HOW TO REPAIR
HISTORIC BUILDINGS

First published 1987
Revised 2001

Planning Services
Newark and Sherwood District Council
Kelham Hall
Newark
NG23 5QX

Tel: 01636 655860
Fax: 01636 655899
Email: planning@nsdc.info
Web site: www.newark-sherwooddc.gov.uk
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This booklet has been written to guide those who care for old buildings towards high standards of maintenance and repair. These buildings are an important part of our heritage. They tell us how our forbears lived and worked; they illustrate the localised building skills of long gone craftsmen, and are built of local materials. They give the area its distinctive character which marks it out as different from other regions of the country. The details within this booklet will help owners maintain this valuable heritage.

If you have applied for any historic building grant from Newark and Sherwood District Council, the work done to your building must reach a certain standard before the grant can be paid. This Booklet sets out what you must and must not do if the work is to qualify for payment.

All applicants for grant are expected to have shown their architect or other agent, and all their contractors, this booklet before tenders are obtained. Further copies can be supplied if needed, although a charge will be made.

Originally written by Mike Hurst, this booklet was rewritten and revised by Stewart Squires. The assistance of both Graham Beaumont and Brian Allebon in the revision is gratefully acknowledged.
1.0 INTRODUCTION

1.1 The Purpose of this Booklet

Since the beginning of civilisation there have been two kinds of building: the monumental and the vernacular.

*Monumental buildings* - Stonehenge, the Pyramids, the Parthenon, the Cathedrals and the great country houses - were conceived and built with different priorities and on a different scale from the vernacular. Works of architecture, they are the brick and stone equivalent of paintings and sculpture. Dealing with their repair is very much a matter for professionals. This booklet is not particularly concerned with them although the general principles are relevant.

*Vernacular buildings* are the every day structures: cottages, farmhouses, industrial and agricultural buildings, and the smaller country houses and churches. In any period they are more common than the monumental ones. They were, however, designed for a shorter life, so as you go back in time they become more rare.

Although a seventeenth-century cottage may not be an outstanding work of art like a great house such as Thoresby Hall, it may be as rare, and it is equally important to keep it as a record of how our predecessors lived. It is especially important to keep everything about it that is original, and to avoid destroying its historical character by well-meaning modernisation.

Each historic structure is unique. It demonstrates identity and local distinctiveness, a tangible and irreplaceable record of local history; an accessible record; a complex reflection of the social and economic factors of a period and a chronological sequence of events in the building life. This cultural significance enables us to relate to the past. The objective is to assure the continued existence of a structure by ensuring its utilisation for a further period.

Of course it is not practical to avoid modernisation altogether. Earlier modernisations can often be traced from the building fabric. Buildings have to be used and lived in, in the present day, and they have to be worked on by present day builders under our economic conditions. But, with the right advice, and using the right techniques, an old building can provide for a thoroughly practical use for today, which still keeps its historical character. This booklet is produced to guide owners of historic buildings in the right direction to attain this.

Monumental buildings are strictly a matter for professionals, but owners of less grand buildings can also employ them too. There are many good reasons for doing so. An architect may be able to usefully assist even with minor repairs to any historic building can be supervised by an architect, but not all architects are familiar with historic repairs and the peculiarities of local buildings. This is another reason for the production of this booklet. It is concerned entirely with the types of construction and materials found within the District, and is therefore able to give more specific advice than the standard works which have to consider conditions throughout the whole country.
The booklet is also intended for use by the many conscientious and careful builders whose experience is nearly all with modern forms of construction. It is hoped they will find it down-to-earth enough that they will be happy to be guided by it in matters which are outside the usual run of their work.
1.2 General Guidelines

This booklet is not a specification in itself; it is more a collection of guidelines. It can be used as a source book to give help in writing a specification for repairs, or it can be used by a builder to assess the standard of workmanship his estimate should take into account, or by a DIY owner to guide him over problems. It also sets out the standards expected in work which is being done with the aid of any of the District Council’s historic buildings grants. It is a condition of payment of these grants that work is done as described here, and grants may be reduced or withdrawn if the advice about methods and techniques is not followed.

There are four main rules:

1. Do only as much work as is necessary, preserving as much historic fabric and detail as possible.
2. Copy any original work exactly if you cannot repair it.
3. If you are doing any alterations, make them reversible, leaving any existing building fabric intact.
4. Do not mix different technologies.

This last point may need some detailed explaining.

In this District there have been three distinct periods in the technology of building. To begin with, all vernacular buildings, (those that have survived), were timber framed, with the walls weatherproofed with some sort of plaster. The roof was usually thatched.

By 1700 a complete change had almost taken place. The typical vernacular building had solid brick walls with timber floors and a timber roof covered in clay tiles. Later, slates replaced the tiles. Plastered interior walls and fine joinery were characteristic.

This sort of building lasted until about 1918. Buildings erected since then incorporate a number of major innovations which put them into a different era. The most important ones were the cavity wall, the damp proof course and roofing underlay.

The older buildings bowed to nature: the new ones fight it. Formerly, when it rained, walls got wet. When it stopped raining, they dried out again. Buildings were made of materials which would stand up to these conditions, and were well ventilated to help them to dry out quickly.

In new buildings, an impervious barrier is placed between inside and outside. Along with this goes a change to more sophisticated internal finishes which will not stand damp. The open fire has gone, underfelt keeps fresh air out of the roof, and draught proofing literally puts the seal on a complete change of internal environment.

It is not possible to completely convert a building from an old technology to a new. If this is tried the historic character, which was the buildings attraction in the first place, can be destroyed and problems created which will only become apparent in the future.
Repair must respect the original material and design, any archaeological evidence, as well as contributions from later periods.
1.3 Learning from History

Many pre-1700 timber framed buildings obtained their durability from the quality of the Oak with which they were framed, from good ventilation through big chimneys and unglazed windows (shuttered at night), and from regular maintenance; they were white washed every year and re-thatched every 20 or 30. They were kept dry and comfortable by mud walls and thatched roofs, which were waterproof and good insulators.

They had weak points. Even Oak will rot if it is alternately wet and dry, and foundation beams laid on the ground, and the bottom of the main posts, decayed. As the building became unfashionable, and if there was economic depression, maintenance was neglected. There was also always fire. Even the chimneys were of wood and plaster, and the thatch became as dry as tinder in hot weather.

By the 18th Century timber framing had become old fashioned. Brick was now the fashion. So were larger, properly glazed windows and plastered ceilings. When a timber framed house needed repair, often rotted sections were not replaced: the old wall was replaced with new brickwork, or it might be refaced with a thin skin of brick. This leaked rainwater and, without ventilation, what remained of the timber frame rotted completely and was taken out. This left the building with half-brick walls which were not as strong or waterproof as the old earth walls.

Thatch was taken off and replaced with pantiles. If the roof was designed for thatch it probably had thin rafters of irregular shape - thatch did not require straight and square rafters; pantiles do. The new roof would last 100 or more years, but it would leak in heavy rain, let snow blow in, and it would be cold. This was overcome to a degree by adding a plaster ceiling under the old open roof beams.

The owner might put a whole new brick front on the house to make it look modern, and cut away main structural timbers to accommodate the new big windows or dormers, and perhaps extra chimneys and more elegant staircases. Naturally, before long the roof would sag and the new wall would crack, more water would get in, more timbers would rot, and more patching would take its place.

Nearly all timber framed houses have been treated like this at some time in their history. It is only because the timbers were so oversized to start with, and made of such good material, that any have survived.
1.4 Twentieth Century Parallels

Here are some examples of changes to old buildings which were made mainly in the 1960s and 1970s.

- Original windows removed, openings enlarged, and standard modern windows put in without proper damp courses. This caused settlement of brickwork, and the windows to rot.

- Walls damp proofed in inefficient ways which made the problem worse, increasing rising damp and perhaps causing condensation.

- Roofs almost completely reconstructed so that interlocking tiles - which require straight and parallel rafters - could be used.

- Old panelled doors replaced by flush or obvious fake ones.

As well as being technically wrong, and requiring expensive solutions, such things have a detrimental effect on the traditional appearance and character of the building.

2.0 INFORMATION GATHERING

A thorough inspection of a property is essential prior to and to enable a proper appraisal of the true condition of the building fabric. Parts of the fabric may be hidden and a certain amount of opening up and probing may be necessary, although non-destructive means should always be considered. It is advisable to discuss the details of this with the Conservation Section.

The final analysis must include both the inherent strength and weakness in the structure and component materials. It is essential to determine the cause of defects before proper consideration can be given to its repair. Professional assistance by a practitioner experienced in historic building repairs should be considered particularly at this stage.

3.0 THE ROOF

3.1 The Roof Covering

Possible materials are:

a. Pantiles (clay)
b. Natural slates (graded sizes or all the same size)
c. Plain tiles (hand made or machine-made clay)
d. Metal sheeting (lead, copper or zinc)
e. Thatch (reed or longstraw)

Repairs using these traditional materials may be grant aided. Modern materials such as concrete tiles and built-up felt are not eligible, although grant aid may be available towards their replacement by one of the materials from the list.
a. **Pantiles**

Old pantiles vary in shape and quality, but it may prove possible to re-use a good proportion of the old tiles from a roof. Even weathered tiles can perform a useful service for many more years if missing hanging nibs can be substituted by drilling and nailing. Experience helps in the sorting and laying of old pantiles. Reclaimed tiles should be saved for use on the more accessible or visible slopes, the numbers being made up with sound second-hand ones. The other slopes can be roofed in new traditional clay pantiles, although it should be noted that new tiles are often very regular in shape and the profile and size can be at variance with the old.

It is not a historic building grant requirement that second hand tiles should be used throughout: they should be reserved for jobs that new ones cannot do.

Ridge, hip and verge tiles should be used in the same way as they were used before repair or in a manner contemporary with the roof covering.

Modern pantiles are holed for nailing, and nails should be used in accordance with good practice. If necessary, old tiles can be drilled with a small masonry bit. Nails should be non-ferrous.

b. **Slates**

Introduced into Nottinghamshire in the late C18. The oldest ones were graduated-course slates from Furness or Leicestershire (Swithland slates). The ones at the first course at the eaves (the lowest edge of the slope) were sometimes very large indeed (3’0 or more in width). After the railways were built, Welsh slates became normal. These were usually all the same size, and fairly small.

With care when they are removed, slates can nearly always be re-used. Usually only cracked ones need to be rejected. However, graduated-course slates cost more than the regular sized ones to re-lay. The graduated type need far more sorting, increasing the labour cost. Despite this, it is important to try and keep the same type of slate. Graduated slates should never be replaced by those of a single size.

Slates are still mined in Wales, in the former Furness District and other parts of Lancashire, and in Cornwall. Some of these need ordering specially, and some may be very expensive, but a reasonable match can usually be found. Note that the thickness is just as important as the other dimensions, and the texture is as important as the colour.

The old position of the holes (top or middle) should be maintained, and the slates be fixed with non-ferrous nails of a suitable length and through a suitable batten thickness for the nail and the distance between rafters to avoid penetration of the underlay.
c. **Plain Tiles**

Old hand-made plain tiles look very different from modern ones. They are nearly twice as thick, they consistently have a cross-camber (a curve across the width of the tile), and are far less regular in colour and texture. If a roof is covered in these, they should be retained as their characteristic texture is inimitable and irreplaceable.

If the nibs (the hanging hooks) have broken or perished, the tiles should be drilled and nailed. If there is still a shortage and no second-hand tiles of the right kind can be found, then the old tiles should be used for the most prominent slopes and the best looking new substitute used on the remainder.

Machine-made plain tiles are usually called Rosemarys in this District, after the locally best known maker. They are quite different from hand-made tiles, and should not be used as a substitute. They are thin, regular, and smooth-surfaced, with a straight, square front edge. The result is a mechanical-looking roof, but appropriate if the building was designed for them.

Other points to notice about plain tiles:

i. Instances abound of half a dozen courses of plain tiles being used at the eaves below a pantile roof. This detail should always be reproduced, in machine-made or hand-made tiles to match the existing.

ii. Many Victorian buildings have roofs patterned in some way; either with bands of shaped tiles, or with bands of diapering, (sometimes lettering), in blue tiles contrasting with the red background. The pattern should always be recorded and accurately reproduced. This feature is found on hand-made tile roofs, but is more typical of machine-made tile roofs.

iii. Tile-hanging will sometimes be found. This is not a detail native to Nottinghamshire; it originates in the South East. It will be found locally on Victorian buildings, especially on the big estates. Again, it may be plain or patterned, and it should be reproduced accurately.

iv. At gable verges, in order to keep the joints staggered, roofers often cut tiles in half. This is not ideal, as the half-tiles cannot be fixed securely enough to resist strong winds. The correct method is to use special tiles the width of one and a half normal tiles (tile-and-a-half tiles). These should also be used when tiles are cut to form a sloping lead valley, to avoid having very small triangles of tile held by only one nail.

d. **Metal Sheeting**

There are three traditional metals.

Zinc corrodes easily and is best replaced by something more durable.

Bright green weathered copper was sometimes deliberately chosen as an architectural feature. If that was obviously so, then it should be retained. Otherwise, although it is a durable metal, it does sometimes crack: it is then very difficult to repair. It can be noisy in heavy rain, and it is not cheap.
Lead is the best of all roofing materials, and the most versatile and durable of roofing metals. It is also probably, in the long term, the cheapest. There is no good reason for replacing it with any other material. There may be one exception, however, this is where a Georgian or Victorian house has an eaves cornice which is lined with lead to form a gutter. It is difficult to make this detail satisfactorily in lead alone, propriety neoprene jointed inserts can be found or stainless steel may be used instead.

The old method of making lead sheets was to cast it on a sand bed. The skill does survive. However, it is a job for the experts, and most plumbers nowadays use milled lead. Leadwork should comply with the Lead Sheet Association’s recommendations, different jobs requiring different thicknesses. The Lead Sheet Association recommends the maximum size of sheets as well as fixings. Most leadwork tends to be specialist work.

Particular note should be made of the following:

i. Joints between the long edges of lead sheets should be made with hollow rolls, not wooden rolls, unless there is likely to be frequent foot traffic across the roof. Hollow rolls are much more reliable.

ii. Do not use a bituminous underlay to separate lead from boarding or concrete. It can melt in hot weather and effectively glue the lead down. If lead’s freedom of movement is restricted, it will crack. The use of a geotextile underlay can help separate the lead from any reactive agents in the boarding.

iii. Try to avoid condensation which can cause corrosion. Leave ventilated voids beneath the boarding wherever possible.

iv. If rain runs off a moss-covered (north facing) slate roof on to lead, it brings with it acetic acid which can corrode the lead into holes. Use a gutter, or a sacrificial lead drip-strip below the edge of the slates.

e. Thatch

This is now rare in Nottinghamshire. Only two pre-C19 buildings in the District are still thatched, although it was once the norm. Water reed, not longstraw, would be expected in the Trent Valley. Thatch is a very good roof covering: warm and reliable. It has a maximum life of around 60 years.

f. Modern Materials

Built-up roofing felt and similar coverings, and concrete tiles, are not traditional materials and will not attract an historic building grant. The same applies to GRP valleys and other roof dressings.

g. Underlay

Traditional pantiles keep rain out, but fine snow can blow in through the gaps, and cause damage when it thaws. It is therefore sensible to use underlay. The cost of this will not attract grant. For slates and plain tiles underlay is not an essential, but it is standard practice. It may be used at the discretion of the applicant. Note that underlay should generally be laid loose so that it sags
between the rafters. This is so that any water penetrating the tiles will run down away from the nail holes in the felt. Underlay should be to British Standard, and should preferably carry an Agreement Certificate. Manufacturers recommendations should be taken as to laps and abutment details. Additional sheet material such as a pitch polymer felt should be used at the eaves to cover the gap between the roof and the gutter. Specialist breathable underlays combined with insulation and vapour control layers may greatly assist the longevity and effectiveness of the roofing and insulation materials.

h. **Roof Ventilation and Insulation**

Warm moist air from within a building will condense on the cold face of materials such as single glazing, the underside of leadwork, roof tile or an impervious underlay. If the area where the condensation occurs remains unventilated, (and unheated in a loft with an insulated floor), it can soak timbers, and insulation, reducing the insulation value of the latter. It can permeate the underside of some tiles which, in freezing conditions, can lead to the tile face shedding. Roof spaces must, therefore, be ventilated. Some suggestions are:

i. It may be possible to insert proprietary ventilators in the detailing of the eaves. Some roofs have overhanging eaves with soffits. Gaps between soffit boards or holes drilled through plaster, protected with fine mesh to keep out bees, can solve the problem.

ii. Make use of unused flues: knock two bricks out of them (carefully) within the roof space, and make sure the top has not been sealed off. A secret cowl may be used to keep the rain out or ventilation may be inserted in the stack above the roof in a discreet position. It is best if there are two flues, at opposite ends of the roof. It is advisable to ventilate redundant flues anyway because old contaminants can attract moisture.

iii. With a pantile roof, as long as the underfelt has been laid properly, sagging loose, a roofspace may be ventilated at the overlaps between the strips of felt by wedging open with plastic tube or proprietary vents may be inserted.

iv. If there are attic windows, permanent ventilators may be installed in them.

v. Airbricks may be inserted in the gables although the design of the airbricks will need careful thought. In a listed building prior listed building consent may be required.

vi. Counter battens may be required to allow ventilation of the underside of the roof covering.

vii. A ‘warm roof’ detail employing insulation material positioned close to the roof covering with vapour control layers to ceilings and a breathable underlay to the tiles may be considered in some cases. The thickness and choice of type of insulating material will have to be carefully considered to avoid problems caused by raising the level of the roof covering.
j. **Chimneys**  
(See also Masonry). While scaffolding is up to overhaul the roof, it is sensible to carefully inspect the chimneys. Any existing chimney pots should be retained, and missing ones may be reinstated if desired. Any missing cornices or oversailing courses may also be reinstated. Ventilation and keeping out the rain should be considered. See the precautions listed in Roof Ventilation and Insulation, above.

k. **Flashings, Hips and Ridges**  
Dressings to chimneys, parapet abutments, lean-tos and dormers are often made in mortar, perhaps with tile creasings. Reference should be made to the Lead Sheet Associations recommendations as to weight of lead (thickness), size and details. Unless otherwise agreed, these should be removed and proper dressings made in lead of the correct weight. The same applies to sloping valley gutters. If hips and ridges are of lead, this must be kept or reinstated. If they are tile, they must be reinstated as they were before. If they are of sawn stone, sound originals must be used on the prominent faces, made up with new sawn stone if necessary. Hidden hips and ridges may be formed in new material in order to provide material for reuse elsewhere.

3.2 **The Roof Structure**

Note: the *carpenter* is the craftsman who does the heavy timber frame: roofs, walls, floors. A *joiner* makes the finishing woodwork, windows, doors and cupboards.

Until about 1750, Oak was the almost universal material for roof structures. After then pine became more common, until that in turn became universal by about 1800. With the change in material came changes in design. Some are apparent only to experts, but an obvious one was the introduction of the ridge-board: the presence of one indicates that the roof must have been built or radically altered after about 1800, no matter what material it is made of.

Many Oak roofs of the late 18\textsuperscript{th} Century were built of old timbers recovered from timber framed houses or barns. A very common tradition has it that these second hand beams are “old ships’ timbers”. More likely they are of a similar quality as used in ships. The original position of these timbers can often be discovered by looking at the position and shape of disused mortices and other joints. Some of these timbers have clearly been used two or three times, and must originate from well back in the Middle Ages.

a. **Defects**

i. **Insect attack.** Old Oak roofs were not built from massive trunks sawn down to size. The carpenters chose a tree that was just big enough to make one member out of, cut it down, squared it up, and used it straight away, “green”, without seasoning. So, many of the smaller timbers were made from trees that were little more than saplings and contained a high proportion of sapwood. Often all four corners of a rafter were
sapwood, and this is vulnerable to attack by woodworm; the heartwood, the middle of the tree, will not be attacked except by Death Watch Beetle.

There is no virtue in scraping off the “frass”, the parts of Oak members attacked by woodworm. As long as the woodworm has been killed, the frass can quite safely be left. If it is scraped off, it leaves a rounded, not a squared-up, shape, quite different from the original appearance. If it is very soft and in a position where it could get knocked, a timber hardener may be used.

The name “Death Watch Beetle” alarms many people. This insect, during the mating season in Spring, makes a ticking noise which is audible only in the still of the night. Corpse-watchers and night-nurses probably gave it the name. It is much less common than woodworm: in fact, an active attack is quite rare in the District. This is fortunate because the grub, which does the damage, is larger and longer-lived than the woodworm. Every visible hole (they are about 3mm diameter) represents about seven years of tunnelling. Most of the Death Watch holes seen are decades or centuries old. Recent ones can be recognised by their sharp edges and are clean reddish-brown inside; brand new ones will probably (in April and May) have, somewhere below, a sprinkling of the granular red dust the beetles produce.

Treatment of woodworm is simple. Identify the areas of active attack - again, new holes and fresh dust (yellow for woodworm) are the indication. Then a suitable insecticide is applied freely to these areas with a paintbrush. It is a simple job, and there is no point in applying it to Oak that is free of attack, or to heartwood. Inspect carefully in the spring of the next two or three years and treat it again if further signs of life are noted.

Death Watch can be treated in the same way, but, as this tends to burrow more deeply into the wood, holes have to be drilled in the larger members and the insecticide injected. An attack is perhaps best left to a commercial firm.

Sometimes Death Watch can cause structural weakness. This is nearly always where long continued dampness and perhaps fungus has contributed to the attack, usually concentrated in a small area, such as a beam end. Inspection and repair is necessary to assess the need for repair, before a failure occurs. (See Repairing Roofs below).

Towards the end of the 18th Century the use of softwood became usual. The quality varied. Some roofs are built of untrimmed trees, left whole for the main trusses, halved for purlins and quartered for rafters. The timbers may still have the bark on. The use of insecticides is controversial and it may be best to limit treatment to locally identified
problem areas although some vulnerable locations and softwoods may benefit from a more thorough treatment with insecticide and fungicide.

Some high quality softwoods are resistant to all native insects, and may need no treatment at all. Woodworm will often tire of a particular source of timber and leave. Identification is the key. The best approach may be to assume that if the roof is well built of heavy timbers, especially ones with a resinous look to them, and has lasted 100 or 200 years without obvious woodworm attack, then it is likely to last a few more decades without the help of an insecticide spraying.

Do not be deceived by woodworm having attacked the tiling battens. The rest of the roof may be quite clear. If the battens are attacked the roof covering may have to be re-laid in time. Meanwhile, the roof structure may be safe.

ii. **Rot.** It is important to distinguish between 'Dry Rot' and 'Wet Rot'. The former is much more serious. It is stressed that analysis and treatment of dry rot is a very serious business and should be left to experts. (See description of symptoms in Interiors; Timber Floors, below).

One of the many kinds of “wet rot” is fairly likely to be found; in wall plates, in valley boarding or in any place where water has been getting in for a long time. No particular treatment is needed, but the cause of damp should be removed, and rotten wood should be replaced with new fungicide-treated timber. Surrounding timber can also be brushed with fungicide as a precaution against dry rot during the critical drying-out period.

The drying out of a building may need careful management.

iii. **Structural weaknesses.** In all periods some carpenters will have been better at their jobs than others. Poorly constructed roofs will have probably collapsed long ago, but some marginal ones will remain. There is a local detail in 16th to 18th Century roofs where the purlin passes through the rafters of the main trusses. If the rafter is slightly undersized it can break at this point where the bending stress is at its greatest. This is especially likely if the roof is altered to incorporate dormer windows or is given a heavier covering - concrete tiles for instance. Weak points like this can also be stressed to failure through weakening by insect attack or rot. The chief cause of structural failure, however, is badly thought out alteration and poor quality repair in the past. Even the best built roof will collapse if the tie beams have been cut through to make a doorway between two attics, for example.

A difficulty can arise with early roofs which have no ridge-board, especially when the common rafters are jointed at the purlin. The main
longitudinal support for the rafters is given by the tiling battens. If these, in the usual way, are removed wholesale when the tiles are stripped, the coupled pairs of rafters can collapse like dominoes. In any case the roof without its battens may be too unstable to support the weight of workmen who have to replace the battens and tiles. Roofs of this sort should have the battens stripped and replaced as one continuous operation. That is, one at a time. It is probably a good idea to see that the new battens are made larger than standard, (say 50 x 25mm), and are fixed with two nails to each rafter.

Most Oak roofs and some softwood ones have the joints held together with wooden pegs. These may not be of the same timber as the main members and sometimes the pegs are badly attacked by woodworm. They will then need renewing. The traditional way was to use a square, or octagonal, peg in a round hole. They should be slightly tapered, and are not cut to length until the roof has had a chance to settle down and the pegs to shrink. This gives a chance to drive the pegs in further if they loosen.

b. Repairing Roofs.

It is not possible to give detailed guidance on this complicated subject. So much depends on the importance and quality of the original structure, and on what the particular problem is, but some notes for guidance follow.

i. Materials. The ideal is to replace like for like, i.e. Oak with Oak and Pine with Pine, but this would not make economic sense if, for instance, the roof structure were completely hidden from view. It may be acceptable to replace Oak common rafters with softwood, provided the Oak ones are really in need of replacement and cannot be repaired, and except in roofs of the highest quality. New ends bolted on to truss beams or rafters would normally be softwood or steel.

Oak, some softwoods and fireproofed timber can corrode mild steel. Galvanising the steel and coating it with bitumen paint will protect it. Stainless steel bolts can be used.

ii. Methods of Repair. Try to reconstruct the original method of jointing, so that the original degrees of freedom of movement are retained. Where breaks in members, or rotten ends require repair, techniques giving greater rigidity can be used, but resin repairs, for instance, should not be used to hold together joints which are parting.

Timber or steel plates secured to the original timbers with through-bolts or coach screws are a practicable method of repair.

Although the ideal is to leave a repaired roof with nothing added and nothing taken away, it is acceptable to add extra members if by doing so
the whole of a complete but rather flimsy roof can be preserved. Extra rafters alongside the original ones, extra purlins to reduce the rafters’ span, and even complete intermediate trusses to reduce the span of the purlins, all these have been used. If these additions result in the finished roof being made thicker, so that the surface of the tiles is higher, there may be problems at eaves and gables and around dormer windows. Adding extra insulation above the rafters can cause the same problems.

To summarise, try to alter the roof as little as possible, except when restoring its original structural integrity where it has been badly altered. Repair, do not renew. Make improvements as simply as possible. Most old roofs, even when they look ramshackle, are standing up perfectly safely and will continue to do so if treated them with care.

3.3 Rainwater Disposal

a. **Buildings without gutters**
   Buildings without gutters may be best left like that. There will be less maintenance and if the building is sheltered, the soil well drained and the ground around arranged so that water does not stand in pools at the foot of the wall, gutters and downpipes are an unnecessary complication and expense. Put a short length over the doorway if there is no porch.

b. **Timber gutters**
   There are two sorts:
   
   i. Plant box gutters lined with lead.
   ii. Solid timber gutters, half-round channel.
   
   The requirement for both is high-quality timber: Pitch-pine, Columbian Pine, or equal quality. The trouble with the first is likely to be in the lead lining, as the sheets will be very long and cannot be properly jointed; cracks will develop. Stainless steel lining is acceptable, and will be more reliable.

   The second type give good service. They should be used only in straight runs discharging into hopper-heads. Do not attempt to turn corners or form bottom outlets. Traditionally they were painted outside but not inside. This avoids them rotting inside the paint if the wood splits, letting in water which cannot get out again.

c. **Metal gutters**
   Cast iron is a traditional and long-lived material. Its main disadvantage is that it needs regular maintenance, or water will collect and can split the gutters if it freezes. This includes cleaning out, occasional adjustment of brackets and resealing of joints, and painting - purely for appearance. Cast iron lasts just as long if it is never painted, but it looks unkempt if it is rusty. It is especially important to keep ogee gutters cleared out, as they have a weak spot where there
is a right-angle at the back. Cracks here will let water run out straight on to the wall. Cast iron gutters can be obtained in half-round and various ogee patterns.

Cast aluminium gutters are an acceptable substitute. They can be obtained in similar patterns and sizes to cast iron, and they are rather lighter to put up. Also, they can be obtained with a permanent gloss finish in various colours, which gets over part of the maintenance problem. However, they still need frequent cleaning and resealing. Their life may be as long as cast iron, but trouble has been found where aluminium gutters have been blocked with pigeon droppings: this corrodes them very rapidly.

d. Plastic gutters
PVCu and similar plastic gutters should not be substituted for traditional types on any listed building. Evidence indicates that these are a short-life material, and they always look out of place on an historic building. The shape and texture are wrong and it needs far more brackets than metal gutters do. Certain high-quality plastics, including GRP, are acceptable when an unobtainable cast-iron pattern has to be matched.

Sometimes an old pattern has to be matched up, and the only reasonable thing to do is to have gutters specially made out of glass fibre.

e. Downpipes
Problems with downpipes on old buildings are often caused by downpipes being too few, and too small. 62mm diameter is the smallest that should ever be used, and 75mm is better. There should always be two downpipes to every length of gutter as a safeguard against blockages.

Lead downpipes, especially if they have hopper-heads, should always be repaired and kept. Sometimes the seams split, and often the fixing ears will tear off with the weight of the pipe. However, lead is very easy to repair. It needs no maintenance; any paint applied in the past should be scraped off.

If cast-iron downpipes are allowed to become blocked, they will crack. Sensible layout will help to prevent this.

- Avoid swan-necks from the outlets. Use hopper-heads instead. They are easier to keep clear and less likely to block.
- For the same reason avoid long runs of rainwater pipe across gable ends. They look unsightly and out of place.
- At the bottom of the pipe, take the outlet via a shoe into an open grid, not straight into the drain. This gives instant warning if the pipe is blocked, and makes it easier to do something about it.
- Fix spacers behind the ears or lugs, so that there is a good gap behind the pipe. This allows the back of the pipe to be painted, and also means that if the worst happens and there is a blockage, the water will run down the outside of the pipe, clear of the wall.
Square downpipes give more trouble than round ones, because cracks develop at the corners, and there are so many different sizes that replacement can be very difficult. The usual procedure is to cannibalise sound sections to use on the front, and put new round ones at the back. Some free-standing buildings demand matching pipes all the way round.

There is no completely satisfactory substitute for cast iron. Most aluminium downpipes have plain cylindrical sockets which look wrong and the same applies in plastic. Aluminium downpipes suffer very badly if they get blocked with bird droppings. Asbestos downpipes and gutters will need replacing with a more permanent material. Precautions will be necessary for the handling and disposal of asbestos.

When painting gutters and downpipes, think about painting the downpipes a warm grey or similar colour to blend with the walls. There is no rule which says they have to be the same colour as the gutters, and if often looks better if they are different. They should not be painted to match the woodwork.

f. **Rainwater Drainage**
Many foundation problems and mysterious damp patches are caused by cracked rainwater drains, or by soakaways too close to or even below walls. When a building is being repaired it should be routine to trace and repair the rainwater drains, and build new soakaways if necessary.

g. **External Plumbing**
The elevations of many handsome buildings have been marred by an elaborate drainage system of pipes allowed to sprawl over the main elevation. Soil and waste pipes can nearly always be put inside. Vent pipes can run up inside an unused roof space and discharge to the air through a flue or below a ridge vent - a normal tile laid crosswise usually looks best.

Think twice before disposing of cast-iron baths (which can be re-enamelled in situ) or modernising an Edwardian bathroom. The old fittings often look better than modern ones, and are highly fashionable. The genuine thing is better than a reproduction.

4.0 **MASONRY**

Masonry is taken to include brickwork and stonework, and also structural elements such as lintels, cills and foundations, which may be of other materials.

Until brick was introduced after 1500, stone was the only material available for solid walling and for things like foundations to timber framing and fireproof chimney stacks. Nottinghamshire is not usually thought of as a stone area, like the Cotswolds, but the Newark district lies between two of the country’s most famous quarries, and it has several different sorts of local stone. Consequently it has a fairly high proportion of buildings partly or entirely of stone.
Brick was a latecomer, and it is rarely used in anything other than a plain manner. However, the local red brick is the most important ingredient in the District’s characteristic environmental flavour.

4.1 Materials

a. Stonework

Both red and white sandstones have been quarried at Mansfield since the early Middle Ages. The white always seems to have been more plentiful and it was used extensively all over the northern and western parts of the District, wherever a stone that could be worked and carved easily was wanted. It is not particularly durable, but it has a good colour and can take a fine finish.

An even more famous quarry is the one at Ancaster, producing three or four different kinds of oolitic limestone, which in the Middle Ages was carried via the River Witham to the sea and all over East Anglia for use on the finest buildings. The great churches at Grantham, Boston, Louth, King’s Lynn, Great Yarmouth, St Peter Mancroft in Norwich and many more were built of Ancaster Freestone. Ancaster is only 12 miles from Newark. The stone was used for the Parish Church, at the Castle, and at Hawton church as well as many of the churches east of the Trent. Curiously, it does not seem to have penetrated west of the Trent to any extent. Southwell Minster’s famous leaves are Mansfield stone, and in the 17th and 18th Centuries Mansfield stone was even used for Newark Town Hall and other buildings in the Ancaster catchment area.

However, these were monumental buildings. Vernacular buildings were rarely built of the expensive freestones, but would use one of the locally quarried stones. Large blocks of freestone found in a cottage wall usually indicates that some grander building nearby has been demolished and the materials sold for re-use. Freestone is a stone that can be obtained in large blocks which can be dressed to size and given a good finish.

East of the Trent, in the Collingham area, the local stone is Blue Lias, often called Coddington stone. This is a hard, intractable and poorly weathering stone, available only in small pieces. Many houses in Collingham have the ground floors built of this stone, with timber framing above. The method of construction is more typical of the larger medieval towns: York, King’s Lynn and Norwich have many examples.

A tradition has grown up in Collingham that this Lias stone came from Newark Castle when it was demolished. There may be some truth in this, but many of the Collingham buildings predate the Civil War, and it is unlikely that the whole village was built in such a short time, as the tradition would imply.

Lias stone is not quarried locally now, but is available from quarries in the same geological stratum where it reappears in Dorset, near Lyme Regis.
Across the Trent a stone which looks rather similar is found. This is called Skerry. It is actually a sandstone, but is rather difficult to tell from the Lias when it is in a weathered state. It is much less commonly used as a walling stone. It often appears as infill for timber framing, plastered over.

The other local stone is Sherwood Sandstone. This is actually a freestone. However, it has very poor weathering qualities, and it is not now quarried for building. It is a ginger colour, is very soft, and erosion takes the form of pits which gradually enlarge. It was used mostly along the north bank of the Trent around Bleasby and the Dumble country. It was also used for the main curtain wall of Newark Castle.

A rather similar sandstone, but grey, is found around Edwinstowe. This is perhaps an inferior form of White Mansfield.

There is no local replacement for these sandstones, but suitable matching ones are quarried in other parts of the country.

b. **Bricks**

The earliest known bricks in the District (c1525) are 9" long, 4½" wide, and 2¼" high. Bricks of exactly this size were still being made up to about 1830. After then, there were two standard sizes in use: both were still 9" x 4½", but bricks from the south of England were 2 5/8", while bricks from the North, including locally-made ones, were nominally 3" thick. (Actually some size between 2¾" and 3¼").

Early bricks were rough, irregular in shape and inconsistent in size. Techniques improved during the next 300 years, but bricks were still hand made from soft clay in a mould which used sand as a releasing agent. They therefore had a surface which was slightly porous, slightly rough and varying in detail from brick to brick. The edges were not sharp, nor perfectly straight.

Later in the 19th Century the pressed brick was developed. This used a dry clay, high pressures and a different method of firing which gave a more consistent shape and a smooth, almost shiny, surface. The edges were sharp and clean. The local “Cafferata” bricks are an example of this technique.

Local bricks are a true brick red. Curiously enough, this colour is not common. Most bricks are brown, orange, purple, yellow or pink, or a mixture. This can present difficulties with brickwork repair. Another major difficulty is that modern, post-metrication, bricks are 215 x 68mm (8½" x 2½"). This does not match any of the old sizes. The third difficulty is in matching up the texture - perhaps the most important of all. No machine-made bricks match the old ones perfectly, and modern hand-mades can be self-consciously rustic, and too even in colour as well.

It is not necessary for bricks to be an identical match for the old in all circumstances. As long as the texture and colour are reasonable the size does
not matter when, for example, rebuilding a chimney stack which comes straight out of the roof rather than forming part of a gable. Extensions and alterations also should be done in new bricks. As long as a definite break is made at the junction between old and new, and in any openings to be blocked the new brickwork is recessed, differences will be unobtrusive, and the different size will not matter. Second-hand bricks are becoming too precious to be used for new work.

However, it is essential to find bricks which exactly match for the following circumstances:

- For repairing individual eroded bricks in a wall face.
- For rebuilding chimney stacks which are a continuation of a wall.
- For filling openings (for restoration purposes perhaps) so that the patch does not show.
- For reinstating previously poorly carried out repairs or alterations.
- For forming brick-on-edge copings to gable parapets.

Good hard hand-made bricks make just as good a coping as engineering bricks, and look much better. Nearly all red engineering bricks have holes through the middle and so cannot be used for gable copings, as the holes show at the end. Blue bricks should not be used for capping a wall which is otherwise entirely of red hand-made ones.

It will usually be possible to find at least some of the right bricks in local reclamation yards, but if numbers are short they can be extended in the following ways:

- Use bricks from elsewhere in the building being repaired. (From new openings, from outhouses to be demolished, from the inner skin of the external wall or from internal walls - replacing with modern bricks or blocks plastered over).
- Carefully extract eroded, but not cracked bricks from the wall face and reuse them with the inner face turned outwards.
- Cut a brick with four sound faces in half with a grinding disc to give two brick slips which can be wedged in backed with fine concrete and pointed up after the concrete has set.
- Make use of all broken bricks with at least one sound end: never throw half-bats away.
- Cut or grind a brick which is too large down to size.

c. **Mortar**

Colour, texture, composition and method of finishing mortar are vital to the appearance and health of masonry walls. The basic rules are these:

- The mortar must be, when it is fully set, softer and more porous than the stones or bricks.
• The sand, and mortar mix, must be chosen to give a match for the original colour and texture.
• The width of new mortar in the joints must not be wider that the original joints. If this means that the mortar has to be recessed slightly, this does not matter, in fact it helps to avoid vulnerable feather-edges in the pointing.

These rules will usually be satisfied if:

• a sand of the right colour and much coarser than often is usual today is selected; it may be necessary to add extra grit or to mix different types of sand.
• the mortar is basically a mixture of 1 part of lime to 3 parts of sand with a small amount of ordinary or white Portland cement added to get a quick first set; (not more than 1 part of cement in 12 of the mixture, or 1:2:9).
• the joints are filled up flush and then finished by stippling with a scrubbing-brush (the traditional piece of sacking is not an accurate tool and can give messy results).
• Mortar for bedding and pointing ridge and hip tiles should be similar to walling mortar, but will need to be stronger: 1:1:6 is suitable. Special techniques are needed for ashlar masonry and certain kinds of fine brickwork.

In the north of the district it is traditional to use red Mansfield sand. This is not usually suitable for mortar as it has too much silt in it, but by agreement it may be used in order to get a good colour-match. If it is acceptable it should be mixed at least 50/50 with a sharper, cleaner sand, and it is even more important than usual to have a lot of lime in the mixture. Red sand is not traditional in the Newark area or east of the Trent.

4.2 Construction

a. Foundations
Old stone walls usually have no foundations, or at most a slight thickening-out at the bottom. They are rarely very deep, topsoil would be removed, but no proper trench dug. Brick walls might be on shallow stone foundations, or, with later buildings, have proper spreading footings.

If there is no sign of recent trouble it is best not to investigate foundations. They may not comply with modern standards, but if they are working adequately, to try and improve them is unnecessary and may in itself cause trouble.

Of course, if there is recent settlement which is definitely due to foundation troubles, action must be taken. First, find out the cause. It might be mining settlement, bad drains, tree roots or recent drainage works nearby. Underpinning is not always the answer.
Be particularly careful if the building is timber-framed. Apparent settlement may be rotting of the cill beam, if there is one, or of the feet of the main posts.

b. **Brick Bond**

Early brick buildings used English Bond - alternating courses of headers and stretcher. In the 18th Century Flemish Bond was introduced - headers and stretchers alternating in the same course. This was considered to look better than English bond, but it was more expensive, so it will be found used for larger houses and public buildings rather than for cottages and farm buildings. Often, the front wall only will be in Flemish Bond, with more economical bonds being used for the sides and rear. Many old brick walls are a variation of English Bond, English Garden Wall Bond, mostly stretchers, but with a course of headers every so often. Header Bond was sometimes used. Its main practical use was in curved walling, but it was occasionally used for its decorative effect in buildings designed to impress. The former Clinton Arms Hotel in Newark Market Place is a fine example.

Stretcher Bond indicates that:

i. That the wall may be only half a brick thick, or
ii. That the brickwork is a facing over a timber framed building, or
iii. That the building is more modern than it looks, and has a cavity wall.

Vertical joints up the face of the building can indicate that it has been extended - builders did not always bond extensions in, and it is not always a good thing to do - or they can be another sign that a timber frame is hidden inside. Two vertical joints close together are an almost certain sign of this, and so are strips of bricks on edge (showing 4½" on face) or tiles.

c. **Openings**

There were several ways to support brick or stone walling above window and door openings. The simplest was to make the frame very stout and support the masonry directly on it. The problem is that if the bottom of the frame rots, the masonry starts to collapse. Upper floor windows often have no brickwork above them, but are fitted directly below the wall-plate. This is satisfactory if the wall-plate is strong enough and does not rot.

A more sophisticated method is to have an arch over the opening. The humbler way was to use a segmental arch of ordinary bricks or half-bricks set on end. The grander buildings had the arches made of rubbed bricks, tapered to fit together with narrow joints; variations on this were to have the arch either one brick or one and a half bricks deep, and to have the bottom line of the arch either segmental, or cambered with just a slight curve to counteract the optical illusion that the arch was sagging.

In the 19th Century openings were very generally spanned by stone lintels with splayed ends to make them the same shape as a cambered arch. These might be thick structural lintels, or might be thin stone facings over a brick arch - or just
plaster. If the thin facing has a false keystone cut into it this is a weak point and the stone can crack. If this happens the stone can be pinned back to the arch and the keystone be glued on to hide the pinning.

Stone buildings of a superior kind had stone frames for the windows with mullions to support the masonry over. The doors in such buildings would have moulded stone arches.

A problem with all these arches and lintels is that what is visible externally supports only the outside half of the wall, and conceals a timber lintel which carries the inner part. The latter will be subject to seasonal variation and might suffer from insect attack, and it is particularly susceptible to dry rot, and well placed to spread the rot throughout the building. This is almost the only place where it is advisable to take precautionary action in advance of trouble, and, at a convenient time, replace such timber lintels by reinforced concrete or steel. Note that reinforced concrete lintels should be ordered as `non composite’. The smaller sections of `pre-stressed lintels` require a few courses of new masonry to be built over them to attain structural integrity. Sagging of an arch for no apparent reason is a sign that the lintel is failing, and any signs of rot internally immediately over a window are a warning to take immediate action. This may not be the only factor, movement and foundation settlement also contribute.

Internal doors have timber lintels too, and they can cause trouble in this way. Think of the plan of a typical small double-fronted Georgian or Victorian house. Inside the front door will be a passage leading to the back of the house or a lobby with the stairs going up from it. Either side will be a solid brick wall. These walls are important in tying the front and back outside walls together. In the majority of houses these cross-walls will be broken by doorways to left and right immediately adjoining the front door: upstairs will be another pair of doors immediately over the ground floor ones. So all that is really tying the house together is a timber lintel and a few courses of brickwork. Any settlement of the front wall or shrinkage or decay of the lintel will cause the brickwork to crack and the tie will be lost. Very often when this happens the front wall of a house will bow outwards through a natural process. The cure may be to replace these lintels with steel or concrete ones tied into the cross-walls. (See the previous paragraph). This is most important when it is a three-storeyed house, as such tall walls can easily bow into an unstable condition.

Some cottages and many agricultural buildings have timber lintels outside as well as inside. Oak lintels are usually durable enough, as long as they are not painted, but softwood ones can rot and are best replaced by Oak.

4.3 Masonry defects and their repair

a. Leans, bulges and cracks
These have been mentioned in passing, above; their cure is usually a matter for professional assessment and advice, but some notes may be useful.
i. **Leans:** Leaning walls can be brought back to near vertical but specialist advice must be sought. If they are particularly bad they will probably need rebuilding. Otherwise, the correct remedy is to tie them firmly to cross-walls to prevent any further movement. If this is done, the whole assembly can be calculated as one structure and will then be found to be stable.

Brick facing to timber-framed buildings is normally very often out of true, and does not need any repair if it is tied to a sound frame.

ii. **Bulges:** Walls were sometimes built on a curved plan, and may appear to bulge when they do not. This can be tested with a plumb-bob.

Stone walls built with inner and outer skins and a rubble core may bulge because the loose core is wedging the other faces apart. Grouting the core will usually stabilise this.

iii. **Cracks:** Some cracks occur at natural stress points: at the junction between builds of different ages and below windows, for instance. Pointing in a soft mortar will help keep out the weather. However, prior monitoring is essential to ensure that a filled crack does not prevent a natural cycle whereby the masonry may return to its original condition when the crack may have a strong tendency to close. Other cracks will need stitching with new bricks cut in, or with concealed reinforced concrete. Systems employing helical stainless steel bars resin bonded into chased bed joints and drilled through whole bricks or stones can be discrete, less disruptive and very successful, however, specialist advice should be sought.

Do not forget the possibility of a concealed timber frame. It may be the frame that needs repair, not the brickwork.

b. **Pointing**
Repointing should not be done for cosmetic reasons, to tidy the building up, but only out of structural necessity. Note the following rules:

- Repointing is not needed until the mortar has weathered away to a depth equal to the width of the joint.
- If repointing is needed, then joints should be raked out properly to a depth of 35mm. Note the word “raked”. A raking tool can be made from a bent screwdriver, and it should be narrower than the joints. If old mortar cannot be got out with this tool, then repointing is not needed. Under no circumstances should a hammer and chisel or a mechanical grinder be used for raking out. This will ruin the arrises, the edges, of the bricks.
- Details of the mortar and finish to be used are given in Mortar, above. The mortar should be forced well into the joint with a proper pointing iron, matching the joint in width. A trowel is not the right tool to use for pointing, although a small one can be used vertically to strike the mortar off flush.
The pointing must not be finished smooth with the face of the trowel. The timing is critical but when the mortar has taken an initial set - about two hours but very dependent upon the materials and prevailing weather conditions - it may be brushed diagonally with a flat short bristled brush to just reveal the arris of the brick.

- There is no need to point the whole of a wall just because some patches are eroded. Do only the areas that need it. It is best not to add colour to mortar to try and simulate deposits of soot. It looks unnatural, and the early patchy effect will soon fade.
- If, when you have finished, it looks as if the building has not been worked on at all, then you have achieved exactly the right effect.

5.0 OTHER NOTES ON THE STRUCTURE

5.1 Cleaning Buildings

The only time it is necessary to clean a building is when soot deposits are so thick that they hide defects. This is not a common condition in country areas. The usual reason to clean a building is to make it look new. Cleaning buildings is not eligible for grant aid from the District Council. Neither is the repair of any damage, to pointing for instance, caused by cleaning.

It may be necessary or desirable to remove render or paint, inappropriately applied in the past to part of an old building. This is a specialised operation. Appropriate advice should be sought on the alternative methods of achieving this. The main criteria should be that the chosen method should not damage in any way the underlying fabric of the building. When a method has been selected a small sample area in a discreet location should be selected for a trial before a commitment to the overall work.

5.2 Timber buildings and Floors

See also the notes in Repairing Roofs, above. The same considerations apply to general timber framing and floor beams as to roofs. Each job needs to be considered on its merits and no hard and fast rules can be laid down. However, note:

- The comments about ‘defrassing’, the removal of wood affected by woodworm, apply even more strongly to floor beams than to roofs.
- Beware of stripping plaster and removing brick skins from timber-framed walls. The timbers are likely to be in too poor a state to leave exposed.
- Do not sandblast timbers to remove paint. This will also remove the historic interest and any original toolmarks and carpenters numbering. When softwood is sandblasted the end result is an extremely rough and splinterly mess.
- If any trace of old paint, especially patterns or lettering, is found on plaster or timberwork, then Conservation staff should be informed.
6.0 WINDOWS AND DOORS

6.1 Windows

The windows are usually the most important feature of the facades of historic buildings, and deserve very careful attention.

In this area windows in historic buildings are nearly all of timber, and may be one of three types: Sash, Yorkshire Slider or Casement.

a. Sash Windows

Some say these were introduced from France in the early 1700’s but it is now thought that they may have originated in this country in the late seventeenth century. Early examples had thick glazing bars, 37mm or so, and were often made of Oak. The wide sash boxes on either side were exposed. As the century progressed glazing bars became thinner, reducing to as little as 15mm wide, and more delicate in section. They had a rounded inner edge which stopped against an extra fillet added to the sash-frame moulding - a typical Georgian refinement. Late Georgian windows, (1800 on) sometimes had glazing bars only ½" wide or even less. These will be found to be of metal: hollow copper or pewter, or solid cast iron. From this time, too, sash boxes were built into the wall and the graceful Georgian window became a thing of beauty and delicacy. Victorian and later glazing bars used a plain ovolo-and-fillet glazing bar as standard, without the Georgian refinements. The normal thickness remained about 15mm until the late C19 Queen Anne revival: buildings in this style tended to revert to the early details.

The pattern of glazing bars in vernacular buildings most common throughout the period was the one giving a 12 pane window - 3 panes wide x 4 panes high. This pattern of window with proportions approximating to the Golden Section (1:√2) is the most obvious hallmark of the genuine Georgian building. Variations were the 9-pane (3x3), and the 6 pane (3x2) window, used for the smaller windows common on third storeys. Late Georgian windows often had squarer proportions and were 4 panes wide.

Victorian windows either used the Georgian pattern, or had narrow borders, (margin lights), a single central glazing bar, or no glazing bars at all. Then came the Georgian revival, when the pattern was at the architect’s whim. In the late C20, the standard factory made window, both sash and casement, was often given the label Georgian, but in fact had nothing in common with the genuine thing, not in proportion or pattern or construction or detail, unsuitable for use in a historic building.

One pointer to the age of a window is the presence or absence of 'horns' below the meeting rail. Old sashes were built with the bottom corners of the top sash square jointed, glued and fixed with a peg. After about 1860, the sides of the sash were usually carried down a few inches below the rail and given a decorative curve: the tenon joint was secured with wedges. Theoretically, this
joint is stronger than the old pegged tenon, but it looks out of place on an early building. Sash windows made nowadays are often given horns, but with a plain chamfer instead of the robust Victorian ogee. Modern glues can make the hornless joint perfectly durable.

Most C18 and C19 windows were not made of Oak, but of very high quality Pine, of a sort which can be difficult to obtain today. The bottom of the frame and cill were, however, nearly always of Oak to resist the weather, and glazing bars were sometimes of mahogany.

b. Defects in Sash Windows
The sash window of about 1800 is a complex and beautifully made piece of joinery, the result of a century of refinement. If it has been looked after properly, by regular painting and renewal of the cords every 20 years or so, it is very likely still in perfect working order and good for an indefinite life. It is also a very practical window. As it can be opened top and bottom with infinitely fine adjustment it gives ideal ventilation. It is easy to clean from inside the building. It can be opened fully without projecting out, endangering passers-by, or in, knocking things off the cill and interfering with curtains. It is easy to burglar proof, and, if the proportions are right, it is the most elegant of all windows.

Yet, many thousands of sash windows have been replaced by modern windows with far less to commend them. The reasons are understandable. Failure to refix the beads properly after renewing cords, and other poor quality repairs, can make sash windows loose in their frames so that they rattle and let in draughts. Incorrect renewal of cords can make them difficult to shut completely. Poor workmanship when painting can cause them to stick. Not painting them often enough can allow the timber to decay, starting with the vulnerable cill and working its way up.

c. Repairing Sash Windows
The first thing to decide is whether the window is (a) capable of being repaired, and (b) worth repairing. This is not at all the same thing. Any window can be repaired, even if only half a dozen bits of wood are left of the original some sort of reconstruction incorporating them can be contrived. However, take a less extreme example: it is often found that the top sash of a window is perfectly sound, and the bottom sash also is sound except for the two bottom corner joints, but the casing (the outer frame which contains the weights and pulleys) is in worse condition; perhaps the cill is completely rotten, the outer side facings show decay a foot up from the bottom, and the parting and the staff beads are all splintered and loose. Whether such a window is better repaired or renewed depends upon its age.

A late Victorian window in this state is probably best replaced by an exact replica. The new timber will not be as good, and it will mean throwing away a sound upper sash, but it is more difficult for a joiner to make a casing to fit an existing sash than to make the whole thing again. However, an earlier window
with the original thick bars and Queen Anne details, or with the late Georgian refined details, should be regarded with the same respect as would be given to a piece of furniture of the same period. It should be carefully repaired, retaining as much as possible of the original material.

First, all the old paint should be stripped off. To start with, strip a small part layer by layer, scraping it, dry, with a sharp blade. This may reveal some original colour: preserve a sample for matching if it is wished to recreate the authentic original scheme. Then strip the remainder using a hot-air gun with a shield to protect the glass. Be very careful not to damage the mouldings.

At some stage it will make life easier if you remove the sashes. Take out any panes of glass you need to in order to repair the sashes, and put them somewhere safe for refixing. Putty can be chiselled out, or can be softened with the hot air or infra red. Clear all the old bedding putty out.

The next difficulty arises in matching up mouldings. If they are copied by a spindle moulder the blade will have to be made after the paint has been stripped, or it will not be accurate. The possibility of cannibalising other windows can be considered at this stage, so that the maximum use can be made of the original workmanship.

If new sashes are being made, the window members must all be moulded before being framed up, and it is important that they are all the right size. Some joinery manufacturers make the glazing bars the right width, but make the frame or the meeting rail much too wide. This is the sort of fault that stands out once the windows are installed, especially if some of the old ones are still there for comparison. The lower, that is the inner, meeting rail should have the glass let into a groove, not a rebate. This saves about 10mm width.

A window should never be made up using plain, not moulded, sections with moulding cut on them afterwards using a router. This poor reproduction is immediately shown up because all the corners are rounded, not square.

When repairing rather than renewing the windows, the next stage is to repair the casings. Cut out the rotten sections and splice in new pieces in matching mouldings. Clean out the tongue and groove joints and glue them together with waterproof glue. Unscrew the pulleys and refurbish them. Make sure that all paint has been removed and re-assemble the window with new cords, and new parting and staff beads. The parting beads should be cut just a fraction long so that they will hold tight without having to be nailed. The staff beads should be screwed with brass screws, not nailed, or at least the side ones should be. This makes it easier to renew the cords next time, and, on upper floors, makes it possible to clean the windows from inside without having to lean out.

There is a correct way to paint sash windows so that they work properly. The principle is that only the timber visible when the windows are shut should be painted. The rest should be waxed. Finally, fix the sash catches. It is best to
try and re-use the old ones as new ones are often too wide for the slender frames of Georgian windows.

d. **Yorkshire Sliders**  
The Yorkshire Sliding Sash slides horizontally. Used in humble buildings and small cottages, it was introduced in about 1700. It is very common in eastern counties, a strong regional style. The treatment for these is essentially the same as for vertical-sliding sashes. The difference in the details of treatment should become clear when the windows are first stripped. Some sliders operate directly on the bare wood of the bottom of the frame, and if this is worn they will tend to jam. Others run on a hardwood strip, and this can be renewed.

e. **Casements**  
The important maintenance item for casements is keeping the hinges well-oiled. If the hinges get stiff then the joints adjacent to the hinge-rail will break. There is also the problem that casements can be caught by the wind and banged violently against the frame, again straining the joints. Some metal reinforcement sunk flush into the timber may rescue a window which is sound but for this point. Otherwise it is the same treatment as before. Do note that the proportions and details of old casements are quite different from modern standard windows. Do not try to fit a standard window in place of an original one. This will damage the character of the building.

f. **Glazing**  
Early in the 19\textsuperscript{th} Century sheet glass came into general use. Before then, crown glass was standard. This could be obtained only in small sheets: it was often very thin, and it had a most attractive appearance, every sheet being slightly curved so that it caught the light in a different way giving Georgian windows their characteristic liveliness. It is difficult and expensive to obtain now, so every effort should be made to try and save whatever remains, even if the window itself is beyond saving.

If a weight-balanced sash has to be renewed the glass must match the thickness of the original or the old weights will not balance it. Horticultural quality glass is thinner and less mechanically regular than normal and may be an alternative. However, careful sourcing and selection will be necessary to avoid a trend to artificial frosting.

6.2 **Doors**  
Front and back doors suffer equally with windows from ill-treatment and neglect, and have even more often been replaced by inappropriate later styles. The most common fault is to fit a door which is too grand for the building. A humble cottage would never have had a polished hardwood panelled door. If the old door is really past repair, rather common because they do get damaged by slamming, kicking, being scratched by dogs, and being altered to take letter boxes and new locks, as well as rot and warping, the best thing to do is to copy it exactly. One problem is that people very often, justifiably, want daylight in
their front hall. If the doorway is too low to allow this to be done in the traditional way with a fanlight then the door will have to be glazed. If the building is listed this will require consent. Before deciding on the design it is best to look around at some glazed doors of the period and choose the most appropriate for the size of doorway and character of the building.

Internal doors suffer less than external ones, but it is surprising how often they have been altered, made smaller, hung on the opposite side and even turned upside down. Often, what looks like a modern flush door turns out to be a fine panelled one with hardboard pinned on to it. The original architraves should be retained, or copied if they are damaged or have been replaced with modern ones. It is common to find that the doors get older as you go higher up in a building. This might be because the ‘polite’ rooms have had their doors renewed in line with fashion, or because doors from an older building have been re-used in the less public rooms to save money. There are houses which have 17th Century Oak boarded doors in the attics, Queen Anne doors to the bedrooms and Victorian or Regency doors to the parlour and dining-room.

Door furniture often lets a house down. One fault with modern brass doorknobs is that they are too large and too elaborate. Traditionally, knobs are rarely larger than about 37mm diameter, and rarely decorated. Large decorative brass knobs in the centre of doors are a London fashion. Appropriate furniture for Victorian doors is difficult to find. The nicest are turned wooden ones, but a black porcelain one may also be acceptable. Plain wrought iron latches and hinges are appropriate.

7.0 INTERIORS

7.1 Staircases

Staircases rarely give problems. The nosings may have been worn away by constant use, and there may be woodworm in the underside, but the remedy is careful repair, possibly cutting back and replacing nosings if the wear is unacceptable, and including screwed and glued timber blocking to strengthen joints. It is always worth investigating painted handrails and turned balusters to see if they are Mahogany or Oak underneath.

7.2 Plaster

Until recently plaster was always lime-based. It stands up to slightly damp conditions very well. Gypsum plaster is less good, and any with vermiculite in it should never be used in such conditions. It will dry and crumble. Interiors of houses are often re-plastered unnecessarily. Lime plaster with a lot of hair in it is very tough, and small areas of looseness do not mean that the whole lot is about to fall off the wall. New plaster, if it is necessary, should be allowed to follow the uneven surface of the masonry. Smooth, flat plaster surfaces do a great deal to spoil the character of an old house, and worst of all is the use of sharp metal corner trims. Corners should be rounded off to about 18mm radius
with no attempt made to keep them perfectly straight. Metal corner and edge trims should never be used for exterior plaster.

7.3 Floors

Floors in old buildings are very often plaster supported on a layer of reed. This is a local peculiarity. The mix is basically lime and sand, perhaps some gypsum, with crushed brick. If one of these floors has to be renewed, vermiculite concrete on expanded metal, with a sand and cement wearing surface - placed whilst the underlayer is still green - has been found to be a good substitute. These floors are fire-resistant, and very good as a sound insulator. Structural problems may be encountered if they are replaced by chipboard because reed and plaster floor relies upon its composition for strength, and the difference in sound transmission will be noticed immediately.

7.4 Timber floors

Timber floors at ground level are the chief breeding place for dry rot. The symptoms are: a strong smell of mushrooms, wood turned dark brown and broken up into small cubes, a network of white filaments over the surface of timbers and on brickwork behind plaster, and, eventually, prominent fungus growths spreading over walls and giving off brown powdery spores. If you meet any of these signs, call in an expert immediately.

8.0 FURTHER READING

The Georgian Group Guides
1. Windows
2. Brickwork
3. Georgian Doors
4. Paint Colour
5. Render, Stucco and Plaster
6. Wallpaper
7. Mouldings
8. Ironwork
9. Fireplaces
10. Roofs
11. Floors
12. Stonework
13. Lighting
14. Curtains and Blinds
15. Papier Mache
The Georgian Townhouse

£3.50 each, including postage, from: The Georgian Group
6 Fitzroy Square
LONDON
W1T 5DX
The Victorian Society Guides

1. Doors
2. Decorative Tiles
3. Fireplaces
4. Interior Mouldings
5. Wallcoverings
6. Cast Iron
7. Brickwork
8. Paintwork
9. Timber Windows

£3.00 each, from:
The Victorian Society
1 Priory Gardens
LONDON
W4 1TT

English Heritage Publications

Lead Roofs on Historic Buildings, Advisory Note, 1997
The Pointing of Brickwork, leaflet, 1994
Practical Building Conservation, Volume 1, Stone Masonry, Ashurst, Gower, 1988
Practical Building Conservation, Volume 2, Brick, Terracotta and Earth, Ashurst, Gower, 1988
Practical Building Conservation, Volume 3, Mortars, Plasters and Renders, Ashurst, Gower, 1988
Practical Building Conservation, Volume 4, Metals, Ashurst, Gower, 1988
The Repair of Historic Buildings, Brereton
Sash Windows, undated leaflet
Scaffolding and Temporary Works for Historic Buildings, leaflet, 1995
Shop Fronts, undated leaflet
Timber Decay in Buildings, Ridout, Spon, 2000
The Use of Intumescent Products on Historic Buildings, Technical Guidance Note, 1997

Society for the Protection of Ancient Buildings (SPAB)

Technical Pamphlets
TP/5 Pointing Stone and Brick Walling
TP/8 The Control of Damp in Old Buildings
TP/10 The Care and Repair of Thatched Roofs
TP/12 The Repair of Timber Frames and Roofs
TP/13 Repair of Wood Windows
TP/15 Care and Repair of Old Floors
Information Sheets
IN2/3 Timber Treatment: Defrassing Timbers and Surface Treatment of Timber Framed Houses
IN/4 The Need for Old Buildings to Breathe
IN/5 Removing Paint From Old Buildings
IN/7 First Aid Repair to Traditional Farm Buildings
IN/8 Tuck Pointing in Practice
IN/9 An Introduction to Building Limes
IN/10 Patching Old Floorboards
IN/12 Introduction to the Repair of Lime/Ash and Plaster Floors
IN/14 Is Timber Treatment Always Necessary

All available from: SPAB
37 Spital Square
LONDON
E1 6DY

Nottinghamshire County Council

A Guide to Repointing Stone and Brickwork
Traditional Sash Windows
Traditional Window Glass

Others

*Cleaning Historic Buildings, Volume 1, Substrates, Soiling and Investigation*, Ashurst, Donhead, 1994
*Craft Techniques for Traditional Buildings*, Wright, Batsford, 1991
*English Stone Building*, Clifton-Taylor and Ireson, Gollancz, 1983
*Practical Stone Masonry*, Hill and David, Donhead, 1995