16 Fire and Flood Damage

16.1 Introduction

Another duty the surveyor may be called upon to perform is to act on behalf of an owner in cases of damage or destruction by fire or flood in a property that has been insured, and negotiate a settlement with the insurers' assessor. The insurers must be informed immediately that a fire has occurred letting them know the approximate extent of the damage, and if possible the cause. In fact, the surveyor will usually find that the insurance company has been notified by the owner before the surveyor arrives on site.

Initial steps to be taken by the surveyor:

- Examine the insurance policy.
- Carry out a preliminary investigation of the damage in accordance with the terms required by the insurance policy.

It is important to understand the term 'reinstatement'. In the writer's view the definition is as follows:

- Where a property is destroyed, the rebuilding or replacement by a similar property in a condition equal to, but not more extensive than the original building.
- Where a property is damaged, the repair of the damaged portion to a condition substantially the same, but not better than the original portion of the building.

In the case of a serious fire or flood, the insurers will often employ an independent firm of loss adjusters to investigate the claim on their behalf. A representative of the firm will contact the owner's surveyor and from then on all negotiations will be between the surveyor and loss adjuster. In the case of serious damage to a large building the surveyor should arrange a meeting with the loss adjuster at the earliest possible date and, if necessary, obtain his or her agreement to have the building cleared of fire debris and demolish or shore dangerous roofs, floors, walls and

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chimney stacks etc. Until this work has been carried out it is difficult to assess the real damage. If the roof is badly damaged then it may be necessary to propose to the loss adjuster that a tarpaulin or heavy duty plastic sheeting be securely fixed over the roof to keep the structure watertight until permanent reconstruction can be undertaken.

One of the conditions of most insurance policies is that the insured is under an obligation to submit full particulars of the damaged property to the insurers. In the majority of insurance policies a period is named within which the claim must be delivered; usually 30 days, but in serious cases this period may be extended by permission of the insurers.

In view of the big rise in values during the past 50 years it has been advisable for building owners to raise the insurance figure on their property including the contents. If the building and its contents are significantly under-insured the loss adjuster will, no doubt, inform the surveyor that the claim could be subjected to 'average'. This means that if the insurers stipulate that the sum insured is less than the amount properly insurable, then the claim settlement will be reduced to the proportion that the sum insured actually bears to the correct figure. For example, if the value of the building and its contents is £800 000 and the owner has insured it for only £400 000, should fire damage occur to the extent of £300 000, the insurance company may then apply the average clause and pay only one half, i.e. £150 000. It will be assumed that insurance for an amount less than the full value means that the owner carries the proportionate balance risk.

The insurers are only bound by the conditions of the policy and it is, therefore, important to check whether or not a comprehensive form of policy is used. This form of policy includes cover for the buildings, contents, loss of rent, claims by the public, theft and larceny etc.

In some cases the owners will have a complete inventory made of the contents prepared by a qualified valuer. In the event of a fire for example, whether a partial or total loss results, both the surveyor and loss adjuster would find time would be saved if the losses were checked against a priced inventory. The advantages of a mutual check are that the surveyor will be able to agree with the loss adjuster at the outset the valuation of the contents as a basis for a claim. If the owner is unable to produce such a document then it will be necessary to compile a list of all the items damaged or destroyed and the owner should be asked to produce accounts or receipts as these would be of great assistance.

When carrying out negotiations it will be necessary to convince the loss adjuster that the owner was in actual possession of the furniture etc. and that the amount claimed is the correct value at the time of the loss. In an industrial situation the building contents, plant or machinery may be separately insured. When preparing a claim, damage by smoke and water can be included, as the insurers are liable for all damage caused by fire, and the question of whether water was used to extinguish the fire does not affect the matter.

If the damage is extensive and a rebuild is necessary, then a complete specification containing quantities which can be priced out in detail will probably be required to satisfy the loss adjuster. Each case must be treated upon its merits, but where a portion

of the building has been demolished it may be necessary to attach plans to the specification showing the building in its original state. After the surveyor has agreed the cost with the loss adjuster he or she will receive a form to sign to confirm that the total figure is the full amount which has been accepted in settlement of the claim. It is important, therefore, to ensure that nothing has been omitted as the insurance company is unlikely to agree a claim for further costs on completion of the work.

The surveyor will certainly be faced with the question of fees and expenses and this must be agreed with the loss adjuster during the negotiations. It is now customary to insure for the full value of the work plus architects', surveyors' and legal fees, cost of debris removal and local authority requirements. The surveyor will find that settling a claim is very time consuming. The duties covered could include the following:

- Making arrangements with contractors to clear debris and silt etc.
- Arranging for shores and struts to support dangerous portions of the building.
- Examination of the damaged portions of the building.
- Making careful notes in sufficient detail to enable a full specification and quantities to be prepared.
- Obtaining the necessary measurements for producing plans for the portions of the building destroyed.
- Negotiations with the loss adjuster.
- Negotiations with the local authority under the Building Regulations in respect of any rebuilding work required.
- Negotiations with the supply authorities in respect of damage to gas, electrical and water supplies.

The negotiations are often prolonged, particularly where a serious fire has occurred to a commercial or industrial building. It is, therefore, advisable to let the owner of the property know that a considerable period of time may elapse before the settlement of the claim and reinstatement of the damage is completed.

On occurrence of a serious fire or flood it is important that the owner or the surveyor should take precautions to see that nothing is lost by theft during or after the fire or flood. The police should be informed at once and will no doubt assist in the matter.

EFFECTS OF FIRE

16.2 Preliminary investigation

Fire damage varies from the superficial to complete disintegration where a complete rebuild becomes a necessity. If arson is suspected, the police will be involved before the surveyor begins their investigation. Before dealing with the various

defects there is the problem of fire debris. All burnt rubbish should be removed and the damaged areas cleaned before an examination can commence. At the same time there is always the possibility that some items may be salvaged and re-used. Precautions should be taken to protect any delicate features such as carved or moulded stonework, ornamental plaster and woodwork which may have only been slightly damaged. Plastic sheeting is useful in such circumstances provided it can be properly secured.

When dealing with badly damaged buildings, measures must be taken to prevent further movement and to ascertain that no part of the building is in danger of collapse. Failure to take adequate precautions might risk the lives of the occupants and members of the public and may also extend the damage. It is the duty of the surveyor to advise on this matter and arrange for temporary supports such as shores, struts and needles. The propping of damaged buildings is difficult to describe in writing as so much is governed by sound common sense. As mentioned in previous chapters, the owners should be informed of any emergency action being taken and a careful record made of the costs.

In the following sections individual materials will be considered.

16.3 Brickwork

Although bricks are non-flammable they can be damaged by heat according to the severity of the fire, and the thickness of the walling. The factor of safety of brickwork is so great that minor cracking can generally be ignored and the joints made good by repointing. If the wall has bulged to a major extent or if there are serious fractures it may well be advisable to demolish the wall and rebuild. Alternatively, remedial work may also be carried out by inserting tie rods to stabilise the wall. If the walls are constructed of sand lime bricks or concrete panels they may be seriously damaged and the structural stability of the wall may be affected which necessitates demolition and rebuilding. If cavity walls are subjected to severe fire they may act as flues exposing the walls to excessive temperatures; and if this is prolonged it will cause vitrification of the brickwork and destruction of the mortar. In such cases demolition of the wall and rebuilding may be necessary.

Water from hoses used during the fire fighting can saturate right through to the internal face of a brick wall and the sudden quenching after being hot may cause cracking and spalling of the brickwork.

One of the most important factors that the surveyor must consider when dealing with fire damage is that the drying out process is very slow and may take several months. In the meantime the remedial work may have been completed. It is, therefore, extremely important to ensure that all embedded timbers such as plates, fixing blocks and the like are carefully removed and replaced with sound materials.

16.4 Concrete structures

The behaviour of concrete during a fire depends largely upon the type of aggregate used. Crushed clay, brick and slag do not cause spalling. Flint gravel expands considerably and causes spalling, and most other stones behave similarly to a lesser degree. Fire damage to concrete will normally affect the outer face of the concrete to a depth of 50–100 mm which will cause cracking followed by surface spalling. Exposed reinforcing bars absorb heat and expand, and will tend to twist. The surveyor must note that steel loses strength above a temperature of 300°C (570°F) and at temperatures of 420– 480°C (800–900°F) there is a loss of strength of up to 80%. High temperatures may cause concrete walls and floors to fall away and leave the fire free to spread into other parts of the building which may not have been affected when the fire first occurred. In cases where concrete floors and walls have suffered a loss of strength it will be necessary to demolish and rebuild the complete structure.

16.5 Stonework

The effect of fire can cause very considerable damage to stonework. Where the rise of temperature is very rapid stone is subjected to considerable stresses, but these will vary according to the thickness of the stonework, the intensity of the fire and the type of stone used. When water from fire hoses is poured on, considerable spalling of the stone is to be expected due to the sudden cooling. When limestone is heated to a high temperature (about 700–800°C, approx. 1300–1470°F) and carbon dioxide is driven off it becomes calcium oxide or quicklime. This process is known as calcination. The Building Research Establishment has carried out heat tests on limestone and has found that calcination usually occurred on arrises and edges of mouldings. Limestone walling is not significantly affected by fire calcination and the strength of the stone is not normally affected to any serious degree.

An important point for the surveyor to recognise is the colour changes which occur in most building stones when subjected to heat. Limestone and sandstone may turn brown, pink or purple. Limestone that is free of iron oxide, such as Huddlestone or Portland, usually turns a greyish colour.

Stonework will need careful examination in order to detect any hidden defects. Projecting features such as mouldings, string courses and cornices will require close examination. If the stability of the stonework has been seriously affected by spalling, consideration must be given to the replacement of the defective stones or, alternatively, whether they can be repaired if only superficial damage has occurred.

16.6 Steel beams, columns and roof trusses

Steel beams built into a wall can suffer damage by distortion and expansion. These defects are likely to cause severe cracking or displacement of the walling. When the steel beam is encased in a fire-resistant material the rise in temperature will be

delayed, but when the heat finally penetrates through to the steelwork the temperature will rise quickly causing expansion and distortion. At 400°C (750°F) the movement can lead to a total collapse of the beam. Steel roof trusses consisting of small angles will tend to become misshapen or twist with loss of strength. This movement will affect the connecting joints by shearing or loosening the bolts or rivets. The surveyor must, therefore, consider all metal as suspect if it has been subjected to prolonged heat and has possibly lost strength. Badly burnt steel should be rejected.

16.7 Timber

Although timber is combustible it will often function satisfactorily for a longer period than metal provided it is of adequate size. Several species such as iroko and teak are highly resistant to fire. However, small sections will quickly burn and disintegrate, but large sections will burn on the outer surface only.

16.8 Roof structure

A description of the common features of timber roof construction has been given in Sections 10.1–10.5. It is necessary to consider the nature and extent of the fire damage to be examined. If all but a few members have survived the fire, the repair may be confined to the joints and members which have failed. Longitudinal splits should be looked for in members which show signs of deflection or have lost their support. Where purlins are in reasonable condition it is well to see that their bearing is still adequate even though the walls have minor cracks. Rafters, struts and collars should be carefully examined as many may be found to be badly charred or split.

Damaged struts and collars are usually readily accessible and can be easily replaced. This is not always possible with rafters or hips. For instance, a rafter secured at the ridge and birdsmouthed at the wall plate could not be withdrawn without disturbing the existing tiling, battens and felt etc.; and ceiling joists cannot be replaced without disturbing the ceilings. A careful note should be made of these defects to enable a full specification and estimate to be prepared. All joints should be examined and a note made of any weaknesses that require strengthening. Badly burnt timbers must be replaced; however, large sections may be cleaned of charcoal and if sound they can be faced with boarding and left in position.

16.9 Pitched roof coverings

Slates and tiles are normally durable but are nevertheless brittle and will often crack or completely disintegrate under intense heat. It is, therefore, essential for the surveyor to make a close examination of outer and inner surfaces. It often

happens that the condition of the roof is so bad that 'patching' would be totally ineffective. When dealing with older buildings it will be found difficult to obtain a similar tile or slate to match the colour and texture of the existing ones. It has often been said when a patch of smooth red tiles has been used to make good a patch in a handmade clay tile roof that 'they will weather down in time'. This is not true: the patch of red will remain a patch as long as the roof lasts. In addition the renewal of the battens and felt etc. may be required.

16.10 Flat roof coverings

The efficiency of flat roof coverings of all types is dependent to a large extent on how much damage was done to the supporting structure. It is difficult to classify the types of damage in a simple manner. In most cases damage may amount to minor cracks, charring of the surface, small holes, joints may have opened, skirtings may have pulled away from the walls, flashings become disturbed and general surface deterioration due to the effects of fire. Many of these defects can be made good which will give a worthwhile extension of life, but where the roof covering has been badly damaged total replacement may be the only remedy. Metal and plastic gutters may exhibit superficial defects if subjected to a minor fire, but intense heat, particularly if applied to the joints, will cause structural failure with possible collapse.

16.11 Floors

Floor joists usually run in the direction of the shortest span resting on trimmers or beams over openings and around staircases. Being protected by the ceiling and flooring it is unlikely that the joists will suffer any serious damage. Serious defects in flooring and ceilings are to be expected as a result of fire and water damage and will often require complete renewal. Serious fire damage to the walls may leave the floor joists without proper support. As long as the joists are in reasonable condition the floor can be temporarily carried on struts until the walling forming the permanent support has been repaired or replaced. It is unlikely that a building so severely damaged as to let the floor drop could, in any case, be worth repairing.

16.12 Internal and external finishes

During the course of a fire, most of the internal and external finishes are damaged or completely destroyed by fire, smoke or water. Damage to internal plastering or external rendering may have arisen from the fire, or from water from fire hoses, or from exposure of the building to the weather before external damage was repaired and the structure made weatherproof. Fire will cause a looseness from the background and will be readily detected as described in Sections 13.5 and

13.6. In the case of gypsum plasters a high temperature will cause the plaster to burn into anhydrous substances and in the case of lime plasters it will change into calcium oxide. The strength of gypsum plasterboards and insulation boards is often permanently impaired where they have been subjected to prolonged soaking or after repeated cycles of wetting and drying. Boards which have been damaged in this way do not constitute a suitable base for plastering or decorating and should be replaced. However, if the boards are only slightly damp their strength is largely regained.

Fire damage and water penetration may have caused serious damage to the woodwork and if the members are badly charred they should be completely removed. Fire resisting partitions and doors will often withstand a considerable amount of heat, and if slightly charred may be faced with plywood, if the strength of the frame structure is adequate. Woodwork affected by smoke stains can usually be cleaned and repainted. With some types of wood, heat may cause a resinous exudation from knots and flaws in the timber, but the source can easily be removed and the timbers made good with fillers.

Plain glass may crack and splinter when subjected to heat and often forms into a fused condition at high temperatures. Roof lights, fire resisting doors and glazed partitions are usually fitted with wired cast glass which usually withstands a certain amount of heat before splintering.

Many defects in paintwork and decorations are to be expected as a result of fire damage and excessive water from fire hoses. Badly blistered or charred paintwork should be completely removed. If the surface of the wood has been slightly damaged, local repairs such as making good with a wood filler may be necessary.

16.13 Services

Electrical, gas, plumbing and heating services should be examined and tested by the various specialists. Testing of the electrical installation is particularly important. Electrical faults are responsible for many fires. Loose connections and damaged insulation can introduce a serious fire risk. It is advisable for the surveyor to obtain an 'inspection certificate' stating that the work has been tested and found efficient.

16.14 Recording the defects

After the defects have been identified the next step is to record every item systematically and mark on the drawing the defective areas with any necessary dimensions in order that a complete specification and estimate can be prepared. When fire damage repairs are to be carried out on a large complex structure, photographs of the damaged areas will be found most useful and will ensure that no details are omitted. It is also important to identify all damaged windows, doors and other fittings. Sketches of all the internal wall surfaces and partitions showing

the position of the openings should be produced together with notes describing the defects. The openings should be numbered so that they are easily identified. It is of little consequence whether the numbering commences at the top of the building or in the basement so long as it is clearly understandable. In addition to these items large scale sketches should be made of any special features such as cornices, mouldings or recessed panels and reveals together with any necessary notes such as 'badly damaged cornice to be removed and rebuilt'.

FLOOD DAMAGE

16.15 Causes

Flood damage is usually due to the following causes:

- Excessive rains or melting snows which cause rivers to rise.
- 'Tidal waves' occurring when high winds drive the sea on to the land at period of high tides.
- Burst storage tanks or water mains causing local flooding in the ground floors or basements.

16.16 Preliminary examination

In the majority of cases the surveyor will find that when called to a flood damaged property the owners have already contacted the local fire services and have had the building drained or pumped out. Trapped water is a problem and the first step is to check that underfloor areas, ducts, cavities in cavity walls and basement areas have been properly cleared. Cavity walls are the worst problem and if water and mud are not properly cleared this could lead to permanent rising damp. The cavity walls should be cleared by removing some of the bricks at regular intervals along the base of the wall to form outlets. Particular attention must be paid to ducts and conduits containing electrical and telephone cables. Water must be removed by opening the inspection boxes and elbows.

Before commencing the examination of the flood damage it is important to test the water, gas and electrical services and isolate them if necessary.

If mud and silt have accumulated under floors or have piled up above the damp-proof course and blocked the ventilation, then arrangements should be made to have these areas cleared as soon as possible and the spaces sprayed with disinfectant. After clearing, the damp areas should be dried out and ventilated (BRE Digests 152 and 163). Heaters are useful for this purpose but all windows and doors should be kept open as long as possible to obtain a good draught. The traditional timber suspended ground floor should be well ventilated, with an occasional floor board removed to increase the draught. Thorough drying out cannot be too strongly emphasised. This operation will minimise the risk of fungal decay.

16.17 General effects of flooding

Brick, stone and concrete in general are unlikely to be seriously damaged by flood water, although brickwork will absorb fairly large quantities of water and will often take months to dry out. The surveyor should check the following points in respect of the main wall structure:

- Scouring and erosion may occur in soft brickwork or sand lime bricks, especially where flooding has been caused by sea water.
- Cracking often occurs in lightweight structures such as timber-framed buildings due to expansion and contraction when the flood water rises and falls.
- Steel and ironwork which are built into walls will corrode, particularly in flood water containing a high proportion of salt or sea water.
- Damage by efflorescence as described in Section 6.6.

16.18 Foundations

In case of serious flooding the foundations of a building are most likely to be damaged especially where they are situated on shrinkable clay. When saturated, the clay is likely to swell and cause movement in the main walls and possible cracking. Erosion from the foundations may also occur, in which case the ground should be allowed to dry out and trial holes dug at intervals along the wall adjacent to the suspected position of the failure. The foundation and base of the wall must be carefully examined to ascertain its condition before a decision on remedial work is taken.

16.19 Ground floors

Solid concrete floors normally will withstand flooding, although defects may occur as a result of damage to the surrounding walls. However, some concrete floors may already be weakened by defects in the original construction or base such as chalk or burnt colliery shale which may cause expansion and serious cracking (see Section 8.9). It is advisable to remove small areas of the floor covering and examine the screed or slab.

16.20 Suspended ground floors

Suspended ground floors consisting of joists on wall plates will require careful examination, and where possible a few boards should be lifted to enable a thorough examination to be made. This operation, however, may well have been carried out previously as described in Section 16.16 above.

Particular attention should be paid to joists embedded in damp walls, skirting boards, panelling and bottoms of door frames and if badly affected by damp it is advisable to recommend their replacement. The ends of defective joists should be cut off and new brick sleeper walls built to support the ends of the joists. No joist should be in contact with the outer walls. A moisture meter with deep probes should be used to measure the moisture content of the timber. If the reading is more than 20% then further drying out is essential.

16.21 Floor finishes

Wood blocks and boarding tend to swell and lift. Plastic and ceramic tiles, linoleum and carpets secured to a screed will often deteriorate when water penetrates through to the screed causing loss of adhesion. As in the case of suspended timber floors it is advisable to lift a few tiles or blocks to ascertain the condition of the base before any remedial work is recommended.

16.22 Wall finishes

Undercoats of cement and sand or cement, lime and sand are not usually affected by flood water, but the old type of lime plasters and calcium sulphate plasters may soften when saturated. These defects are often followed by expansion and a rippling of the plaster face. Plasterboard, insulation board and fibre board become soft when wet and tend to warp or sag.

16.23 Metal finishes and fastenings

Metals are unlikely to suffer much damage if the flood waters are cleared as quickly as possible. However, metals are liable to corrode if they have been submerged for long periods, particularly if the flood water was contaminated with sea water or salts. The metal surfaces should be cleaned where possible as a precaution against corrosion. Door furniture and locks should be cleaned and oiled.

16.24 Drainage systems

Inspection chamber covers should be removed and the interiors checked for defects. All main drains and branches should be rodded to remove mud or silt that may have built up causing partial or complete blockage. In cases of serious flooding it is advisable to dig two or three trial holes at the side of the drain to ascertain the condition of the concrete bed. The soil supporting the bed may be washed away by underwashing currents of flood water leaving the base unsupported.

16.25 Pavings

Flood waters that penetrate through to the subsoil causing clay to swell may often cause the pavings to break up. Hardcore bases will require careful examination and if washed away will require complete reinstatement. If the area is suspect, one or two small trial holes should be dug around the edges of the paving or slabs lifted to ascertain the condition of the base.

16.26 Recording defects

As with fire damage, sketch plans of the various rooms and external works should be prepared showing all relevant details, and if large areas are affected, photographs will no doubt be found useful. A full description of all defects and dimensions should be included on the drawing sheet. If the flooding is extensive the surveyor will require a builder's 'attendance' to deal with cavity wall blockages, removing floor coverings and test drains etc. It is the surveyor's responsibility to explain the service required. The builder will usually charge for this service on a 'daywork basis' and the client should be made aware of the costs.

The surveyor should always bear in mind that flooding can cause serious deterioration and decay if debris and silt are left behind when the water subsides. It is, therefore, necessary to allow the structure to dry out completely (as per BRE Digest 163) before recommending any remedial work to take place. A useful 'check list' describing the various defects that may occur when dealing with flood damaged buildings is contained in BRE Digest 152.