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Risk Improvement in Historic and Heritage Buildings
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The threat to heritage buildings and their contents

Fire is still the greatest single threat to our heritage. It can cause the total destruction of a building and its contents in only a few hours and its primary impact is the potential loss of authenticity - which is, after all, the quality from which the importance of our cultural heritage flows. While facsimiles of destroyed buildings or parts of buildings can be created the loss of the actual historic fabric takes away from the building the very quality which makes it unique and important. Loss of contents may be just as damaging, particularly in the context of a museum or gallery.

As in all matters concerning fire protection, it has to be accepted that while all legal requirements must be complied with, merely meeting statutory obligations does not, of itself, provide any kind of guarantee that a property or its contents will be safe from fire. In the past, many property owners who have undertaken fire protection improvement work in order to obtain a Fire Certificate have not understood this and in a number of cases there has been confusion in respect of a fire authority's *requirements* as opposed to the *advice* given by fire brigades or insurers.

Fire spread in historic buildings and adaptive reuse

The ways in which many historic buildings were constructed themselves create fire safety problems. Some features actually assist in the rapid spread of fire (for example undivided roof voids) while others may allow a fire to smoulder unnoticed for many hours before breaking out some distance from the actual point of origin.

It is, however, the presence of interconnecting voids which probably presents the greatest hazard to the historic building in a fire. Long forgotten ducts, chases, chimney flues, ventilation shafts and even old dumb waiter shafts provide fire and smoke with an easy route by which to spread.

Difficulties will often arise when additional staircases for means of escape are required. The incongruity of fire precautions "hardware" such as exit notices, emergency lighting, fire detection, warning and suppression equipment is another facet of this problem. There may thus be a conflict of interests between, on the one hand, the need to provide adequate fire safety and, on the other, the need to preserve the architectural and historic character of the building.

In such cases a logical and systematic fire safety engineering approach to the assessment of fire safety requirements is needed to reveal alternative methods of achieving adequate, appropriate, and cost-effective standards of fire safety. The analysis and evaluation of the problems that exist in a specific building make it impossible to specify the appropriate package of fire precautions and management actions for that building.

For example, in some situations it may be possible to adopt an alternative approach which places more emphasis on the early detection of fires to provide for the evacuation of the occupant at the earliest possible opportunity thereby permitting conventional standards of fire resistance to be reduced. This does not imply a lowering of safety standards but achieving a comparable standard by an alternative approach more suited to the needs of the building.

There is, of course, a need to differentiate between provisions for life safety and measures intended to protect property. Whilst standards of fire safety required for the safety of the

¹ The Loss Prevention Consultancy Ltd: www.risk-consultant.com

occupants of the building will generally help to reduce damage to property in the event of fire, additional measures may well be required to minimise the potential for loss in respect of the building and its contents.

Measures to improve fire safety should be arranged according to priority. Some may be needed immediately. Less important ones may be delayed until there is a suitable opportunity.

When fire precautions involving alterations to the building cannot be avoided, careful and sympathetic design is needed to minimise the impact these have on the architectural and historic character of the building. In some cases, a more satisfactory approach will be to avoid the circumstances that bring about the requirements for alterations.

Most heritage authorities and organisations have accepted the principle that the best way to guarantee the future of a building is to keep it in use for its original purpose. Only where this is not possible will a change of use be considered and it is clear that significant strides have been made in finding appropriate alternative uses for many historic buildings. Dwellings have been created from structures as diverse as mental hospitals and barracks, old spinning mills have provided units for small businesses and shops have been created out of flour mills and warehouses. The 1999 conversion of an Edinburgh orphanage into the Dean Gallery of Modern Art is an excellent example of this.

In all cases where a change of use of a historic building is proposed, the planning authority should be contacted to see if Listed Building Consent and Planning Permission are required.

Action plan for fire safety management

It is essential that fire safety be managed in a systematic way and the following plan, based on the recommendations of Sir Alan Bailey's report² into the fire at Windsor Castle makes an excellent starting point:

1. Each historic house or premises should have a written fire safety policy statement. Effective internal mechanisms should exist to ensure that the policy is properly implemented and the policy should cover not only the normal operating regime of the location but take into account special or occasional events.
2. Each location should appoint an individual at senior level as fire safety manager with specific responsibility to implement the fire safety policy.
3. Where appropriate, particularly in larger premises, the fire safety manager (who may have other duties) may be assisted by a full-time, specialist, fire officer. (In some locations, this role may be combined with a similar activity such as security.)
4. Each location should compile a fire safety manual setting out its strategy and detailing its plans in case of fire and as a basis for training. Location should also maintain a log book to record all fire-related events such as training, drills, inspections and equipment maintenance.
5. Premises should undertake (or commission from a reputable consultancy) a detailed fire risk assessment. This should make recommendations for fire safety improvements consistent with the preservation of historic fabric.
6. The installation of a modern, reliable fire detection and alarm system should be seen as a high priority. Such systems should be closely monitored by senior management to ensure that unwanted alarms do not undermine confidence in the system. Maintenance of such systems should be to the highest standard.

² Bailey, Alan and others (1993) *Fire Protection Measures for the Royal Palaces*, London: HMSO

7. Following the fire risk assessment, locations should establish a priority for implementation of physical fire safety improvements including establishing or upgrading fire compartments, segregation of areas of high fire risk and providing protected escape routes.
8. Where legally required, fire certificates should be obtained and their requirements fully complied with.
9. Systematic and effective training programmes should be introduced to ensure that all staff know how to minimise fire risks, how to raise the alarm in case of fire and to provide enough trained staff to tackle incipient fires quickly.
10. Private apartments, where they are found, should be included in fire surveys and re-inspected at least every five years. (These inspections should include electrical equipment and the occupants should be given the opportunity of obtaining reliable fire safety advice.)
11. Clear fire safety requirements should be included in all contracts for building, maintenance and other work and for special events. Management must check to ensure that the requirements are being carried out.
12. Larger locations should form and train a salvage/damage control team.
13. Management should liaise regularly with local fire brigades on risk management, fire fighting and salvage. Exercises should be arranged periodically.
14. Consideration should be given to the advantages offered by sprinkler systems for the protection of areas where effective compartmentation or segregation cannot be carried out or for high risk areas.
15. A proper programme of preparation and safe storage (possibly off-site) of architectural and other information should be put in place.

The risk assessment process

As has already been stated, the objectives of fire risk assessment are to ensure that fire safety risks are eliminated or managed to ensure that fires are prevented or the impact of those fires which do take place is minimised. It is axiomatic that there is no 'right' way in which the fire risk at a particular building should be undertaken - what works, works! However there are certain elements of the process which will be common to any activity of this sort - regardless of whether the process is being undertaken for statutory reasons (for life safety) or to determine the appropriate levels of protection for building and contents.

At its simplest, risk assessment demands that one consider the following:

- the likely causes of fire;
- the materials likely to be ignited;
- the structural features which will permit fire or smoke spread;
- how the building or contents are likely to be affected by fire;
- means of escape;
- the occupants.

When this has been done, the next stage is to review the measures which will help to counter the hazards and risks identified, for example:

- the presence or absence of fire detection or fire protection features;
- the presence of persons present to counter an outbreak of fire;
- proximity to a fire station; and

- the time it will take for a fire brigade unit to intervene;
- availability of fire fighting water.

From these factors (and others) it is possible to determine the range of risks to which the building and contents may be exposed and then to estimate what steps can be taken to reduce the level of risk.

Using risk assessment data

Once hazards have been identified, efforts can be made to reduce, eliminate or control these. At the same time, if the risk assessment process has been followed, the scoring or ranking of risks and their possible consequences also allows for prioritisation of a work programme and the allocation of the necessary funding. For example, a typical risk assessment in a heritage building might indicate the following unsatisfactory features or hazards:

- high fire risk from old chimney breast;
- possibility of delayed discovery of fire;
- probability of fire spread from kitchen via unstopped dumbwaiter or old service shaft;
- arson risk from insecure rear windows of store rooms.

These factors can be ranked according to their probable consequences. The simplest (and cheapest) way to counter (a) would be to discontinue the practice of using the fireplaces which lead to that particular chimney. If this was not possible then the chimney flue and breast would have to be repaired or replaced.

In the case of (b) either a 24 hour presence would need to be assured or an automatic fire detection system installed. In the case of (c) fire resistant materials could be used to seal the shaft and in (d) the security weakness could be eliminated by adequate physical security measures.

A detailed examination of the first risk (a) could be worked as follows:

The hazard is, of course, the fire (or its effects of it, escaping from the fireplace and chimney and setting the house on fire. The risk (the probability of an impact of the fire (hazard) on the building) can be managed as follows:

- Risk elimination - replace open fire with other form of (safer) heating;
- Risk control - use a fire guard to retain sparks; sweep chimney regularly; use only seasoned wood to minimise tars and soot; re-point/reline chimney; replace or upgrade hearthstone; replace or upgrade structural elements which abut chimney or where chimney passes through floors; ensure that adequate fire protection measures to prevent, detect and extinguish fires are in place; ensure that structural fire precautions will contain the fire and minimise fire spread and damage;
- Risk avoidance - do not have open fires;
- Risk transfer - [not appropriate in this case]
- Risk financing - ensure that the house insurance covers risks resulting from open fires;
- Risk acceptance - after reviewing the whole process decide that the risk is acceptable.

Principles of risk improvement³

Any changes to a heritage building must meet a number of tests:

³ Reproduced by permission of Historic Scotland from TAN 22 *Fire Risk Management in Heritage Buildings*

Minimal Intervention

Any changes to a listed or heritage building must cause as little impact to the building and its fabric as possible. Any work undertaken 'to improve compartmentation, or to provide fire detection or suppression, should not cause unnecessary disruption or damage during installation, maintenance or eventual removal'

Reversibility

Any changes to a heritage or listed building should wherever possible be reversible ie 'adopting a plug-in, plug-out philosophy'.

Essential

Only the minimum amount of work necessary to achieve the stated objective(s) should be undertaken and all the work should be justified and informed by a detailed fire risk assessment.

Sensitive

Fire protection devices, equipment and systems should be installed with due consideration to the overall appearance of the building as well as having the minimum impact on the fabric of the building which they are intended to protect. Appropriate use should be made of existing features (such as voids, risers, old chimneys and ducts) to allow concealed pipe or wiring runs. Where notching or penetration of structural timbers may be required this should be subject to an expert review and continuously monitored.

Appropriate

The fire protection measures adopted must be appropriate to the level of risk - for example there may be little point in providing a full automatic sprinkler system for a location which is sparsely furnished and where there is little or no fuel load.

Compliant

The fact that certain fire protection measures are required by law, does not overrule the need to comply with other legal requirements (listed building consent, building standards, fire regulations and certification procedures). Where a building is not listed or is not in a conservation area, due consideration should still be paid to protecting its valuable historic fabric. A compromise may need to be agreed between the relevant authorities on the best means of satisfying these separate requirements

Tailoring a fire protection project to the building

When a decision has been taken that fire protection improvements are essential to either reduce the risk from fire or prevent it increasing where the occupancy or circumstances change there are a number of factors which must be carefully considered and evaluated before any work can begin. In particular the tests noted above must be applied to ensure that the proposed work will not cause unnecessary damage to historic fabric or contents.

A careful exercise to determine the advantages and disadvantages of undertaking the work must be carried out - even if the advantages of carrying out the work seem overwhelming there may be hidden factors which when discovered may swing the balance. For example, a decision to convert a heritage building into a hotel will almost certainly require the installation of an automatic fire detection system which can, with care, be accommodated with little damage to the

heritage fabric (depending of the choice of detection devices and selection of cable routes etc). However, until all the building standards and fire authority requirements have been established no work should start because, for example, the building regulations may require that the only (grand) staircase to the proposed guest rooms should be enclosed. This may be an unacceptable alteration, affecting the experience of the space of the building to such a degree that an alternative means of securing a safe escape route must be sought.

Case Study: Duff House, Banff

Duff House is a mansion constructed in the Baroque style between 1735 and 1754 by William Adam. The house was rarely used and in 1906 The owner, the then Duke of Fife donated the house and its surrounding parkland to the two neighbouring Burghs of Banff and Macduff.

For some 30 years the house was variously a hotel and a sanatorium until it was requisitioned by the military in 1939. In 1945 it was returned to joint municipal ownership in poor condition. Various options were considered (including demolition) and the condition of the property deteriorated further. In 1956 the house was taken into the care of the Secretary of State for Scotland as a Scheduled Monument. Over the next 30 years debate over the house's future was conducted locally and nationally and while limited access to the public was available the house was essentially a shell, empty of furnishings and contents. In 1990 a partnership⁴ of local and national organisations was set up to refurbish the building to provide it with the facilities suited to a major national art gallery.

Apart from the necessary refurbishment, upgrading and redecorating necessitated by more than 50 years of disuse, the project also had to consider not only the need for proper protection of the building but also of its intended contents.

Following a fire risk assessment the following improvements were recommended:

- Risk reduction and control to minimise the possibility of a fire
- Upgraded fire barriers to contain fire to zone of origin for at least 30 minutes
- Upgraded supplementary escape routes
- Smoke detection system - with air sampling as a strong recommendation
- Dry riser
- Automatic sprinkler system
- Security against arson

At this stage it became clear that there were three options for the future of Duff House:

- To do nothing and retain the house as an empty shell
- To refurbish the building as a gallery and provide only the minimum fire safety measures required by law for life safety protection
- To follow the conclusions derived from the risk assessment

The principal reason for the concerns expressed related not just to the lack of structural fire safety inherent in the building but also to the location of the house. This meant that only a relatively basic level of fire brigade intervention could be anticipated if a fire occurred if the nearest retained fire appliances were busy elsewhere. The local brigade's disposition mean that significant fire fighting resources and specialist vehicles could take up to 60 minutes to marshal.

In addition to the installation of fire detection and suppression equipment, the building was rewired and the necessary disruption of internal structure also enabled fire segregation and compartmentation to be upgraded.

The risk assessment had considered the need for minimum impact on the interior architecture

⁴ Historic Scotland, National Galleries of Scotland, Banff and Buchan Council

and this determined the type, choice and position of each sprinkler head - for example, in rooms with plain ceilings and deep coombed cornices, sidewall sprinklers were mounted at the base of the cornice.

The completion of the project has allowed the establishment of a major gallery in a previously unused building - which was, like all such structures at great risk from vandalism and arson. The application of modern fire protection engineering, informed by a thorough and detailed risk assessment has meant that the works of art on show enjoy high levels of protection in an environment where minimal levels of disturbance of fabric due to the care and attention to detail in the positioning of the fire system components.

This has been so successful that in 1998 Duff House was awarded a *Europa Nostra* award 'for the nationally important restoration and cultural re-use of a major country house, in particular for the innovative fire protection measures'.