roof and allow the sources of the thatch materials, including substratum layers, to be identified. Many thatches survive as an insulation layer under corrugated iron roofs.
5. Proposals for the repair of traditional thatched roofs should follow the original as far as possible and include repair or replacement of structure, substratum and thatch type.

3.10 Rainwater Disposal

1. Check that the existing rainwater goods are adequate to control and discharge water safely away from the building. If not, the professional adviser should submit proposals for reconfiguration of installations.
2. Where sound, ensure they are clear and flowing freely, and that there is maintenance access at ground level and at key junction points above. The as built information should include plan and method of access to all areas that require maintenance.
3. Where sections are broken, damaged or missing, or in non-original materials such as uPVC, replace to match original profile, detail and original material.
4. Ground drainage to be checked, recorded and made fully operational to ensure water is being conducted properly away from the building. Groundworks within sensitive areas may require an archaeologist.
5. All cast-iron pipework and rhones to be prepared, primed and painted in accordance with manufacturer's written instructions using a high performance paint specification. Paint new cast iron goods before site assembly and make good joints, chips and fixings immediately after fixing. Particular attention should be given to preparation and paintwork at sharp arrises to fresh castings. The final colour may be selected using evidence gained in the cleaning process or to match the background fabric
6. The addition of trace heating may be considered in particularly problematic or inaccessible areas.

3.11 Skylights/Ventilators

1. Original cast iron skylights should be repaired and re-used rather than replaced.

2. Where replacement rooflights are required, replace with new rooflights to the same size, detail and materials. Incorporation of thermal break alloy castings is acceptable
3. Original cast iron and sheet metal roof ventilators should be retained and overhauled, or replicated where beyond repair.
4. Cast iron skylight and ventilator elements are to be painted as outlined for rainwater goods above. Zinc and copper sheet metal should be painted or left as self-finish as appropriate to building.

3.12 Safe Access

1. The opportunity should be taken to ensure there is adequate safe access for maintenance and repair with a strategy for maintenance beyond the completion of the works.
2. Locate and detail interventions such as access ladders and roof hatches discreetly.

3.13 Lightning Conductors

1. Lightning conductor systems can result in a considerable visual intrusion on historic structure. English Heritage design guide "*Lightning Protection of Churches*" contains useful information for guidance on discreet design.
2. Fixings should be secured in joints rather than stones and conductor lines are to be discreetly located behind or beside other building elements such as downpipes or buttresses.
3. Early lightning conductors may be retained and integrated into the new system.

4.0 MASONRY

4.1 Structural Condition

1. Where significant structural movement, settlement cracking or other evidence of a compromised structure is identified, advice from an engineer experienced in the repair of historic structures may be required. Discuss the proposed remedial works with Historic Scotland.

4.2 Removal of Moss and Algae from Masonry

1. Where damp conditions have caused moss and algal growth on masonry, the area is to be scraped clean with wooden spatulas and cleaned down to remove all organic debris and soil prior to re-pointing. The source of moisture encouraging such growth must be addressed in order to prevent re-growth.
2. Seek specialist advice on biological growths such as algae, fungi, and lichens where the effect to the masonry may not be benign but removal could cause masonry damage.
3. It should be recognised, that biocide is unlikely to have a long-lasting effect and may damage the masonry. Consequently, the use of biocide should not form part of a regular maintenance regime.

4.3 Removal of Vegetation from Masonry and Immediate Vicinity

1. Consider the proximity of large and mature trees and the risk and likelihood of damage to historic fabric from root heave or fall, including affected foundations and drainage.
2. Carefully remove any invasive vegetation while avoiding damage to the masonry
3. Main vegetation trunks are to be cut and roots treated with suitable systemic weed killer. Larger growths of surface vegetation may be cut into smaller areas (creating a grid) prior to treatment. This will identify areas where growth persists and allow

subsequent treatment to be more selective. More than one treatment may be necessary over a period of time.

4. Vegetation adhering to the masonry is to be left until dead, and then carefully removed by gently teasing the mat away from the building taking care to sever roots that penetrate the masonry.
5. Larger vegetation should be removed by hand weeding ensuring that all roots are removed to avoid leaving potential open paths for water ingress as they decay
6. Stones that are found to be loose are to be held in place by wooden wedges and suitably propped as required until repair work is undertaken.

4.4 Masonry Repair

1. From the scaffolding, brush down loose stone (with bristle brushes, not wire) and tap the existing surface to ensure the face of the stone is sound. Where the stone face is eroded or crumbly but this does not pose a threat to the weathering function (eg cills), the structural integrity or the architectural interpretation of the building, it is advisable to leave for attention at some time in the future.
2. Where soft, cracked or friable stones are identified as a threat to the structure or weathering, or significantly detracting from the architectural composition and integrity of the building, they may be carefully cut out and indented with a matching stone that respects the existing stone joint pattern. Where it is necessary to replace missing, broken, cracked or eroded stones with new stone, ensure that the new stone is a suitable replacement for the original in terms of colour, texture, porosity, crushing strength and weathering properties. Analysis services and advice on suitable new stone to match existing can be obtained from British Geological Survey.
3. Remove any redundant fixings, surface-mounted cables, television aerials and extraneous ferramenta - including redundant drainage branch pipework. Where services cables or aerials are required, site and route these discreetly.
4. Exposed surfaces of new stone should be hand dressed to match the original face or tooling. Avoid the use of power tools on any exposed surface of stone. Cut replacement stone on the correct geological bed for the circumstances of its use in different elements of the building. Lay on to a full mortar bed, grout behind and point fully to ensure loads are taken by the new stone. Indented face stone should have a minimum bed depth of 150 mm. New stone should not be distressed or toned down to match original.
5. Avoid the use of pre-mixed restoration mortars. Mortar made from lime, sand and graded matching stone, may be acceptable for fine cracks or small “pocket” repairs in otherwise sound stone and where lying water and subsequent frost damage may be considered a risk.
6. Very fine detailed repair will require the input of a specialist stone conservator and report.
7. Do not point open joints which were originally dry built.

4.5 Joints in Ashlar Masonry

1. Where ashlar masonry is quite tight with few open joints, avoid re-pointing this masonry.
2. Re-point open ashlar joints by raking out loose or crumbly mortar by hand with a hacksaw blade or similar and hose joint clean. The expert use of appropriate power tools to assist may only be considered in strictly controlled situations.
3. Wet joints and re-point using lime mortar and fine light coloured sand.
4. Take care to protect the arrises to avoid staining on the ashlar.
5. Brush off any loose mortar. Ensure stones are not stained by water used to sponge off any mortar residue. Protect pointing while it is curing in accordance with best practice.

4.6 Removal of Cementitious Pointing

1. As it can be damaging to the adjacent stone arrises to remove well-adhered cement mortar, it is often better to avoid removing sound cementitious pointing.
2. Where pointing is cracked and open, separating from the stone or causing evident distress and erosion to adjacent masonry, carefully remove cementitious mortar by the use of fine masonry chisels. The expert use of appropriate power tools to assist may only be considered in strictly controlled situations.
3. When free space has been created, mortar may be freed from the stone by working back into this space. Pointing should be raked out to a minimum depth of 35 mm and the joint flushed clean.

4.7 Joints in Rubble Masonry

1. Where mortar joints in rubble masonry are loose or crumbly, carefully rake out to a minimum of 35 mm using tools narrower than the joint to avoid damaging the stone.
2. Thoroughly flush clean the joint and re-point with the mortar mix informed by analysis (see below). Pointing to be well packed into the joint and finished to match the original and suit the style of masonry construction. Where appropriate, the correct number, size, shape, orientation and type of pinning stones to maintain the mortar/stone ratio and original character of the wall evident in the original build.
3. Stones used for pinning repair in rubble masonry should typically have the same colour, surface treatment and edge dressing as the surrounding masonry.

4.8 Brick

1. Note the character of the original brickwork including bond, brick type, sizes, and mortar pointing profile. Survey and record location of types of decay to inform repairs required.
2. All brickwork repairs to accurately follow the original build, using brick of accurately matching colour, size, hardness and porosity.
3. Following brickwork repair, re-point to match original using a pointing tool and application technique similar to that used originally with a mortar specification to suit the age of the building and the strength of the brick.

4.9 Flue Terminals

1. Missing or defective chimney pots to be replaced to match the original form indicated by documentary or site evidence. Where there is no evidence of the original, use pots to pattern in use on buildings of similar period in the vicinity.
2. Ensure that the number of pots accurately reflects the number of flues and where appropriate reflects historical variation in types used on the respective flues.
3. Chimneys not in use should be cleared of debris and then terminated with a vented weathered top and a vent at the bottom of the flue to allow free air circulation.

4.10 Concrete

1. Commission an independent investigative specialist report on the condition of the concrete and repair the structure accordingly. The report should include such techniques as use of a cover-meter to establish the depth of reinforcement cover and include core samples at strategic locations to enable analysis of the depth of carbonation, chloride content and quality of concrete.
2. Remedial works may include specialist treatment to enable retention of as much original fabric as possible.

4.11 Harl/ Render

1. Harl or render coats should be applied in accordance with traditional harling (or throwing) techniques. Samples of the original harl should be analysed to clearly identify the various constituents e.g. shell, aggregate, lime proportions etc. The new harl should have a wide range of aggregate grading and replicate any local mix or application traditions.
2. Quality and appearance of work to be determined by sample panels.
3. Harling/rendering to be applied using a lime mortar mix in 2 or 3 coats respecting local techniques and traditions. Harling should be screened from rapid drying in accordance with best practice. Where the harling is exposed to drying winds or temperature, repeated wetting of the screens will be necessary.
4. Site operations should ensure that flashings, rainwater goods and external joinery are fitted at the appropriate time in order to ensure a good finish to the harl/render.
5. Where a lined out “ashlar” appearance is to be made, the surface should be pressed flat and the lining out undertaken to a pre-determined pattern of joints. The ruling tool is to be appropriately shaped in order to provide lines of the correct depth, consistency and cross-section.

4.12 Limewash

1. Historic limewash can have several constituents ranging from natural pigments, tallow and other organic additives. As with mortars, analysis and sample panels should be carried out before the specification is finalised.
2. Limewash should be applied to a pre-wetted surface. Multiple coats, usually a minimum of eight, will be required as it should be applied in sufficiently thin coats (usually the consistency of skimmed milk) to allow carbonation at each coat. Layers of limewash should not be applied if the appropriate attendance to control rapid drying is not possible.
3. Limewash should be screened from rapid drying in accordance with best practice. Where the limewash is exposed to drying winds or temperature, repeated wetting of the screens will be necessary.
4. Regular maintenance coats will be required over subsequent years.

4.13 Mortars for Building, Pointing and Harling.

1. Lime mortars have significantly different working properties to cement mortars. Advice on procedures and suitable mixes may be required and can be obtained from various specialist advisors.
2. Care is required to fully understand the nature of the original mortar and the function of a mortar used in the repair scheme, the location, detail and visual appearance, as they may not fulfil the same requirements.
3. Mortar specification for repairs should not adversely affect the weathering of adjacent masonry.
4. All works to be undertaken by fully trained masons with experience of historic building work.
5. Lime mortar mix for indenting or pointing should usually match the original mortar and be informed by careful analysis of original build mortar samples. It should be prepared in advance to achieve maturity and may require a hydraulic content to achieve a predicable set and avoid lime leaching. Pozzolanic materials may be added to putty lime mortars to aid setting. Lime and sand for the mix is to be carefully selected to ensure the mix has a suitable self colour, even if it is to be limewashed.
6. Hot lime work can be appropriate when rebuilding and consolidating wall core taking care to include pozzolan to control free lime carbonisation and risk of leaching
7. Ensure lime mortar work is undertaken in appropriate weather conditions and protect lime mortar from sun, rain and frost until cured in accordance with best practice.

8. Earth mortar exists in some early or rural buildings. Care should be taken to identify, analyse and carefully reproduce where repair is required.

4.14 Removal of Graffiti from Masonry

1. There are different methods to removal graffiti resulting from vandalism. It is necessary to analyse the paint, dye or ink type to establish the least damaging removal method. Removal of markings should be tested and approved for use on that particular stone type before approval to proceed is given. Chemicals used on stone are to be neutralised immediately after use as recommended in the manufacturer's written instructions.

4.15 Damp Proof Courses

1. Installation of new chemical DPC is not considered acceptable as the long-term chemical effect on the masonry has been shown to be detrimental.
2. Appropriate DPCs may be considered for situations such as under copes, with consideration of how to avoid slip planes.

5.0 EXTERNAL CARPENTRY, JOINERY

5.1 Repairs to Timber Cladding and External Finishing and Architectural Joinery

1. Retain as much original material as possible.
2. Replace rotted sections, with timber to match species, visible grain characteristics, quality and colour, suitably treated for the location.
3. New sections are to match the profile of the original with fixings to match existing.
4. Reinstatement of missing sections and elements may be acceptable where supporting historical documentary evidence is available.

5.2 Treatment and Finish refer also to item 6.7

1. Timber cladding and weatherboarding may be left to weather where this is the original finish.
2. Treatment and finish to external carpentry and joinery such as cupolas, fleches, balustrades, louvres, porches, barge and eaves boards, should match that evident on the original fabric or, if not feasible, should be based on research study and historical documentary evidence available.
3. Products and systems selected for treatment and finish should be appropriate for the location; at exposed and inaccessible areas high performance oil treatment and non traditional paint systems may be applicable. Modern protective wood stains are unacceptable.

6.0 WINDOWS AND DOORS

6.1 General Repairs

1. Carry out repairs to windows, cupolas and doors sensitively retaining the original fabric in preference to replacement where possible. Reinstatement of former details may be considered where later unsympathetic and inappropriate alterations exist.

6.2 Secondary Glazing

1. Historic secondary glazing is to be repaired as window joinery.

6.3 Original Glass

1. Original historic glass (crown, cylinder, plate, drawn, patterned or coloured glass or glass with seeds, reams or other notable impurities) should be retained in-situ, and where this is not possible should be put aside for later reinstatement. The use of a proprietary putty lamp can be valuable in removing old putty without damaging the glass.
2. Modern cylinder, Vauxhall, crown, float glass or horticultural glass may be used for replacements depending on the original glass type to be found on the building. These may vary on a single building or elevation.
3. Match glass type to original examples on site or to date of building construction. Any patterns established as a result of evolution of the building should be respected.
4. Repair of glass in-situ should be considered for small cracks, modern techniques may be considered.
5. Where interiors are of recognised historic significance and are sensitive to UV light, UV blinds may be considered; avoid using UV film on historic window glass as this cannot be removed easily without risk of damage to the glass.

6.4 Window and Door Joinery

1. Windows and doors should be overhauled and repaired wherever possible by carefully splicing in new matching timber to follow accurately the original profile using traditional techniques and glue.
2. Where new replacement windows or doors are required they should be glazed as the original and manufactured from matching timber sections accurately following the original design and profiles.
3. Reuse original ironmongery where possible. Where necessary select historically appropriate new ironmongery that meets the modern requirements of security and exit, yet is of an appropriate style and quality. Use only slot headed screws of the correct type to match original installation.

6.5 Metal Windows and Doors

1. Retain and repair as much original frame, operating gear and ironmongery for re-use as possible.
2. Replace damaged sections, to match section and profile.
3. Where repair is not possible, replace to replicate size, profile and finish.

6.6 Abutment Pointing

The joint between joinery and masonry is to be pointed with either of the following:

1. A traditional site mixed mastic comprising burnt mastic sand and boiled linseed oil placed against a suitable backing stop.

   or

2. Lime mortar pointing placed against a suitable backing stop. Where a building is harled/rendered the use of lime mortar to fill this joint will allow the harl/render to be brought up to the joinery. This should be placed after joinery fascias have been decorated to ensure good protection of the fascia.
3. For metal windows that are a feature of the original design, alternative mastics may be considered for agreement with HS.

6.7 External Painting of Window and Door Joinery

1. Paint using traditional methods prior to assembly of sections where possible. Use good quality oil-based paint preparation as recommended in the paint manufacturer's written instructions including knotting preparation treatment. Particular attention should be given to rounding sharp arisses to avoid thinning of paint
2. Ensure paint is not spread onto adjacent masonry.

3. Appropriate window colour is to be agreed; choice can be informed by paint analysis from scrapes. Off white (avoid brilliant white on pre 1920's buildings) or other colours such as black or green following historic local practice may be appropriate.

6.8 External Painting of Metal Windows and Doors

Generally as for section 6.7 with specialist preparation, and coatings as required.

6.9 Leaded Glazing and Zinc Kame Glazing

1. Before beginning a repair to lead or zinc kame windows, a report should be commissioned from a glass specialist to schedule the works required to bring the window construction into a good state of repair. This report should be sufficiently detailed to give an outline of the works proposed including proposed works to the surrounding opening such as saddle bars and drainage, along with the associated costs, give a brief outline of the importance of the glazing and identify any unique attributes that may require more in-depth investigation.

6.10 Leaded Glass Protection

1. Remove any inappropriate window protection and make new window protection in woven or welded non-ferrous or stainless steel wire mesh with a pitch and strength designed to meet the risk. Meshes should be made by a skilled wireworker to accurate templates.
2. Protection should follow the glass line and not cover stone tracery. It should be fixed using non-ferrous fixings into joints in the masonry ingo, back from the outside stone face but suitably spaced away from the glass to give maximum protection.
3. To increase protection in highly vulnerable areas, consider safety glass or where weight is an issue, clear polycarbonate. Clear sheet material should be fitted behind mesh but not against the leaded glass and be installed with adequate ventilation at top and bottom. Clear sheet used without mesh gives unsightly reflections.

7.0 INTERNAL

7.1 Plaster Repairs

1. Plaster should be in lime plaster to match the original as determined by analysis of the existing.
2. In rooms where lath and plaster exists, repairs should be carried out in matching materials. New lath sections should be hand split or sawn to match existing.
3. Repairs to rooms or buildings where the existing lath is lost entirely, may be undertaken in modern materials to match original appearance but this is not grant eligible.

7.2 Joinery Work Repairs

1. Carefully record, using profile gauges, the original size and form of original internal joinery.
2. Where it is necessary to repair or replace internal joinery sections, profile new timber of suitable species and quality to the original profile, cut and fix in accordance with best practice.

7.3 Rot and Insect Attack Works

1. Locate the reason for moisture penetrating the fabric and successfully prevent this happening. Where prevention is not possible take suitable measures to control the source, and monitor the situation. Remove the source of rot and, where time permits, allow fabric to dry out.

2. Seek independent expert advice on methods of treatment, adopting a conservative approach including environmental controls and with green principles wherever possible.
3. Seek the advice of a suitably experienced engineer for advice on decayed original structural timber sections and repair needs.
4. Carefully patch in new pre-treated structural timbers to match original
5. Make good internal finishes to match original.

7.4 Decoration

1. Internal decoration with paint scheme should be based on research study of the interior, where it forms part of a historically significant decorative scheme.

7.5 Services Installations

1. Heating installations within the envelope of the building should be discretely located and sympathetic to the historic fabric.
2. The scheme of services works should include testing of the electrical installation and any upgrading found to be necessary as a result of the testing.
3. Refurbishment of significant historic electrical and mechanical fittings should be considered.

8.0 METALWORK

The identification of the form of ironwork to be repaired i.e. mild steel, cast iron or wrought iron should be made at an early stage to guide subsequent works.

8.1 Cast Iron

1. Each project should be assessed and the most appropriate repair technique(s) employed given the application, materials and historic importance.
2. In certain circumstances cast iron may be welded by specialists using high nickel electrodes, or brazed using aluminium bronze. Plate repairs or pinning by drilling and tapping adjoining components may also be appropriate. Cold metal stitching may also be feasible.
3. Re-casting missing components using traditional techniques might also be considered. Design and quality should match existing.

8.2 Wrought Iron

1. Wrought iron should be removed for repair by proven experts in this field.
2. To correctly repair wrought iron, use only suitable quality recycled wrought iron or pure iron if this is unavailable.

8.3 Steel

1. Retain as much historic steelwork as possible, using appropriate cleaning systems and anti corrosion treatment.
2. Where repairs are necessary use appropriate grade of steel, matching sections and original fixing details.

8.4 Decorative and other Metal Work Repair

1. Weathervanes, roof ventilation louvres, solum ventilators, railings, gates or other historic architectural ferramenta should be repaired with matching materials using traditional methods.

2. Flame cleaning; needle gunning, blast cleaning and chemical cleaning may be appropriate. Particular care is required for cast iron due to the porosity of the material.
3. Where there is evidence of historic gilding, re-gilding may take place.

8.5 Metalwork Protection

1. Generally new steel (not cast or wrought iron) should be galvanised following manufacture.
2. Suitable long life paint treatments for ironwork, such as zinc rich primers, and micaceous iron oxide build coats should be considered for use and applied in accordance with manufacturers' written instructions. Hard shell epoxy paints should not be used on cast iron; dry film thicknesses should strike a balance between protection and loss of detail.
3. Protection with rust inhibiting greases and waxes treatments may be appropriate treatments.

9.0 RESILIENCE TO WEATHER

The resilience and the sustainability of building elements and materials are affected by an increased frequency of unusual weather events such as rapid and significant temperature changes and storm conditions with severe wind forces and intense and prolonged rainfall.

9.1 Rainwater

Review the overall size and cross section of gutters and hoppers, and the location, number and size of overflows and downpipes. Consider the effect to the building appearance along with any proposed functional improvements to rainwater fittings and any consequent changes to existing below ground drainage systems including soakaways to the surrounding landscape drainage.

9.2 Rising Groundwater Table

Review the existing provision to adequately ventilate the building fabric to the underside of ground floor construction and assess effect of improvements to land drainage around the building perimeter and changes to existing external ground level. Addition of solid floor construction and impervious material or coating to walls at and below ground level can increase deterioration of existing building fabric.

9.3 Flood Surge

Consider wider landscape protection measures such as flood plains or storage basins, as well as local intervention measures at vulnerable areas such as entrances. Monitoring and maintenance provision are required for local sump and pump installations to buildings.

9.4 Trace Heating

Trace heating to rainwater goods can be considered beneficial where there is a risk of damage to the exterior building face or to significant historic interiors from snow or ice build-up during low temperatures and where access is difficult. A monitoring system is required for regular check of continuity function.

10.0 ENERGY AND BUILDING SERVICES

10.1 Building Energy Sources

A review of the current energy supply and use required for the building maintenance and the consumption by building users is beneficial to make best use of available resources.

10.2 Building Energy Provision

Care is required when considering the installation of power to help maintain historic buildings, to retain significant features and avoid loss of setting from inappropriate infrastructure such as substations. Alternative energy sources to carbon fuels may be appropriate for historic buildings as for new development when considered sensitively.

11.0 BUILDING SERVICES PROVISION

A review of existing building services is advisable for safety measures and to consider improvements for sustainable energy efficiency.

11.1 Renewal or Replacement of Building Services

Re-wiring may be required for safety reasons. Similarly renewal of other building services may be required such as the upgrading of existing heating systems. This should be approached sympathetically to minimise any impact on historic fabric and retain historic fittings where appropriate.

11.2 Building Services Controls

Thermostatic and humidistatic controls for heating and ventilation systems should be fitted where applicable, set to appropriate level for historic fabric. Dry and hot environmental conditions can be as damaging to some materials as damp.

12.0 ENERGY USE AND BUILDING FABRIC

12.1 Insulation and Ventilation

Much can be done to improve the resilience of existing buildings by properly considering insulation. This requires an understanding of the existing building fabric ventilation and an evaluation of insulation proposals particularly risk of condensation leading to damage from damp conditions. Specialist advice may be helpful to develop proposals which respond to current standards and are appropriate and sympathetic to historic buildings.

12.2 Damp Conditions

Damp environmental conditions can cause significant damage to building materials and structure and it is important to understand the source of the water or condensation when considering appropriate actions and treatment. Where it is not feasible to eliminate the risk of water ingress or accumulating condensation consider monitored control measures with options for extraction, dehumidification and natural charge installation. Equipment will not avoid the risk of damage and monitoring is required for regular function check and maintenance. Alarm detection for water

leakage can be considered for difficult to access areas such internal pipe runs where there is a significant risk to building structure and historic interiors.

12.3 Roof Insulation and Ventilation

Consider the risks of condensation, damp and rot from both warm and cold roof constructions. Avoid loss of natural ventilation and maintain traditional details; different measures may be necessary for roof features such as coombs and dormers.

12.4 External Wall Insulation

Avoid the loss of significant external features. Avoid non-breathable materials and consider the likelihood of damage to masonry and timber substrate. Consider the detail implications at wall fixtures and openings to avoid consequent thermal bridging and condensation.

Consider retention of significant interior details and the effect to existing wall construction and ventilation. Use breathable materials and avoid dependence on membranes based on modern construction practice and consequent damage from interstitial condensation. Be aware of the implications of creating cold spots and thermal bridges and the related condensation risk.

12.5 Insulation to Floors

Ensure air movement around timber joist ends and sole plates is maintained when considering adding insulation below floorboards. Note that the addition of solid floor construction at ground level can increase risk of water ingress and rising damp to adjacent walls.

12.6 Fireplaces and chimneys

Chimney flue ventilation should be maintained. Retaining open fireplaces can be beneficial as part of the ventilation strategy. Vented caps can be fitted to chimney tops and modern linings and variable dampers can be fitted within flues.

13.0 GLAZING

13.1 Existing glazing frames

Where the existing window or glazing frames are considered appropriate to the building these should be retained. Glazing options should be appropriate to the building appearance considering colour, tone and light reflectance.

13.2 Single glazing

Assess the existing glazing as plate glass may be more efficient than modern standard replacement single glazing.

13.3 Double glazing

Where the glazing to existing window joinery is not historically significant, double glazing units such as slimline can often be fitted into the existing window frames. Incorporating gas fill units and low emissivity glass can increase the performance to retain interior heat and reflect solar heat gain. Modern putty glazing compound may need to be substituted for traditional putty and the weighting of sash and case windows may need adjustment.

13.4 Secondary glazing

Secondary glazing systems should suit existing opening reveals and not impede existing shutters or opening operations for general cleaning. The secondary glazing system should not create an unventilated void. Ventilation to suit the room requirements has to be maintained and it may be necessary to incorporate openable units to suit the occupants' use of the room. Purpose made joinery systems can provide a discreet installation whilst reducing heat loss.

13.5 Shutters and Blinds

Repair of existing timber shutters and blinds can contribute significantly to a reduction in energy use for interior spaces. Existing joinery details should be respected when incorporating new appropriate fittings. Ventilation requirements and control of light levels need to be considered.

14.0 DAMAGED MASONRY

The use of alternative or modern materials and techniques can be appropriate in certain circumstances.

14.1 Acrylic Resins

Specialist stone conservator techniques and materials can be considered for delaminating, fissured and cracked masonry and sculpture work. This type of work with acrylic resin will have a limited life and implies on-going condition monitoring.

14.2 Proprietary Restoration Mortars

Limited and localised use of proprietary restoration mortars may be appropriate for small key areas to retain building significance, extensive use is not appropriate. Consider the composition of the restoration mortar and the compatibility with the masonry, as a difference in breathability will exacerbate erosion and loss of the masonry.

14.3 Removal of Paint and other Coatings and Facings from Masonry

Removal of coatings and facings may be acceptable where there is evidence of distress to the underlying masonry or where the finish may be considered incongruous and detrimental to the building significance. Analyse the paint or other coating or facing to establish the least damaging removal method, tested and approved for use on the particular masonry type. Gels, chemical poultice systems or air/water abrasion may be appropriate. Test the proposed system as a control sample for approval to proceed, particularly where chemical poultice or low level air/water abrasion is proposed. Chemicals used on stone are to be neutralised immediately after use as recommended in the manufacturer's written instructions.

14.4 Wallhead Treatments

Wallheads provide protection to the core construction from rainwater. Where it is not feasible or appropriate to fit copings to shed rainwater alternatives may be considered. Soft topping, usually comprising turf and sedums over a clay base or other water proofing layer may be appropriate for ruinous structures or boundary walls. Specification must take account of the local climate, natural diversity and risk of invasive vegetation colonisation. Proprietary membrane system may be considered as an alternative option for the repair or renewal of existing impermeable cover where appearance and effectiveness to shed water is not further compromised.

15.0 FIRE SAFETY

15.1 Fire Strategy

Adopt a fire safety strategy to protect and retain historic fabric which minimises impact to significant interiors features and fittings.

15.2 Compartmentation and Services

Fire-resistant breaks across large voids within existing buildings to form smaller compartments reducing the risk of fire spread, as will dampers and fire breaks to pipe and duct services.

15.3 Fabric Interventions for Fire Resistance

Fire rated linings, fillers and seals can be considered to enhance the fire resistance of existing building fabric rather than replacement with modern proprietary materials and fixtures.

15.4 Fire Detection and Suppression

The positioning of fitments for fire detection and suppression installations should be carefully considered to minimise any detraction from the aesthetic value of significant interiors.

16.0 ASSOCIATED ISSUES WITH CONSERVATION AND REPAIR WORKS TO HISTORIC BUILDINGS

16.1 Improved Access For All

Changes to external building doorways and to the interior to improve access for all should be sympathetic to the building appearance and form. Access equipment and fittings should be carefully selected to enable retention of existing building features.

16.2 Natural Diversity and Protection Measures

Planning for repair and maintenance work should include assessment and survey if required to protect the natural diversity within the area and respect recognised protection measures for wildlife, flora and fauna. Further information should be sought from Scottish Natural Heritage and other groups such as Bat Protection League and the Royal Society for the Protection of Birds.

16.3 Security of Materials

Where metal theft is prevalent and deterrent measures are not appropriate, additional securing methods may be needed. In exceptional cases the use of a substitute material may be considered for specific areas, following the general appearance of the original detailing.

FURTHER SOURCES OF INFORMATION

Historic Scotland publications www.historic-scotland.gov.uk

search under these headings:

- Technical Advice Notes – traditional repairs and recommended building processes
- Short Guides – information and practical guidance on specific building conservation matters, aimed at professional and trade level
- Inform Guides – a series of A5 leaflets giving key information on common topics encountered when looking after traditional buildings, aimed at home owners to give a basic introduction to important areas of repair
- Guides For Practitioners – professional level guidance on specific building and construction matters
- Technical Paper Guides – practical research on building fabric, focussing on energy efficiency measures
- Refurbishment case studies
- Managing Change – Heritage Management Directorate publications on key building fabric elements
- Ancient Monument Guidance

Other sources

English Heritage	www.english-heritage.org.uk
Welsh Government Historic Environment CADW	cadw.wales.gov.uk
Institute of Conservation ICON	www.icon.org.uk
Scottish Lime Centre Trust, Charleston, Fife	www.scotlime.org
British Geological Survey	www.bgs.ac.uk
Lead Sheet Association	www.leadsheetassociation.org.uk
International Zinc Association	www.zinc.org.uk
Mastic Council	www.masticasphaltcouncil.co.uk
Copper Development Association	www.copper.org