CHAPTER 12

MATERIALS AND CONSTRUCTION TECHNIQUES

NEW OR RECLAIMED MATERIALS

12.1 South Cambridgeshire District Council supports sustainability and environmental issues as a general rule.

12.2 Over recent years there has been an increasing move to use recycled building materials, and in particular bricks, slates and roofing tiles. The decision whether to use salvaged or new (but normally traditional) materials for Listed Building related work needs to weigh the circumstances of each case against the factors set out below.

12.3 Responsible salvaging of resources helps achieve sustainability objectives. When repairs are being carried out on a Listed Building it is important that materials are carefully removed, stored, and reused (if applicable). When whole or parts of buildings are demolished materials can be used successfully for new structures on the same site. Salvaged materials are particularly valuable in making repairs to Listed or even historic buildings that match the existing and this use should be given priority. For example, matching reclaimed roofing materials can be used successfully to patch a small area or make up for deficiencies when re-roofing.

12.4 On the other hand, the demand for second-hand materials can encourage theft, particularly when they are in short supply. It is important not to encourage the sort of markets in salvaged materials that lead to the needless and damaging stripping or demolition of historic buildings. Materials should only be reused if they are of good quality and fit for purpose and are appropriate to a building's construction, type and location.

12.5 The changes made to historic buildings over time are usually reflected in their materials and details. Using new materials, as opposed to salvaged ones, means that this tradition is continued as recent additions can be clearly read.

12.6 When carrying out major works to a Listed Building, such as adding an extension, the preferred approach is to use new materials. The new works will then be honest and 'of their time'. In many cases the new construction and materials will be of a traditional type such as brick, tile and stone. The use of new but traditional materials, preferably from a local source, helps promote their production and availability.

12.7 In the particular circumstances when modern design is appropriate, traditional materials can still be used, sometimes in new ways. Modern materials may also be appropriate in these situations, and can successfully be combined with traditional ones.

ROOFING MATERIALS

12.8 Many historic buildings within South Cambridgeshire still retain their original roof structures, which undulate or appear wavy. Most historic roofs are still structurally sound and any movement that is evident occurred early in the buildings history. This previous movement adds to the charm and character of the building. Roofing materials vary throughout the region and can also denote a hierarchy of building importance.

12.9 Different roofing materials require different roof slopes in order to shed rainwater and for durability. The pitches of roofing materials found within the district are:

- **Slate**: 25 degrees and above
- **Thatch**: 55 degrees and above
- **Pantile**: 35 degrees and above
- **Plain tile**: 40 degrees and above

12.10 One of the most common problems of a tiled roof is slippage due to rusting metal fixings and decaying battens. Routine maintenance is required to monitor the roof. The best solution is typically to relay the tiles, salvaging and reusing as many of the originals as possible.

12.11 Machine made tiles are more prone to frost damage than hand made tiles as the surfaces are more even and regular allowing moisture to be trapped. The Council encourages the use of traditionally produced hand made materials.

12.12 If the condition of the roof covering and structure require a complete stripping and overhaul, the new work will be required to comply with current Building Regulations. Careful consideration should be given to ensure that airflow and ventilation is not restricted and a modern breathable lining is used. In addition, the location of insulation should be discussed with a Historic Building or Building Control Officer to ensure the best solution is found.

12.13 If the quantity of salvaged tiles or slates is insufficient to re-roof the entire building, it may be best to reuse them on the most prominent and important part of the building, providing new on the other roof slopes.

Slate

12.14 Welsh slate was produced in great quantities during the Industrial Revolution and was transported to all parts of the country with the advent of the railways in the middle and latter half of the 19th century. Its fine grain meant it could be split into thin even thicknesses and mass-produced in uniform sizes, and a roof slated with this material appears thin, smooth and precise. Colours range from greys to blues

and purples. In most cases one type of slate was used, giving a pleasing natural colour and texture to the roof. However in the late 19th century different coloured slates were sometimes combined to create a decorative effect. Ornamental slates, such as fish scale slates, were also used often in combination with decorative ridge tiles.

12.15 Slate roofing is a double-lap covering laid in bonded courses on pitches from 30 – 35 degrees, though large Welsh slates can be satisfactorily laid at lower pitches. Usually each slate is fixed by two nails in the centre to prevent them being lifted by the wind. Slates may be fixed to battens or to boarding, which is often found in traditional roofs. Some slates, generally on prestigious buildings, are laid in diminishing courses with the largest slates at the eaves and the smallest at the ridge. Good slates will last for generations, but a slate roof covering can fail due to corroded fixings. When carrying out repairs or re-slating, good quality aluminium alloy or copper roofing nails should be used. If the fixings perish but the slates are still in good condition, they should be salvaged and re-laid. If replacement slates are required they should match the existing in colour, size, thickness and texture.

12.16 Traditionally ridges and hips were finished with lead rolls although mitred slates with concealed lead soakers were also used. More recently red or dark grey clay ridge tiles have been used and whereas these may be acceptable on outbuildings and cottages they are not appropriate for larger houses. Decorative terracotta ridge tiles and finials are a feature of some Victorian buildings. Where possible these should be salvaged and re-used following roofing works. Second-hand ornamental ridge tiles are in short supply but replicas are available from some roofing-tile manufacturers.

12.17 The Council supports the use of locally sourced materials from within the United Kingdom, particularly natural Welsh Slate on Listed Buildings. Slates from other parts of the world are unlikely to be appropriate on Listed Buildings due to the colour, texture, size, thickness, quality, weathering capability and environmental impact.

Pantiles

12.18 Clay pantiles appear to have been introduced into this country from the Netherlands in the 17th century and by the end of the 18th century their manufacture was well established in East Anglia. Local clays produced mainly yellow and pink tiles, which were made by hand until the mid 19th century when machine pressing was introduced. The size of pantiles was fixed by statute under George I at 13 x 9 inches. However, the actual profile of the tiles – the depth and form of the “S” shape – did vary and later forms had triple rolls and even interlocking flanges. This may lead to difficulties in repair work where a small number of compatible tiles are required to replace damaged ones. It is still possible to obtain new traditional clay pantiles and a list of sources is available from the Conservation Section.

12.19 Pantiles are designed to be laid to a single lap and a lower pitch (35 degrees) than plain tiles. They therefore provide a roof covering which is relatively light and which allows savings in roof timbers over, say, plain tiles. The single lap arrangement necessitates that each tile has two mitred corners, which prevent a build-up of thickness of tiles where four adjacent tiles meet. Pantiles have been vulnerable to penetration by driven rain and snow, which, in the past, led to them being laid on a thin layer of reed and haired plaster. In common with other types of roof, pantiled roofs are liable to water penetration at eaves, verges and abutments. General failure of battens and fixings is not uncommon, particularly in previously thatched roofs of steep pitch. Pantiles are sensitive to movements in the roof structure. Over many years, quite natural distortions such as sagging of the rafters, affects the laps between tiles allowing water penetration. This often leads to the tiles being pointed with mortar to such an extent that the roof looks unsightly.

12.20 Pantiles are best suited to roofs of simple form and can be used over a range of pitches from 35 degrees to 47 degrees, but may be found on steeper pitches where pantiles replace an original covering of thatch. Traditionally they were used on vernacular buildings such as agricultural buildings and cottages. Details that demand cutting and changes in plane such as hips, valleys and mansards, are unsatisfactory both visually and technically. Dormers therefore present problems and where new ones are to be introduced it is best to employ the traditional catslide dormer, which should be as small as possible in breadth and height if they are not to look awkward. Ideally the dormer roof should start well below the ridge and the window cill should be at eaves level.

12.21 Normal practice at the eaves is to bed the lowest course of pantiles on an under cloak of plain tiles giving sufficient overhang to shed water into the gutter. The spaces between the rolls in the tiles should be filled with slips of tile and pointed. The pantiles should rest on the under cloak to avoid a thick bed of mortar which is unsightly.

12.22 Half round ridge tiles are normally used, bedded into lime mortar. The undulating surface of the tiles requires a thick bed in the channels, which can look unsightly. The beds should be made as shallow as possible with tile slips or dentils inserted in the channels.

12.23 Verges present the greatest problems and plain left hand and right hand verges require different approaches. The left hand verge requires careful attention because the tile profile sweeps up to the left. Ideally half round or double roll verge tiles should be used bedded in mortar on a plain tile under cloak. If matching verge tiles cannot be obtained, the only alternative is to make the verge in lime mortar with plain tile slips, but again a minimum of mortar should be used. The right hand verge should be bedded on a plain tile under cloak in lime mortar and the upper course of plain tiles must be narrow to allow nailing of the pantiles. Where the gable leans in or out the tiles must be carefully cut and may be angled slightly to reduce the amount of cutting.

12.24 The traditional detail for an abutment is a mortar fillet or tile. In this situation, leadwork may sometimes be less visible, so that, where a roof abuts a brick parapet or wall a stepped lead flashing taken over the adjacent tiles will make a better joint. Where the wall is rendered the flashing may be tucked under the render.

12.25 The most satisfactory detail around chimneys is a lead flashing and apron. However, clay roof coverings look better without extensive leadwork so that the alternative of a mortar fillet with a layer of cut tiles and dentil slips may be preferred.

12.26 Hips and valleys are rarely encountered and should not be used in new work. In the case of a hip, the bonnet hip tile must be carefully bedded with as little mortar as possible and cutting and nailing tiles carefully done. Valleys are usually carried out with a lead channel and tile under cloaks.

12.27 Where re-roofing is required pantiles should be carefully salvaged for re-use and where additional tiles are required the use of second-hand tiles or new with a matching profile may be appropriate. Where difficulties are encountered in obtaining a match it may be possible to use different tiles on different pitches or new clay tiles on an inconspicuous slope.

Plain Tiles

12.28 The traditional roofs of hand-made buff tiles are one of the most important elements in the appearance and identity of the South Cambridgeshire area. Produced from gault clay, these tiles were manufactured until the end of the 19th century and were the predominant colour until the 20th century. A shortage of buff tiles led to the introduction of red tiles on historic roofs and this has become known as a “Cambridgeshire Mix”. Buff plain tiled roofs are found throughout the district but are more prevalent in the north particularly along the Fen Edge. Historically plain tiles were reserved for high status buildings such as manor houses, rectories and farmhouses and were normally laid on pitches of 45 degrees or more.

12.29 When repairing peg tile roofs the existing tiles should be carefully salvaged for re-use. Tiles, which are not sufficiently intact to serve as they are, may if sound, be trimmed to form half tiles for details. New or second hand tiles to make up any shortfalls should match the existing profile, texture and colour variations. Salvaged and new tiles should be mixed as randomly as possible.

12.30 Tiles will normally be laid over roofing felt, which should be “breathable” to reduce the risk of decay to historic roof timbers. Where, as in the case of some agricultural buildings, the tiling is visible from below, the felt should be omitted. If felt is used the roof voids should be ventilated. Modern treated, sawn battens will always be used for nailed tiles and be of a size depending upon the space between the rafters and gauged to give a headlap of 75mm. Where tiling is visible from below, riven

laths should be considered and tiles hung on oak pegs in the correct historic fashion.

12.31 Traditional peg tiles are not even in shape and often require to be sorted by a practised eye to produce an even lay. Also tiles traditionally fixed with a single oak peg will settle over time to a more even lay. This cannot happen when nails rigidly fix them.

12.32 Peg tiles have holes made by hand and are not uniform. It is preferred that traditional methods and materials be used on Listed Buildings, including the use of pegs. For modern practice each tile must be nailed into the centre of the batten. This will ensure a good fixing and the nails of the tiles will not line up, hence avoiding a regular and precise appearance. Nails should be of aluminium alloy or copper. Steel is too hard to allow safe removal of tiles for later repairs.

12.33 Mortars were traditionally used for pointing verges and bedding ridges and tile fillets. It is most important that hard, cement-rich mortars are not used as they will crack and allow water to enter. They will also permanently stick to the tile preventing its re-use in the future. Torching with lime/hair mortar to the underside of the tile joint at the batten was also a traditional practice.

12.34 Traditional details should be used on all historic roofs. If original features or details exist and are not capable of being retained, recording of historic details should be undertaken before any repairs are carried out and then replicated. Where later inappropriate repairs are to be removed the traditional details should be restored. Modern practice uses a tile-and-a-half in alternate courses to make up a verge, which is an inappropriate detail on Listed Buildings.

12.35 Old or matching half tiles should be used in all cases. Code 3 or 4 lead soakers should always be used at abutments. These go between the tiles and are not visible. Abutments with a render face such as the cheek of a dormer are formed with tiles and half tiles in alternate courses, which are tilted up at the abutment by a dab of lime mortar. This tilt leads water away from the weakest point of the detail. Abutments with brick are formed in a similar fashion but a tile fillet bedded in lime mortar covers the junction of tile and brick. More rustic roofs may have just a lime mortar fillet. Higher status and later buildings may have lead flashings.

12.36 At the eaves old tiles should be cut to form the short tiles in the under cloak. They will need to be drilled for nailing and it is important to follow any existing traditional detail. Gutters will normally be held on rafter irons or rise and fall brackets. The roof must discharge into the centre of the gutter. Hipped dormers and half hipped upper gables should not change pitch at the eaves.

12.37 Laced valleys are the traditional and most attractive detail. They are also most effective at shedding water. Laced valleys call for the utmost skill and can cause problems if attempted by inexperienced roofers. Valley tiles are not normally acceptable on historic roofs.

12.38 Matching clay hogback ridges must be used. Salvaged originals for historic roofs are becoming increasingly rare so that new tiles will usually be required. Modern half-round tiles will be obtrusive and spoil the appearance of the roof.

12.39 Plain tile roofs require the use of matching clay bonnet tiles or mitred hips. Bonnet tiles are nailed to a hip rafter. Half-round ridge tiles or hogback tiles must be avoided on short slopes such as dormers, but matching hogback tiles have been used on fully hipped main roofs.

12.40 Gambrel, or mansard, roofs have a small change in pitch between the two slopes on each side. Modern practice is to overcome this by the use of an intrusive lead flashing but traditionally the change in angle was covered by using two rows of cambered peg tiles (a small proportion of hand made tiles will always bend after traditional drying and firing).

Decorative Roofing details

12.41 Always retain decorative features such as ridge crests and gutter supports. Original drainpipes and gutters should be repaired or replaced with the same materials as the original.

WALLING MATERIALS

12.42 Within the district, there are many different types of traditional buildings constructed from a variety of materials, which were produced or found locally.

Timber

12.43 The timber framing tradition spans several hundreds of years. Earlier buildings dated up to the 1600s tend to be survivals from the higher end of the social scale. Constructed mainly from oak and elm, they are usually the work of skilled craftsmen using substantial timbers. Exposed timber frames and close studding often distinguish high status buildings. More humble cottages and barns have survived from the 17th and 18th centuries, and these make up the majority of the remaining timber framed buildings date from this period. By their nature the best quality timber was not always used. Frames may consist of hedgerow timber in the form of poles or of roughly sawn with a lot of sapwood. This increases the likelihood of decay and makes repair more difficult. Timber framing extended into the 19th century and these later frames were often of sawn softwood.

12.44 Framing, or load distribution, is of the post and truss type. In this form the building is divided into bays by posts, which support the roof trusses, which distributes the load of the structure. The majority of the roof load is transferred to the trusses by way of the purlins. The framing within the bays in this system is lighter infilling. The most important structural characteristic is the method of jointing which leads to a flexible, pin-jointed structure. This, combined with the original use of “green” timber usually means that movement and distortion will have occurred.

12.45 Frame members and joints can fail for the following reasons;

- Decay due to being overstressed or being altered
- Failure caused by inherent problems of design
- Quality of the materials employed
- Later changes to the use of the building
- Poor maintenance
- Changes in ground and environmental conditions

12.46 A framed building must be considered as a whole structure of related parts.

12.47 Steps should be taken to cure any problems affecting the integrity of the timber frame by ensuring that problems of water penetration, ground conditions and structure are resolved before timber frame repairs are undertaken. When repairs are undertaken they should be the minimum necessary to ensure the stability of the building and should be carried out using matching materials, traditionally spliced and jointed. Structural repairs using steel may be considered acceptable if it is the only option available and recommended by a structural engineer.

Wattle and daub

12.48 This was the traditional way of infilling the spaces between the timber frame until the fashion for plastering over exposed timbers, which began in the late 17th century, gave way to lath and plaster in the 18th century. Wattles (oak, hazel or other readily available hardwood sticks) were fixed vertically between timber studs and tied to horizontal staves known as ledgers, with twine, briar or other natural material. In tall narrow panels where there was no room for upright staves, short laths were wedged horizontally between grooves in the side of the timbers. The panels were then daubed on both sides with a mixture of clay, dung and chopped straw and finished with limewash.

12.49 Minor repairs can be carried out using salvaged or new daub but where a whole panel has become detached it may be possible to re-secure it using a system of screws and washers or wire ties. Sometimes loose areas can be held by making good around the edges or by capping the top. Where this is not possible the loose daub should be salvaged, broken up, mixed with a little water and chopped straw and reapplied to the wattles.

12.50 Where necessary, reinstatement /replacement of wattle and daub infill panels should be carried out using oak or hazel wattles tied with twine. Daub can be made on site from locally sourced chalky marl mixed with chopped straw or bought ready made from specialist suppliers. To avoid shrinkage, this should be as dry as

possible and when dry, cracks should be stopped with a similar mixture omitting the straw. Panels should be finished with at least three coats of limewash.

Lath and plaster

12.51 This method differs from wattle and daub in that it was applied directly onto the internal and external face of the timber frame and the space between timbers was left as a void. Early laths were generally oak and were split or riven by hand and nailed horizontally across the timbers with a gap of approximately (10mm) between each lath. In the late 18th and 19th centuries sawn softwood laths were commonly used. Lime and hair plaster was applied with a wooden float; the gaps between the laths provided a key and the hair gave strength and prevented shrinkage. The plaster / render was normally applied in three coats; hair was omitted from the final coat. The traditional finish was limewash, which could be coloured by the addition of natural pigments. External render was usually finished with a smooth float finish but in the 19th century roughcast render, which had gravel thrown onto the final coat, was often used to finish cottages. In the villages to the east on the borders of Suffolk and Essex there are a few examples of pargetting, decorative plasterwork formed by simple tools or moulded by hand.

12.52 Daub, the same mix that was used for earlier infill panels, was a cheaper alternative to lime and hair plaster and was often used in humbler buildings such as cottages. It was normally applied in one or two coats and was either finished with limewash or a thin skim of lime plaster.

12.53 Failure of internal plaster and external render is usually due a lack of maintenance and poor protection, the common results being disintegration of render and separation of successive coats. The latter may also be due to loss of “key” as a result of differential expansion between the render and background, or structural movement. When making repairs, further damage may be caused if work is poorly specified or undertaken using inappropriate repair methods and materials. It is therefore important to identify probable causes before attempting any repair. Where failure is localised it is usually possible to implement minor repairs without removing large areas of lath and plaster / render. Existing laths should be retained and where replacement is necessary due to failure of the laths, matching riven or sawn laths should be used. Guidance on repairs including mixes, preparation of background and application can be obtained from the SPAB website and specialist suppliers.

12.54 Listed Building Consent will normally be required for re-rendering unless it is confined to a small area of repair.

12.55 The traditional finish for lime and daub rendered buildings is lime wash. However, lime wash will not adhere to buildings which have had modern masonry paint used. In these situations, high quality micro porous masonry paint can be used instead.

Brick

12.56 Brick has been used as a building material in parts of Cambridgeshire since the 15th century but was generally only used on high status buildings. The earliest examples in South Cambridgeshire are found in the Fen Edge villages and date from the draining of the Fens in the mid 17th century. The early buildings are all constructed in red brick but in the 18th and 19th centuries local gault clay, which produces a buff coloured brick, was worked on a large scale. This clay produced at first a white brick that weathers grey, then later in the 19th century, the characteristic yellow "Cambridge stock" brick.

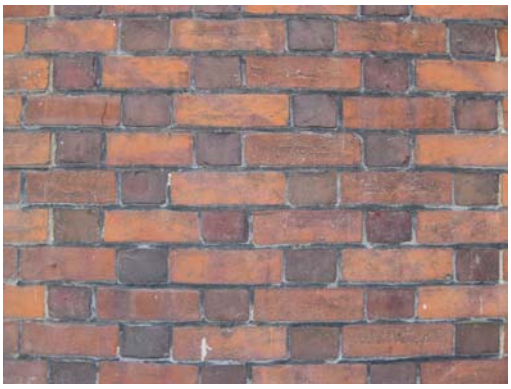
12.57 As bricks became cheaper and easier to transport they became widespread and were used for all types of buildings but particularly for agricultural buildings, cottages and farmhouses.

12.58 Repairs to historic brickwork should always be carried out using matching materials. Bricks should match the existing in colour, size and texture and mortar should match in materials used, strength, colour and texture. Original mortar can be analysed to determine the ratio of lime to aggregate (including size) and can often identify the source and type of the aggregate. Where individual bricks are badly decayed they can be carefully cut out and replaced with new matching bricks. Cracks can be "stitched" with new bricks and in areas where a greater degree of intervention is required walls can be strengthened with the addition of stainless steel ties inserted in the bed joints.

12.59 Rebuilding should only be carried out when brickwork is in danger of collapsing and all methods of repair and strengthening have been considered. Listed Building Consent will be required. Existing bricks should be carefully salvaged and reused and any shortfall made up in matching bricks. Bricks should be laid in lime mortar, matching the bond, joint details, mortar mix, colour, etc.

Bond Patterns

12.60 Bricks were laid in lime mortar, at first in English bond and later, in the 18th century, in Flemish bond. Some Fen buildings have Dutch gables, reflecting the 17th and 18th century links with the Low Countries. Details include sash windows set in reveals over shallow stone cills and with gauged or segmental brick arches, brick bands between the ground and first floors and brick dentil or saw tooth cornices. Occasionally bricks of a contrasting colour were used for the brickwork around the windows and for quoins, cornices and horizontal bands.



Flemish Bond

English Bond

Mortar Joints

12.61 Repointing is only needed where mortar has become loose, powdery, decayed or eroded and water has begun to penetrate the joints. Unnecessary repointing can be damaging. A recessed joint or mortar that is "chalky" and soft does not necessarily indicate the need for wholesale repointing. If mortar is not easily raked out by hand to a depth of at least twice the width of the joint, repointing is not necessary. Power tools should never be used to remove existing mortar – if they are needed then the wall does not require repointing. Lime mortar should always be used, as cement mortar does not allow the wall to "breathe" and to tolerate small movements in the structure of the building. Mortar that is harder than the brick will increase the risk of frost damage and cause the bricks to fracture or "spall".

Clay lump / Clay bat

12.62 Clay lump walling is a type of earth construction. It differs from other forms in that the material is formed into blocks and left to dry before construction, rather than being built as one solid mass. Its use is confined almost exclusively to Norfolk, Suffolk, Essex and Cambridgeshire, where it is found in the clay marl areas of South Cambridgeshire. It is thought to have originated in Great Shelford c.1800 and was used extensively in the 19th century mainly for the construction of humbler buildings including cottages, boundary walls and agricultural buildings.

12.63 The blocks are formed from clay mixed with water, barley straw, sand and often a small amount of manure, pressed into moulds approximately 450mm x 225mm x 225mm, then removed from the moulds and dried in the sun. When dry they are laid like bricks using clay slurry or weak lime mortar with a brick or flint plinth to protect them from damp. For similar reasons, clay lump buildings are invariably designed with overhanging eaves, often with thatched roofs, with surfaces being rendered and limewashed. Some agricultural buildings were tarred, as this was cheaper than render and prevented animals from licking the surface. Boundary walls were protected by a coping of tile or thatch.

12.64 It is most important to protect clay lump walling from damp penetration; failure to do so will ultimately lead to disintegration. Regular maintenance of roofs, plinths and surface coating is therefore necessary to prevent water ingress and long-term damage. Repair is relatively easy as faulty blocks can be cut out of the wall and replaced with new blocks either made on site or purchased from a specialist supplier. Occasionally salvaged blocks from another site can be used. Minor repairs such as open joints; cracks and small holes can be filled with fine clay tamped home with a rod, a soft lime mortar or a clay and straw mixture.

12.65 Lime render should be repaired but where this has been replaced with a hard cement based render, consideration should be given to re-rendering with a soft lime mix. Traditionally fixing wooden pegs into the blocks and looping string or tarred twine between them provided a key for the render. This method is still carried out today. The use of expanded metal lath is more common, although fixing this can be a problem.

Clunch

12.66 Clunch is a soft limestone from the Lower Chalk found in the southwest of the district. Historically it was quarried in Little Eversden, Harlton, Barrington, Orwell and Haslingfield and was used for the construction of churches, agricultural buildings, dwellings and boundary walls. Apart from the medieval churches the majority of the surviving clunch buildings date from the 19th century although several early domestic buildings have finely carved clunch fireplaces. Clunch provides an even consistency and is easy to carve.

12.67 Until the 18th and 19th centuries clunch walling was mainly coursed rubble with larger stones for the quoins; carefully worked clunch was confined to windows, door heads and similar features. In the 18th century walling became more regular and by the 19th century ashlar (large dressed blocks with fine joints) was the preferred method of construction for all types of buildings although some agricultural buildings were still built from clunch rubble.

12.68 Like clay lump, clunch is susceptible to damp penetration and walls were usually built with a brick plinth and overhanging eaves, often with thatch, slate or pantiled roofs. Rubble walls were usually rendered and limewashed while ashlar was not given a surface treatment. A coping of tile generally protected boundary walls.

12.69 It is most important to protect all walling from damp penetration; failure to do so will ultimately lead to disintegration. Regular maintenance of roofs, plinths and surface finishes is therefore necessary to prevent water ingress and long-term damage. Repair is relatively easy as faulty blocks can be cut out of the wall and replaced with new purchased from, a quarry. Minor repairs can be carried out using lime mortar, tile or stone indents.

12.70 Clunch, like all stone, has a limited life. Its decay may impair the aesthetic appearance of a building or affect its structural stability, and proper remedial measures will be needed. Surface scaling is characteristic of clunch ashlar and it may be necessary to remove friable material with a stiff bristle brush and consolidate the surface with limewash or a shelter coat (a coloured surface treatment of lime and fine sand or stone dust). Cementitious render and masonry paint should never be used, as moisture trapped behind an impervious membrane is unable to evaporate from the wall and will damage the surface. Repointing and repairs to small areas can be carried out using a lime mortar no stronger than the clunch. For larger repairs it may be more appropriate to apply a lime render or replace stone.

Flint

12.71 Composed almost entirely of silica, flints developed as a result of chalk deposits and are found mainly in the south eastern half of the district. Although unrelated to chalk, flint originated from marine organisms with skeletons of silica that after the creatures' death dissolved into the chalk and were re-deposited in a more stable form as flint nodules. The traditional form of flint walling was to lay rough nodules of flint in beds with one side crudely faced or knapped. However, flint can be finely knapped into small blocks and decorative patterns created. Both methods can use brickwork to frame window and door openings or to turn corners. Whole flints were also used and some buildings and boundary walls are composed solely of unknapped nodules.

12.72 Flint has a long history of use and was used extensively in the Middle Ages for the construction of churches. It was seldom employed after the middle of the 16th century, except for a brief revival in the 19th century. By the 17th century only humbler buildings, such as cottages and farm buildings, were built of flint: a vernacular tradition that continued until the late 19th century. In addition to buildings, flint was used extensively for the construction of boundary walls. Traditional walls consist of two parallel leaves of flintwork containing a central void filled with flint rubble. The walls are often bonded at intervals with long flints that tail into the rubble core. Flints were laid in courses where nodules were of an even size, or randomly which utilised flints of different sizes. As flints fitted loosely together, large quantities of mortar was needed to fill the spaces and construction was very slow as each lift had to be allowed to dry out slowly to achieve a firm set in order to prevent possible failure. Shuttering was frequently used to support the flintwork while the mortar dried and to ensure that a straight edge was maintained. This method resulted in an even finish but with wider joints than "freehand" construction.

12.73 Repairs to flint walling require considerable skill and should be carried out only by a specialist contractor. Localised displacement of flint can be easily repaired using the salvaged flints laid in a lime mortar. Mortar should match the colour and surface texture of existing mortars. Repointing should only be carried out when the existing mortar has been eroded to such an extent that the flints are likely to

become displaced. Where large areas of facing flintwork have become detached from the backing (normally flint but sometimes brick) stainless steel brick ties or roof tiles can be inserted to provide reinforcement between the two faces. Rebuilding is a last resort and then as much of the original flint should be re-used as possible. Detailed records of the remaining original construction should be made before work commences, to ensure that the reconstruction is a faithful replica. Planning permission and Listed Building Consent will normally be required.

FLOORING MATERIALS

Timber

12.74 Medieval floorboards were predominantly oak and were either riven, axed or pit-sawn in widths of up to 450mm or more. The boards tended to be laid parallel to, and rebated into, the upper edges of floor joists which were laid flat. Elm boards, typically (390mm) wide, were common in the 17th century and softwood came into general use in the 18th century at a time when floors began to be wholly or partly carpeted. Tongued and grooved boards appeared in the 1820s.

12.75 Old boards can be repaired in situ by piecing–in sections of the same species of wood, with matching grain. In rare situations where a boarded floor is beyond repair, new boards can sometimes be laid over the old as a means of retaining the original floor as part of the archaeology of the building. However, careful thought needs to be given as to how the new floor level will affect adjacent architectural features such as doors, skirtings, architraves, thresholds, hearths etc. and whether structural problems may also arise due to the increased height.

12.76 A sloping floor that has reached an uncomfortable state can sometimes be improved by fixing tapered firring pieces to the top of the existing joists. This may enable boards that have not become too distorted, to be re-laid as an almost level surface. A floating floor may be considered to provide a level surface for new materials to be laid, however it may have an impact on the skirting boards, doorframe and door height.

12.77 Early ground floor boarded floors were often nailed to rough joists laid directly on earth, an arrangement that could encourage decay due to excessive dampness. Later boarded floors were laid on joists supported on brick piers or sleeper walls leaving a void usually with the provision for ventilation at the perimeter. It is important to ensure that air bricks or other means of venting such voids are kept free of rubble, earth and plant growth and that contact between timber and walls is avoided to prevent damp.

Brick and pamment

12.78 Most early brick and pamment (clay floor tiles) floors were bedded directly on the earth and have acquired a protective and attractive patina over the years. Their surfaces are seldom level but can contribute to the aesthetic value of a room.

There is a strong argument in favour of retaining a brick floor with minimal disturbance. Many old bricks are of non-uniform dimensions and of irregular thicknesses due to wear. It can be difficult to lift and reverse them and set them to the level of the renewed lime/sand base. Traditionally the joints between floor bricks are not filled with mortar, but are closely butted. The lack of mortar will allow any moisture present to evaporate through open joints instead of through the bricks.

12.79 When there is no alternative and the floor must be relaid, the bricks should be set close together on a bed of lime and sand above a well compacted hardcore. A lime / sand mix is brushed into the narrow joints, which will solidify.

12.80 Relaying old bricks above a dpm can affect the appearance and durability of the floor. Salt contamination, in the form of white crystals, originally absorbed from the subsoil, may migrate to the surface and may in turn absorb moisture from the air and create a damp floor. Regular brushing may become necessary to reduce the deposits.

FINISHES

Paint (internal and external)

12.81 Vernacular buildings were usually decorated simply, using materials found locally. The most common of these materials was limewash. Limewash (discussed in greater detail later in this chapter) is a durable and breathable material, used externally on timber framed or rubble stone buildings and internally applied to partitions. Traditionally seen in a white colour, it is capable of being tinted or pigmented to create an earthy colour- of reds, oranges or pinks.

12.82 Grander buildings, from the Georgian period onward, would have been finished using higher quality materials, such as lead based or oil based paints. Soft distemper is a water-based paint that primarily comprises a white base pigment bound with glue size. This basic mix can be tinted with pigments to give a wide range of colours, including blues, greens and various earth tones. Soft distemper has a velvety, matt finish and is used almost exclusively internally due to its water solubility. Soft distemper is not to be confused with oil-bound or ‘washable’ distemper, an oil-based water paint that was the forerunner to modern emulsion.

12.83 Lead paint comprises lead pigment, usually lead carbonate bound in oil. The pigment creates either a white paint or a base for tinting with colour. Historically, linseed oil was the usual binder and turpentines the thinner, their proportions determining whether the finish was matt or semi-gloss. From the 20th century, the flow, gloss and drying time was improved by using an alkyd resin medium and the addition of titanium dioxide pigment boosted the covering power.

12.84 It can be worth finding out what was used on a building, which is done through paint analysis. A cross section of the material is analysed, possibly chemically tested, to determine what was used previously, including the colour and the material of the layers applied over the years. This information can inform those restoring a building or room back to an original decorating scheme.

12.85 Listed Building Consent is generally not required to repaint the inside or outside of a Listed Building if it has been previously painted. However, Listed Building Consent is required where the surface has not previously been painted. In addition, it is important that an appropriate product is used. As indicated previously in this document, it is essential for a historic building to breathe and retain its flexibility. In order for this to be maintained, any paints should be vapour permeable - porous and breathable. The main difference between modern and traditional paints is that modern paints are made with synthetic and chemical materials whilst traditional paints were made from natural materials.

12.86 It is possible that due to the age of most Listed Buildings, there have already been inappropriate materials used on the building. For instance, a non-breathable paint could have been used on the walls, such as an acrylic paint, which contains a plastic-like substance.

12.87 Any material that will trap moisture within the wall will prevent natural evaporation, which can lead to damp, condensation or mould growth. Good quality finishes, such as lime wash or linseed oil paints can last for years and allow the natural evaporation of any moisture. Rooms where the moisture content is high should have the appropriate finish to prevent mould and mildew from growing.

12.88 Further advice and information on which paints are appropriate can be found on the English Heritage or SPAB websites.

CLEANING METHODS

12.89 Cleaning finishes off of materials can prove difficult, as the act of removing the finish could cause damage to the surface of the material. Removing paint off of surfaces such as brick or timber, if not carried out properly, can result in the loss of the brick face or remove finer details from the timber. It is critical that each case be reviewed to determine what, if any, method is appropriate. This section does not deal with the cleaning of monuments, war memorials, or other freestanding structures, but aims to provide a general overview of the options for cleaning timber or masonry, either internal or external.

12.90 Paint is one the most common finishes people seek to remove. Many years and layers of paint can be unsightly or even cause problems through the use of acrylic paints. Also common is the removal of cementitious or pebbledash renders. These too can be visually displeasing and lead to problems with moisture being trapped. Cleaning the surface of pollution and soot is another scenario, however,

less common in South Cambridgeshire. Paint or render are both capable of being removed, however, selecting the appropriate method of removal is vital.

12.91 It is important to first try and assesses the area in question, and asks some basic questions:

- Are there areas where the finish has started to come off already?
- What does the sub-surface look like?
- What is the structure of the building?

12.92 On the market today are many solutions, remedies, etc. but most are too harsh and inappropriate to historic fabric. There are air or water high-powered treatments, the use of solvents and even lasers are being used to assist in cleaning delicate surfaces. The Council cannot recommend a particular system or product, but The DOFF and JOS systems are widely used and have been proven to be gentler on historic fabric. However, any cleaning of a Listed Building will require Listed Building Consent. Contact the Council for advice. It is important not to saturate any historic building.

12.93 Sandblasting is inappropriate to any part of a Listed Building and will not be supported by the Council.

The JOS system

12.94 JOS is essentially a wet, mild jet abrasive cleaning system, made suitable for conservation applications by a controllable low pressure vortex of air, water and granulate, swirling almost parallel to the surface of the stone. The swirling action cleans away unwanted matter more carefully than conventional right-angle impact systems.

12.95 JOS is a chemical-free and environmentally friendly system, in which dust and slurry levels are kept to an absolute minimum. It is gentle enough to be used on delicate surfaces, including mouldings and areas of carving. Experience has shown that this system is unsurpassed in its efficiency in removing black sulphate skin from limestone.

The DOFF system

12.96 A normal water supply is taken into a high-pressure pump, and the pressure increased to the appropriate level before it enters the hotbox where, if necessary, the temperature is increased up to a level of 150°C. This is then fed through high pressure heat resistant hoses to the nozzle. Special jets, efficiently directed to the surface, cut through and remove unwanted matter.

12.97 The ability to maintain high temperatures and low pressure is a particularly special feature of the DOFF system. However, simultaneous high pressure and high temperature can be introduced if necessary for the removal of paint and other heavy coatings. Heating of the surface is controlled and it dries within minutes. Depending upon the requirements of the system, a range of appropriate lances and nozzles are available.