

Further and Higher Education Building Design Guide

A guide to the design and protection of
further and higher education buildings

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Welcome to the 2011 version of the **Further and Higher Education Building Design Guide**. As key insurers within this part of the education sector Zurich are keen to share risk insight and design guidance with relevant stakeholders. The guidance offered is aimed at stakeholders involved in the provision of new-build Further and Higher Education buildings, though the guidance may also be of use in the refurbishment of existing buildings.

Developments in all education sectors are continuing to present increasingly complex and often more challenging building design. Such developments also introduce differing and contemporary risks, which in terms of service provision and overall management require careful understanding and control. Whilst parts of the education sector generally suffers from a prevalent problem of arson and wilful fire raising, predominantly the school type environment, due consideration still needs to be given to the threat of malicious fire setting in Further and Higher Education buildings.

As a market leader for the insurance industry within the education property sector, Zurich have intimate knowledge of how fires and malicious damage creates a waste of resources and interruption to the educational process. We are therefore in an unrivalled position to be able to provide constructive comment and advice on ways forward to tackle the problems posed by incidents and subsequent losses within such premises.

To ensure best use of available funding it is essential that new-build projects result in high quality, well designed and constructed buildings in which to educate for many years to come.

As with any educational building, risk management forms an integral part of the day to day management of such a premise and does not stop after the construction is completed. The design and construction phase is however a key point within the life of the project to avoid undesirable and threatening risks, and to mould the future risk profile in terms of the structure and much of its day to day operation.

In a document such as this we cannot hope to cover all aspects and whilst the contents should be used as a good starting point it is advised that contact is made with our Risk Engineering Department at the earliest possible opportunity. With complex developments, or highly specialised occupancies, further detailed guidance regarding key areas of risk and acceptable protection measures can be provided, following an overview of such schemes.

Consultation is available, through our Risk Engineering field staff who are able to work alongside design teams to ensure effective and bespoke solutions are incorporated appropriate to the risk.

The guidance contained within the document is directed towards all Further and Higher Education providers and their Design Teams. Whilst comprehensive guidance is offered, this is predominantly of a generic nature and Zurich are keen to work along side customers in order to assess individual circumstances of particular projects and associated risks.

Early consultation with Zurich Risk Engineering is essential to ensure that designs meet the Underwriters' requirements.

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What can we learn from the past?



A great many Further and Higher Education premises have been in existence for a significant time and most will have survived for years without any serious material property loss. However, new building projects present the ideal opportunity to build in resilience to these facilities and assist in future proofing such assets for many years to come.

Whilst certain aspects of the risk profile of Further and Higher Education premises can align relatively closely with that of a typical secondary school, there are a number of key differentiators in terms of property risk.

Generally, the problem of arson and wilful fire-raising within this sector is significantly lower than that facing many UK schools. Additionally, general vandalism and theft are considered to be much less of an issue within Colleges and Universities.

Despite the reduced threat that malicious fire setting poses, fire continues to present significant threat to all aspects of the education sector. The extent of damage caused by fire typically results in significant property related losses and in many cases the Further and Higher Education sector suffers to an increased extent in terms significant Business Interruption losses.

Although fire losses in this sector have historically been limited, the scale of these cannot be underestimated. For this reason, such factors must be considered at initial design stage when involved in any new-build project.

Other relatively recent losses encountered involve both storm and flood damage to educational premises. Changing climatic conditions are now presenting new challenges to many building occupancies and colleges and universities have not escaped without impact. Flood and storm resistance was generally perceived to be much less of an issue in the design of buildings 10 or 20 years ago, though the recent climatic changes really demonstrate the importance of addressing such issues for all new projects.

Escape of water and resultant damage has for years presented quite significant losses, both in relation to material damage to property, but also with regard to contents, equipment and research projects.

If we can focus attention on such issues when designing new buildings we will be confident that past mistakes are not being repeated and the risk profiles within these sectors will continue to be improved.

“Zurich are confident that through careful design, these high profile, inspiring and essential facilities can offer much improved risks, with the incorporation of appropriate Risk Management measures.”



2.1 Adverse design features

The following is a brief list of adverse features, which are frequently present on College and University sites. Future building designs must take these issues into consideration if we are to improve the risk profile of these buildings:

- Colleges can be located on open sites, many of which have limited natural surveillance, particularly outside normal hours of occupation;
- Limited boundary security often presents security issues, though it is appreciated in the vast majority of cases this feature cannot be avoided;
- Limited investment in fire protection measures in key areas;
- Widely varying designs of, and poor quality doors, windows, frames and locking devices;
- Easily accessible, often flat, roofs and canopies;
- Recessed doorways and courtyards providing hidden and therefore vulnerable points;
- Limited or inadequate firebreaks in wall, ceiling and roof voids;
- Use of combustible external wall cladding materials
- The presence of large internal spaces such as atria undivided by fire compartment walls
- Extensive service ducts and voids that can assist in rapid fire spread;
- Inappropriately located services and facilities that may be vulnerable to flood, or escape of water losses;
- Lack of appropriate waste storage areas;
- Inadequate and poorly performing intruder alarm installations;
- Limited or insufficient protection measures to areas containing high value or critical equipment, archives etc;
- Lack of sufficient storage space resulting in inappropriate storage in plant rooms, electric switch rooms and cupboards;

In order to progress, it is vital to know exactly how we can replace a poor feature with something better, or how protective measures can best be applied.



It is essential that Property Risk Management issues are considered at the earliest possible stages within the design process. In many cases whilst consideration is given to the wider Risk Management issues, the design is already progressed to such a level that it is not possible to make changes without detriment to the budget and building programme. The timeline of the design process must allow sufficient opportunity to consider Property Risk Management in addition to the more conventional statutory design aspects, i.e. compliance with Building Regulations and Building Standards.

Issues such as the location of the proposed building in relation to recognised flood plains all require appropriate consideration. Using flood risk as an example, detailed consultation should take place in such cases where flood may present a degree of risk to the completed project.

Full stakeholder involvement must be encouraged throughout the design process to ensure the building solution delivered provides a robust long term provision, tailored to best possible use and appropriate to risk.

Wider stakeholder groups may consist of such parties as:

- Geotechnical Engineers
- Structural Engineers
- Environmental Consultants
- Environment Agency
- Mechanical and Electrical Engineers
- Fire Authority
- Police Authority
- Insurers
- Facilities Management
- Estates and Security Teams

These are of course in addition to the conventional participants, i.e. Client, Architects, Cost Consultants, Project Managers etc.

Fire presents one of the most significant threats in terms of education provision, property damage, community impact, financial loss and business interruption. A single fire can have a devastating effect and leave long lasting damage in various ways. Throughout much of this document therefore, a significant focus is towards fire, the resistance of the building to it and appropriate measures to resist the affects of fire.

It is accepted that all fires start as small fires, yet without adequate protection measures within a building extensive damage can result as the fire spreads throughout a premise. Additionally, externally set fires introduce substantial ignition sources to a building which may not be able to adequately resist the effects of fire.

The design process cannot simply address statutory requirements in terms of provision, design and construction but must include additional elements to ensure the delivery of building fit for purpose and acceptable to all stakeholders.

“ It is essential that Property Risk Management issues are considered at the earliest possible stages within the design process.”



With increasing pressures on budget allocations and funding streams, the concept of building refurbishment and reinstatement may be considered more viable and achievable in terms of affordable educational building provision. Sustainability targets faced by building providers, designers and end-users can present real challenges and the concept of re-modelling existing building provision, upgrade of existing facilities, services, building envelope and the overall environment may in some cases offer the only viable and affordable solution.

Such concepts however must maintain the focus towards achieving appropriate levels of property protection, something that is increasingly embedded into new building design. Whilst not specifically aimed at achieving improved property protection, i.e. security provision or behaviour in fire, re-modelling presents not only challenges, but also opportunities in this regard.

The following guidance is aimed providing examples of key considerations for reference as part of refurbishment and remodelling schemes. It should be noted that further, more detailed guidance on many of these aspects are provided throughout the other sections of this guide and appropriate cross reference should be made.

“Zurich Risk Engineering welcome the opportunity to be involved within the design phase of refurbishment and re-modelling projects and are keen to work flexibly with Design Teams to achieve appropriate risk solutions. Early consultation is recommended to ensure acceptability of design proposals.”

4.1 Internal Layouts and Circulation

The existing building fabric may place significant constraints on internal layouts, with caution needed to ensure buildings can operate effectively and routinely without compromising security for example. In respect of fire, appropriate separation and compartmentation should be facilitated in order to limit potential fire losses, for the benefit of both life safety and property protection.

In the case of re-modelling of buildings for educational use, this may have complex implications and a detailed analysis of the overall fire strategy for the building is normally required. It is recommended that current legislative standards for fire compartmentation in new build premises are specified and achieved as a minimum, in order to implement improved fire resilience within an existing building.

Refurbishment schemes can involve the opening up of internal spaces, the creation of more flexible environments or the removal of part of an upper floor to create an atria type feature, for example. Such improvements should embrace, maintain and ideally improve not only the learning environment and provision facilities, but should be designed to avoid compromising security (both daytime and out of hours), and potential fire performance of the building.

4.2 Thermal Performance

Where improvements are proposed in the energy performance of existing buildings, the provision of additional and/or replacement thermal insulation is likely, with this taking a variety of forms. Where externally applied insulation systems are to be incorporated, or new cladding systems proposed, the fire performance of such materials can have a significant impact on the overall behaviour of the building in a fire condition. In extreme cases, the application of combustible insulation products in such a manner could introduce unacceptable fire loads to the building and could potentially assist in leading to a total fire loss.

In the case of improved or upgraded roof insulation, it is often the case that roof voids are exposed in order to gain access for the installation of insulation materials. Extreme caution is required to ensure that any existing fire cavity barriers and fire stopping provision are not adversely affected. The opportunity to introduce or improve the existing fire stopping provision should be considered within the scope of such works with appropriate reference to the Fire Risk Assessment or building's Fire Strategy. Reference should be made to clause 6.2.14 regarding the likely suitability of insulation products.

“Zurich Risk Engineering should be contacted with respect to any works of this type to ensure acceptability of the scheme.”

4.3 Asbestos Removal

Where the extent of refurbishment works entails the removal, treatment or encapsulation of asbestos within the fabric of the building, reference should be made to the building's fire strategy to determine the function of any asbestos linings, cavity barriers or ducting. It may be necessary to re-introduce barriers or linings in order to maintain the fire performance of a building, which could have an impact on not only property protection, but also life safety measures within the building.

Refurbishment schemes may also introduce the need to remove pipe/service lagging that may contain asbestos. The removal of such products is considered best practice, however, appropriate alternative protection systems must be introduced, in order to avoid the freezing of pipes and subsequent escape of water losses and associated damage.



Some existing buildings, commonly those constructed in the 1960's and 1970's, asbestos linings may be present within cladding panels, for example beneath windows and around window reveals. **Where such panels are removed as part of a refurbishment programme, appropriate replacement materials should be used, and ideally be non-combustible.**

4.4 External Envelope

Refurbishment projects of a relatively large scale can often involve upgrade works to the external envelope of the building with external cladding systems being applied, including rain-screen and external insulated finishing systems, for example. Caution should be exercised when specifying such systems to ensure that these do not adversely contribute to the fire load of the building, increase the vulnerability in terms of external fire spread, or introduce substantial combustible elements to the building fabric. Further reference should be made to Section 6.2 within this guide. **Where there is any doubt as to the potential impact of such treatments, reference should be made to Zurich Risk Engineering.**

Re-roofing is often required as part of refurbishment works in order to manage and control the life cycle risks of the building and to improve overall aesthetics of the facility. It is not uncommon to see pitched type roofs being created over existing flat roofs, which is often desirable to limit the extent of disruption internally. Such works can however introduce the potential for reduced fire performance, in that fires within the building may not be so readily vented and heat building up within the 'new' roof void can in many cases assist in rapid fire spread. Current design standards and regulations must be observed to ensure appropriate fire compartmentation and separation is introduced.

Where green roofs are to be incorporated as part of the refurbishment programme, specialist design is required to assess the adequacy of the existing structure and the suitability of any existing roof decking that may be retained. Please refer to Clause 6.2.11 for further guidance in this area.

4.5 Building Structure

Structural works that form part of any refurbishment or remodelling project should comply with current Building Regulations and Standards. In some cases, it may be necessary to review the provision of fire protection to the elements of structure within the building. In the case of some system built buildings, typically of the 1960's and 1970's, structural fire protection may not have been provided, resulting in a poor risk in relation to fire exposure. In such cases, even relatively small scale fires can result in disproportionate damage and in many cases, total loss of such buildings.

Existing fire protection afforded to a structure must be maintained, and in the case of major refurbishment programmes, enhancement of such protections may be considered appropriate.

The overall behaviour of the structure in relation to wind storm can be dramatically altered following refurbishment programmes, with choices of external wall treatments, curtain walling systems and rain-screen cladding potentially affecting the likely performance of the building.

4.6 Building Services – General

In the majority of refurbishment schemes, it is likely that existing services will be impacted upon to varying degrees. Consideration should be given to the adequacy of the existing service provision and the need for and feasibility of replacement within the project.

Mechanical and Electrical services may form an integral or pivotal element of the refurbishment, with the opportunity to install services being essential to void future, short to medium term disruption to the facility. Where emerging technologies may be being considered, for example with regard to heating and ventilation strategies, early discussions with Zurich Risk Engineering should take place to agree likely acceptability of such technologies. Further guidance is provided within Section 7.0 of this document.

4.7 Building Services – Protection Systems

In the majority of refurbishment schemes, it is likely that existing services will be impacted upon to varying degrees. Consideration should be given to the adequacy of the existing service provision, with particular focus on both fire and intruder alarm systems. Often the re-modelling of a building will require a major overhaul of an intruder alarm system, owing to changes in layout and use of key areas.

Fire alarm systems in many existing buildings are often little more than manual break-glass type systems affording no measurable degree of property protection. The opportunity should be taken to incorporate updated and contemporary protection systems, to protect the refurbished facility for the foreseeable future. Please refer to Section 8.0 and 9.0 regarding Fire Alarm and Intruder Alarm systems respectively.

It is unlikely that existing buildings that are being re-modelled will already incorporate existing sprinkler systems, though this should not detract from the possibility,

feasibility and benefits of installing such systems. Whilst it is recognised that the cost of installing sprinkler protection within existing buildings can in some cases be disproportionately high, for example where all internal finishes were being retained, it remains possible and beneficial to install sprinklers as part of major refurbishment schemes. Where a building is being taken back to little more than a structural frame, and all ceilings are to be replaced, the installation of a 'retro-fit' sprinkler installation should be considered. The benefits of sprinkler protection within educational environments, together with key design issues are highlighted in Section 9.0 of this guide.

Early consultation with Zurich Risk Engineering is recommended to determine the suitability of existing and proposed service provision.

4.8 External Landscaping

Whilst not specifically building related, refurbishment works often incorporate external landscaping schemes. Such schemes present both threats and opportunities in relation to the risk exposure for a building. Caution must be exercised to ensure that security strategies are not unduly compromised, for example, by the removal of inner security fencing, or the introduction of landscaping features that may allow easy roof access for intruders.

Such landscaping schemes may also present the opportunity to improve flood resilience of the building, particularly in respect of pluvial flooding, where large expanses of hard surfacing exist around the building. Checks as to the adequacy of the existing drainage system should be carried out, and where necessary, additional drainage channels, attenuation facilities, or adjusted ground levels introduced. Please refer to Clause 5.2 for further guidance in respect of flood protection measures relating to refurbishment schemes.

The construction of a building can influence the extent of any property related loss to a dramatic degree. Within this document it is not possible to address all construction aspects or indeed to address all perceivable risks, however the content is directed towards assisting both designers and end users in considering risk management concerns in an appropriate manner.



From inception to completion and beyond the choices made in terms of construction can have a significant impact on the success of a project. Robust and tested technologies present fewer and more measurable risks in general terms. It is however recognised that in many cases however it is both necessary and pleasing to see new and innovative products and methodologies being adopted.

Pressures in terms of project delivery deadlines can often limit the choice of both design and materials as can the resultant costs. Increased awareness at the earliest possible stage within a project can assist in reducing these pressures and help steer a project through to a successful completion and robust future.

The construction of new educational and research facilities needs to encompass and successfully present a building capable of resisting: fire, flood, storm, vandalism, impact, subsidence and collapse. In most of these areas, statutory requirements and associated guidance offer

designers the solutions to deliver such a project. However, statutory requirements in the form of Building Regulations for example, are based purely around life safety aspects and the health and safety of the users. They offer minimum requirements or standards and not necessarily the optimum in terms of protection, as is sometimes perceived. A college or university building designed in accordance with contemporary building regulations, whilst offering perfectly acceptable safety to the occupants, could potentially suffer a total loss in a fire scenario. In terms of life safety this would be acceptable; in terms of risk management, how acceptable is this really going to be to students, staff, sponsors and the wider community?

This concept ultimately applies across the spectrum of property risk management issues and it is therefore necessary for all stakeholders to embrace the understanding that from a property protection aspect, we must look beyond the minimum statutory requirements.

5.1 Choice of Site

It is appreciated that from a design perspective, designers are not commonly presented with a choice of sites for a new building to be constructed upon. However, in those situations where a choice is offered it is necessary to consider, again at the earliest possible stage, the wider issues in design terms. The vulnerability of the site to flood risk may be an issue where land is low lying and in close proximity to a water course. Furthermore, dependant on the topography of the site and the land within the adjoining area, the premises could be placed at undue risk of flooding when surface water drainage in the locality is overcome by storm conditions.

The design of foundations is again an issue that requires early consideration and ground investigations will be necessary to reveal the extent of the likely sub-structure works necessary for the project. Issues such as ground treatment on contaminated or brownfield sites, ground stabilisation works on reclaimed or unstable land often pose designers with costly challenges. In the case of contaminated land, will it be necessary to introduce remedial measures to the entire site or purely in the locality of the building footprint? Substantial unforeseen costs can result presenting budgetary and programme problems.

Fire Service access can in some cases be limited where sites are located in either a remote location, within congested campuses, or indeed in dense built up areas. Appropriate provision has to be provided in accordance with Building Regulation guidance, though consideration must be given to any possible future development and the effect this may have on access. The topography of the site, together with the hard and soft landscaping proposals will all impact on the suitable access provision. Early discussions should be undertaken with the relevant fire authority in this regard.

The location of buildings on a site can again lead to differing problems. Buildings located in isolated or extremely secluded locations may be prone to increased vandalism at some point during their life, though the same can be said for central locations where open access around the site presents similar issues outside normal hours of occupation. The location of glazed features, large elements of glazing or proprietary cladding systems all require careful consideration and collectively such issues may influence the location of the building/s on the site.

With many building occupancies, boundary security to a site can be achieved with limited effort and a reasonable level of security achieved. However, in many cases, the very nature of College and University sites or campuses, preclude such measures and such proposals would be neither desirable nor feasible. Whilst these measures should not be viewed in isolation, such issues can present compromised security to both the site and buildings and alternative means of affording adequate security must be considered.



5.2 Flood Risk

Following a number of major flood events in recent years, there is an ever increasing awareness of the consequences of flooding.

Consequences can include:

- Need to ensure the safety of students and staff if a flood occurs during the school day
- Parts of the building or campus cannot be used for several months whilst building/s are dried out and repaired.
- Loss of irreplaceable research, coursework, equipment and resources
- Inconvenience of relocating all or part of the facility to alternative location(s) requiring alternative transport arrangements and likely impact on the education provision
- Temporary facilities may be required on site, or alternative temporary sites and accommodation sourced

It is therefore vital that when new buildings are planned or refurbishments undertaken the risk of flooding is minimised.

Causes of Flooding

Floods can occur following:

- Prolonged rainfall
- Sudden heavy rainfall
- Rapidly melting snow and ice
- Storm surges (coastal locations only)

Typical sources from which floodwaters might result include:

- Coastal, including estuaries or tidal rivers
- Rivers or other watercourses
- Blocked, poorly maintained or overloaded drains, sewers and drainage ditches
- Surface water run off from heavy localised rainfall
- Rising groundwater

Appropriate Protection Measures

New Buildings

Planning Policy Statement 25 (PPS25), published in December 2006, sets out Government policy on development and flood risk. The full guide can be downloaded from:

<http://www.communities.gov.uk/publications/planningandbuilding/pps25floodrisk>

There is a statutory requirement to consult the Environment Agency at the planning stage for new developments in areas of High and Moderate Flood risk as defined in the Environment Agency flood maps and for major developments (size of site 1 hectare or above) in low flood risk areas. In reality this means that consultation with the Environment Agency will be required for almost all new school building projects. The developer has to provide proposals for management of the flood risk, including a flood risk assessment, which should be prepared by a specialist company.

PPS 25 also requires that for low flood risk areas, the flood risk assessment takes into account:

- Vulnerability to flooding from other sources in addition to river/coastal flooding
- The potential to increase the flood risk elsewhere through the addition of hard surfaces
- The effect of the new development on surface water run-off

The finished floor level of the new building should ideally be protected to resist a river flood event with a 1 in 200 per year return period. As a minimum the finished floor level must be 300mm plus climate change allowance above the predicted 100 year flood level for river flooding. This represents the normal level of protection required by the Environment Agency.

Please Note: Zurich will require confirmation that the Environment Agency agrees with the flood risk assessment and the proposed measures taken to prevent flooding.

Refurbishments Schemes

Where major refurbishments do not fall under the requirements of PPS25, it is essential that the potential flood risk is assessed and opportunities taken to enhance the level of flood protection. It is strongly recommended that the flood risk assessment is undertaken by a specialist company.

Refurbished buildings must be protected to ensure that they will be resistant to a river flooding event with a return period of at least 1 in 75 chance per year although a 1 in 200 per year return period is strongly recommended.

Any flood assessment must also take into account:

- Potential storm water entering the site from neighbouring premises and areas.
- Surface water run-off as a result of storm drainage being unable to cope with flash flood situations.
- Backing up of internal drains and sewage systems
- Susceptibility of walls and internal partitions to water damage – many modern materials used in the construction process are highly susceptible to water damage
- Adequacy of foundations, floor slabs etc and vulnerability of the building
- Topography of the site and layout of the building, i.e. is the building in a hollow
- If the area gets flooded, how long will the building be affected by flood water (the longer the building is affected, the greater the damage is likely to be)

Details of the flood assessment and proposed defences are likely to be required by the insurer. Zurich Risk Engineering should be contacted at the earliest opportunity to discuss such issues.

Flood prevention measures must be considered at an early stage within the design so they can be incorporated within the budgetary planning.

Possible solutions to problems identified by the flood risk assessment can include:

- Use of flood resistant building materials for external walls
- Use of flood barriers to protect external openings. Products with the PAS 1181-2 or PAS 1181-3 kitemark should be selected
- Ground floor levels raised above the anticipated flood level
- Installation of non-return valves on sewers and private drainage
- Floor construction and foundations designed to prevent water ingress into the building
- Basement/sub-floor void protection
- Use of flood resilient floor coverings and internal partitions in vulnerable areas. Avoid the use of plasterboard and other panel systems that will be prone to damage from contact with water
- Raise electrical services above the anticipated flood level
- Location of plant equipment, boilers, heaters etc above the anticipated flood line.
- Locate IT equipment, servers etc on an upper floor where possible
- Where possible, store all contents above the floor line

Previous Flood History

From a Risk Analysis perspective it may not always be reasonable to suggest that because a particular area or property has never flooded in the past, there is no increased flood risk. The following could result in an increased flood risk at the premises;

- Possible future increase in the frequency and intensity of rainfall (climate change)
- Increased vulnerability to flooding due to flood defence improvements further upstream
- Changes in the characteristics and use of agricultural land resulting in increased surface water run-off. There is an increasing requirement for very large fields, unbroken by hedges, gullies and drainage channels. Also, topsoil can become compacted as a result of intensive farming and therefore less able to absorb sudden and heavy rainfall.
- Increased building development (including very large roof areas) and paving (including roads, car parks and walkways) in recent years. This can cause rainwater to 'run off' quickly, creating large accumulations of flowing water that would have otherwise soaked into the ground.

- Increased development can increase the demands on surface water drainage systems, increasing the potential for drains to surcharge.
- Condition of drainage systems and maintenance/upgrading regimes by water companies, statutory authorities or building owners or occupiers.
- Modern Methods of Construction and the use of materials being relatively new to the construction industry. Many modern buildings are less resilient to water damage than buildings constructed of more traditional materials. For example, requirements to improve the energy efficiency of new buildings, means that there is increased use of varying insulation materials, many of which may not be sufficiently resilient to water damage.

PPS 25 seeks to address many of the issues detailed above but they may still apply to developments undertaken prior to 2007.

5.3 Wind Storm Risk

As with the changing risk posed by flooding, as a result of climatic change we are continuing to see changes in terms of Storm risks faced by buildings. In recent years buildings in many parts of the UK have been the subject of aggressive storm damage.

The result has again been costly claims and substantial disruption caused to building users and largely the wider communities too.

The materials used within the construction of all buildings must be appropriate to the risk. It is therefore essential the consideration is given to potential changes in the storm patterns throughout the UK. This key issue must be addressed at design stage; there will be no second chance within the life of a building to address this, other than after a storm incident or loss.

The exposure of the site in general should be considered initially and an assessment made as to the current perceived exposure. Issues such as windspeeds and likely behaviours need to be accounted for when selecting the orientation of the building, elevational details, external profile, materials and methods of construction. The situation of the building within a site can also have a significant impact on the potential exposure to storm. Within a built up area for example, wind is likely to be diffused and filtered by nearby buildings, though conversely the geometry of the nearby buildings may channel wind towards the proposed building.

As with most property related risks, the more robust construction, generally the better resilience to storm related damage. Heavy masonry type structures are generally perceived to offer much greater resistance than say lightweight panel construction.

Within the education building sector there have been relatively recent incidents where entire roof structures have been peeled from the main structure during heavy winds, some occurring during hours of occupation. Architectural details such as overhanging eaves, mono-pitch or irregular shaped roofs and lightweight construction, for example, may pose increased risks in this regard. The appropriate selection of materials, fixing details and on-site quality control can significantly improve such risks.

The correct selection of roofing and cladding systems can again reduce the storm risk presented with a completed building. A relatively recent storm related loss saw the peeling of a lightweight Externally Insulated Finish render system from a multi-storey building. The extent of the loss was significant in terms of property protection and in terms of potential danger to the public. Where such localised losses do occur, they automatically pose the question from a risk management perspective as to the adequacy of the remaining cladding system and its vulnerability to future losses.

Where lightweight Externally Insulated Finish cladding systems are utilised, their vulnerability to mechanical and malicious damage can also impact on the storm aspect. Where areas of weakness are present, for example, where malicious damage has resulted in the 'external skin' being broken, the entire system becomes less resilient to the effects of both wind and rain. This can in turn lead to the rapid degradation of the construction materials.

Key aspects to consider include:

- Is the building in an exposed location or position within the site?
- Height above sea level, contour of site and adjoining land
- Location of and effect caused by neighbouring buildings
- History of wind / storms in the area / exposure of site
- Orientation of building/s within the site
- Height of building/s
- External profile, design features – overhanging eaves, recesses, canopies etc
- Nature of construction – heavy traditional, lightweight modular, cladding systems etc.

5.4 Sustainable Construction

Sustainable buildings are key to a sustainable future, both in terms of benefit to the environment, but also in relation to providing robust educational provision for many years to come. Designers are faced with significant challenges to meet all stakeholder needs in terms of a sustainable building. The current trend of building design seems to see "sustainability" in a different light. The definition 'sustainable' is a key point to focus on when considering any new building project. Commonly, the term 'sustainable' seems to mean using materials from what are seen to be sustainable sources. Unfortunately from a property protection perspective in many cases this means "combustible".

In many cases, combustible also means relatively lightweight, therefore raising the question of not only being susceptible to fire, smoke and water damage; but also highly susceptible to malicious damage, storm and flooding. In many cases, little thought seems to have been given to the true objective of sustainability – i.e. will the building still be standing in years to come?

Contemporary buildings are now incorporating considerable amounts of timber and increased amounts of insulation to help improve fuel efficiency. These materials, whilst considered positive in terms of meeting certain sustainability targets, often tend to increase the fire development risk, even when encapsulated in other materials. Building Regulations and Standards are in the main aimed at life safety and if protected, or externally facing, these combustible materials are allowable.

As stated, many of these materials meet Building Regulations if encapsulating materials are imperforate at the time of construction, but do not take into consideration damage or alterations that could be made when the building is in use. Once these materials are breached, possibly through malicious damage or a careless contractor, the combustible insulation is exposed, significantly increasing the fire development potential.

Whole life costing of key constructional elements in relation to the posed risks and resilience can sometimes be overlooked. Ongoing repair programmes of inappropriate cladding materials, or even the likely need for entire replacement within the relatively early years of a building's life do little to manage the whole life cost for the end user. If such constructional choices present the opportunity for easy fire inception or indeed assist in the rapid or extensive development of a fire, again, with the need to re-build or carry out significant repairs, the life cycle cost of the building could justifiably be questioned by certain stakeholders.

With exciting proposals utilising Modern Methods of Construction and sustainable materials becoming increasingly common, all stakeholders, including insurers, are faced with greater challenges in considering and in many cases accepting the posed risks. Fire continues to be the major exposure and whilst the insurance industry does not wish to hinder such innovation in construction and sustainable materials, it still has to ensure that acceptable terms are applied and are appropriate to perceived risk.

Much detailed and thought provoking guidance exists for use by designers on the broad subject of sustainable construction, and indeed the wider concept of sustainable buildings and education methods. However, limited reference is made within the general guidance offered to stakeholders to the threat offered by fire in terms of sustainability. Given the degree of encouragement offered to educationalists, service providers and designers to utilise sustainable construction, much more of a focus is required on the threat offered by fire.



6.1 Sub-structure Considerations

Foundation design is an issue commonly referred to Structural or Geotechnical Engineers at a relatively early stage within the design process. From an insurance perspective we may request details of structural design where construction is anything other than standard construction practice. Engineered foundation design is likely to be necessary on the majority of projects and certainly on the more complex schemes or where ground conditions dictate engineered solutions.

Issues where early attention may be required include:

- Brownfield / reclaimed sites
- Areas where mining has been / may be present
- Water courses run through or near to the site
- Underground culverts, wells or watercourses
- High water table within or near to site
- Unstable ground, i.e. where ground improvement may be required
- Sloping sites
- Landfill within or close to the site/building
- Varying ground bearing pressures (where sub-strata is inconsistent)
- Shrinkable clays, non-cohesive soils etc.

Wherever the ground conditions may affect the stability of the structure or dictate specialist foundation design, it is likely that Zurich Risk Engineering may request formal details to be provided.

6.2 Super-structure – Building Fabric

The construction industry as a whole is seeing a rapid change in the type of products being utilised in creation of new educational buildings in all sectors. Being aware of the insurance risks and concerns surrounding particular constructional issues, materials and methods of construction is vital to the success of a robust built school environment.

As mentioned earlier within this document and relating to much of the following guidance, fire presents one of the largest challenges in terms of the super-structure. Given the significant risk that fire presents and the potential consequences of any fire, due consideration is required even prior to planning application stage. External cladding materials often present significant risks in terms of malicious vandalism and external fire setting or assisting in the rapid spread of fire across a structure. In terms of aesthetic detailing, whilst from an architectural aspect

features may be both desirable and acceptable, often in the longer term from an operational angle they are inappropriate. Examples include the provision of low level timber cladding systems, lightweight externally rendered insulation systems etc.

Whilst as insurers we consider fire to present the most significant risk across not only the education sector, but many other sectors in addition, the other key aspects that we must consider are the resilience to both storm and flood damage. Environmentally, we are beginning to see significant global change in terms of weather systems. Design teams perhaps need to question initial design proposals in this area to a much greater extent than ever before.

Storm damage can lead to large losses in terms of damage to a building, service provision and potentially in terms of life. There have been examples where roofs to school buildings have been unable to resist wind forces and have been peeled off during the school day when pupils and staff were present in the buildings. Such losses are in no way unique to schools and the potential threat to life in such instances is immeasurable. Careful selection of appropriate external envelope materials and systems is essential.

The buildings must be designed to comply with the requirements of current Building Regulations and associated standards in terms of such issues as Structural design, resilience to fire, resistance to moisture and weather etc. These requirements generally relate to life safety and the health and safety of the users of those buildings. It is however necessary to think beyond these requirements in terms of property protection and continuity of service provision. Whilst people's lives may not be placed at danger, the continued provision of the service offered and the damage to the building may be overlooked.

Generally from a structural viewpoint, robust and commonly heavier construction is favoured in terms of such threats as fire, storm and flood risk. Heavy masonry construction for example is likely to behave in a much more stable manner than a lightweight system built construction in the event of such losses.

From an insurers perspective it is required that new premises should be constructed of non-combustible construction conforming to Euroclasses A and B of BS EN 13501 or Class O of BS 476 Parts 6 and 7 (now Euroclass B) in respect of fire. In terms of approval of materials used within the construction, any product that has Loss Prevention Certification Board (LPCB) approval for the appropriate fire test will be acceptable to insurers, provided it is used in the application for which the approval was given.

The following guidance is a representative view of the many different aspects of construction though may not address all aspects. Please contact Zurich Risk Engineering for further advice before construction details are finalised.

6.2.1 Modern methods of construction

Modern Methods of Construction (MMC) is a term used to describe a number of construction methods which differ significantly from 'traditional' construction. Other terms that are commonly used include: off-site construction, factory-built, industrialised/system building and prefabrication. However, Zurich's definition is:

“ A construction process that can encompass the use of composite new and traditional materials and components often with extensive factory produced sub-assembly sections and components. This may be in combination with accelerated on-site assembly methods and often to the exclusion of many of the construction industry traditional trades. The process includes new buildings and retrofitting, repair and extension of existing buildings.”

There has been a continued growth in the use of Modern Methods of Construction in recent years, primarily driven by the desire to improve quality, speed and delivery of construction projects. MMC offers many benefits to developers and given the current political support for such initiatives and the environmental agenda, it is inevitable that MMC will continue to develop and increase in terms of popularity. When compared to more traditional techniques, modern methods of construction can reduce on-site labour significantly.

The established and accepted LPCB (Loss Prevention Certification Board) approval process uses existing standards as the basis for listing approved products and companies. However, where no standards exist, as can be the case with a variety of MMC technologies, innovative products are approved by drawing on the experience of scientists, engineers and expert groups to devise a suitable assessment regime for the product or service concerned.

“Modern Methods of Construction present a variety of technologies, with many construction projects incorporating a number of different MMC components or systems.”

Zurich Risk Engineering must be consulted at the earliest opportunity with regard to proposals utilising Modern Methods of Construction, either entire building construction, or those incorporating limited aspects of MMC.

Key issues that will need to be considered include:

- Quality of construction/ quality control
- Performance under individual peril conditions (both in construction phase and when completed)
- Resilience/durability
- Resistance to Fire
- Resilience to Flood / Water Ingress
- Vulnerability to Malicious Damage
- Reparability

Identified below are examples of the more common types of MMC:

Super-structure

- Volumetric
 - Modular Construction
 - Pod Construction
- Panellised
 - Open panel – Timber frame and Steel frame
 - Closed panel – Structurally Insulated Panel (SIPs)
 - Solid Cross Laminated Timber Panels
- On-site technologies
 - Insulated Concrete Formwork (ICF)

External Finishing Systems

- Timber Cladding
- External Insulated Finishing Systems (EIFS)
- Brick Slip
- Green Wall and Roofs

Common MMC Components

- Light Gauge Timber Floors and Roofs
- Studded Compartment Walls
- ETFE Roofs
- Glulam Structural Members

Please Note: Where Modern Methods of Construction (MMC) or Fire Engineered Solutions are being utilised, early consultation should take place with Zurich Risk Engineering.

6.2.2 Combustible materials

Generally, within the overall construction combustible materials should be avoided, though extremely limited amounts and elements may be permissible. However care will need to be taken in the location of these materials e.g. on external cladding or linings on escape routes etc. Other areas are specifically mentioned. Early discussion with Zurich Risk Engineering is recommended.

6.2.3 Volumetric type buildings

Factory built building units may be considered by designers for ease, speed and quality of construction. These can consist of small 'pod' type units used within areas of a more conventional build, or can in some cases form the entire building. The following aspects require careful consideration:

- Construction materials used in the units, including combustible elements and insulation products used. How resilient to fire, flood and storm are these products?
- Fire compartmentation between each unit/pod
- The effect of a fire in a unit/pod - how will this effect the structural framework and reparability of partial losses
- Potential damage to services and how these would be reinstated after a fire.

6.2.4 Panellised timber construction

Zurich have concerns regarding the use of timber both as a structural element and as an external cladding material within new-build premises in view of the fact that not only are many malicious fires started externally, but such construction can dramatically increase the extent of fire damage. The use of fire retardant treatments are considered to have a limited effect on the combustibility of the timber and structure as a whole and it is likely that a major fire could develop which could overcome internal fire protection offered.

The risk presented by different types of timber construction, vary greatly and require early consideration within the design process. Behaviour in fire is a key consideration of any timber structural elements and both the completed and future fire performance of the operational building must be addressed.

Engineered Cross Laminated Timber is an increasingly popular technology which generally offers a far more robust solution than conventional open-panel timber frame construction. Such systems consist of large solid panels of engineered and laminated timber members. With the more traditional timber frame construction (generally lightweight frame of slender timber members), there is considered to be greater potential for a significant loss in a fire scenario than with that of cross laminated engineered timber panels.

With either of these technologies the cladding choices are of key importance, so as not to introduce additional fire load and potential for fire starting. Furthermore, the resilience of timber to flood risk is likely to be limited. Where the building has the potential to suffer some effects of water ingress or flooding or through escape of water from services within the building, the use of structural timber should be avoided, owing largely to its likely behaviour resulting from saturation, then associated drying out and potential shrinkage.

“Where Timber Frame construction is being considered or combustible/ timber cladding is to be used details must be forwarded to and agreed with Zurich Risk Engineering at the design stage.”

6.2.5 Timber cladding

No matter what fire protection systems are incorporated within the building, they will not generally restrict a fire starting or spreading on the outside of the building. Whilst it is not possible to address all design proposals in respect of the use of timber, the following should be observed:

- 1 Timber cladding should be at high level only with the lowest point being no less than 3m from ground level;
- 2 Generally there should be no overhanging eaves adjacent to the timber cladding into which a fire can spread. Where eaves exist above the cladding area, they must be appropriately fire stopped;
- 3 Where the external timber clad walls are raised above the roofline, as an alternative to overhanging eaves, this is likely to be acceptable;
- 4 There must be no storage of waste e.g. skips, bins, etc. in the vicinity of the cladding;
- 5 Timber cladding to be treated to Class O / Euro Class A or B and be re-treated in accordance with the manufacturer's recommendations for maintenance throughout the life of the building;
- 6 The cladding to be on a non-combustible backing e.g. concrete blocks;
- 7 Continuous stretches of cladding should be 'broken up' by non-combustible materials to limit potential fire spread.

In relation to timber cladding, as a guide to the allowable areas the following would normally be acceptable, though observing the points outlined above. These figures represent the percentage of the timber cladding allowed in relation to the total wall area of all the communicating buildings within one communicating range of buildings, and not all of the buildings on the site:

Up to 10%	No additional underwriting terms would apply
11 – 25%	Acceptable but underwriting terms may apply
26% and over	Acceptability will be unlikely but this will depend on several factors. The views of Zurich Risk Engineering regarding the individual proposals must be obtained at the earliest opportunity

6.2.6 Sandwich panels

The use of sandwich panels is increasing in many areas of construction and are acceptable if they are LPCB approved to LPS 1181.

LPS 1181 Part 1. Requirements and Tests for Built-up Cladding and Sandwich Panel Systems for Use as the External Envelope of Buildings provides for 2 main grades of products:

- **Grade EXT-A.** A product that satisfies the requirement for both 'fire resistance' (i.e. LPS 1208) and 'reaction to fire' test (i.e. LPS 1181 Part 1).
- **Grade EXT-B.** A product that satisfies the 'reaction to fire' requirement (i.e. LPS 1181 Part 1) only

Please Note: It is strongly recommended that only wall panels complying to Grade EXT-A will be acceptable for walls and these must have a minimum integrity and insulation of 30 minutes.

It should be noted that Grade EXT-A or B panels will be acceptable for roofs.

6.2.7 Rain screen systems

Generally, these are a lightweight wall construction on a steel frame with insulation and internal plasterboard or similar linings. Given the environment these will be subject to, the robustness of the construction must be considered with extreme care and with full stakeholder involvement. Lightweight constructions such as these are likely to offer minimal resistance to malicious vandalism and result in significant continual maintenance costs. Internal insulation products and cavities can become exposed as a result of attack to the internal lining, or indeed malicious activity externally.

Guidelines for the acceptance of such systems are:

- 1 The use of a non-combustible insulation material, or a system proven to perform in a similar manner must such as mineral fibre/wool, stone wool, lamella, phenolic or a fire rated polyisocyanurate (PIR) product.
- 2 A robust external cladding material at ground floor levels to be used e.g. metal, stone, terracotta and composite materials with a high impact resistance may also be acceptable
- 3 The external cladding system to be of non-combustible construction. Limited use of combustible claddings such as timber may be acceptable subject to individual circumstances and Zurich approval.
- 4 Appropriately specified and designed fire barriers will be required within the cavities, usually, falling in line with fire compartmentation as a minimum requirement.

The construction of the external wall needs to be considered in relation to how easy it will be to repair or replace and how quickly (and easily) fire will spread up the outer face of the building. In the latter case internal fire barriers, or other fire restriction features, are likely to be required at specific intervals along the wall.

Please note that rain screen cladding products must not be selected purely on the basis that the system meets Building Regulations approval e.g. Class O of BS476 Pts 6&7. Rain screen cladding products which use combustible insulation such as expanded polystyrene, but meet the criteria under BS476 for Class O, are not considered acceptable.

6.2.8 Sprayed on Polyurethane or similar materials

External cladding systems utilising 'Sprayed on Polyurethane or similar materials', are not likely to be considered acceptable in the construction of College and University buildings.

6.2.9 External Insulated Finish Systems

The careful selection of the insulation material and render system for EIFS construction is considered essential. EIFS should be avoided at low level because of the potential damage that educational buildings of this type may be subject to. The resistance of these systems to mechanical malicious damage or even normal wear and tear is considered extremely limited. Additionally, from a storm aspect, the provision of such systems must be questioned in the case of exposed buildings.

The insulation used should be of non-combustible construction e.g. rock mineral fibre type, stonewool or mineral wool, or other material with similar performance characteristics proven by appropriate testing. Such systems should conform to the LPCB test (LPS 1581), or be the subject of equivalent large scale testing methodology.

EIFS system must only be used at first storey level or higher UNLESS a robust cladding material is used, e.g. brick slips. In the majority of cases, the use of a reinforcing, heavy duty, mesh is not considered adequate protection against mechanical damage at ground floor levels.

Please note that EIFS systems must not be selected purely on the basis that the product meets Building Regulations approval e.g. Class O of BS476 Pts 6&7. EIFS systems which use a combustible insulation such as expanded polystyrene, but meet the criteria under BS476 for Class O, are not considered acceptable.

6.2.10 Ethylene Tetra Fluoro Ethylene (ETFE) Structures

Where this material is used either to provide entire roof coverings, or on a partial basis, Zurich Risk Engineering will consider each case on its particular merits and therefore early consultation is advised. General guidance as to acceptability are:

- 1 The fire load in the area covered by ETFE should be low. For guidance in this respect please contact Zurich Risk Engineering
- 2 As a guide, if the ETFE roof is more than 15% of the total building*, the building should be protected by a fire sprinkler system
 - *"Building" refers to any separate fire risk i.e. series of communicating buildings where the ETFE roof is located and **not** the whole site.
- 3 The location and orientation of the roof must not aid the spread of fire, or the products of combustion, to adjacent buildings
- 4 ETFE roofs should not generally be erected at a low level, be easily accessible or used in situations where it is likely to be subject to malicious damage.
- 5 If the building is protected by a fire sprinkler system, generally the ETFE roofed area should generally also be protected. However, the requirement for this will depend upon the particular circumstances, i.e. extent of areas open to the air, height, use within covered space etc. If it is decided that the ETFE covered area will not be suitable for the protection by a fire sprinkler system then appropriate separation of this area from the sprinklered areas of accommodation must be provided and agreed by Zurich.
- 6 Where ETFE covers an area which causes the compartmentation guidance under Building Regulation Approved Documents or Technical Standards to be breached, then further fire protection measures will need to be incorporated into the design. The most appropriate fire protection measure to overcome this will be the provision of a fire sprinkler system.
- 7 If a fire sprinkler system is incorporated into a non-heated ETFE covered area, the system will need to be of an alternate type.
- 8 If the ETFE covers small areas in non-sprinklered buildings an automatic fire detection system will need to be installed and the standard agreed with Zurich.

For any building containing the use of ETFE type roofing systems, in some cases there may be further underwriting considerations, e.g. restriction of storm or malicious damage cover or the imposition of higher excesses. In view of this it is recommended that you contact Zurich Risk Engineering at the design stage for their views on the particular risks presented.

Please Note: There are other flexible products that are being considered by designers for the covering of open areas. Each of these will need to be considered separately by Zurich Risk Engineering.

6.2.11 Green Roofs and Walls

The construction industry is seeing continued growth in the use of 'green envelopes' on a whole host of buildings.

The issue of green roofs and walls is one which requires careful consideration in order to make a confident and realistic assessment of the risks presented.

From an insurance risk perspective, if the design is such that the planted surface could be able to readily burn without penetrating the building via the planting mixture/substrate or via adjoining surfaces and penetrations and it is located at a high level, it is likely to be acceptable. However, in such situations as single storey buildings where access to the roof can be gained relatively easily, or where green walls are readily accessible, then it is viewed that such a finish should be considered carefully.

During summer months if not properly maintained there may be a potential risk that the vegetation could dry out significantly, without the provision of an effective irrigation system or procedure. Whilst the plants used in green roof design are generally succulents, the issue of limited maintenance may result in other vegetation of a less succulent nature growing on the roofs. In periods of sustained dry weather these may offer potential for easy fire starting, if readily available roof access exists.

As a minimum requirement, fire breaks must be installed at 40m intervals and are recommended around all roof penetrations.

In order to minimise such risks, it is essential that specialist green roof/wall designers and providers are consulted with respect to suitable design features to obviate these risks.

Zurich Risk Engineering must be consulted at an early stage where green roofs and/or walls are being considered.

6.2.12 Overhanging Roof Eaves

These are a feature introduced into many modern single storey buildings often to make roof access by vandals more difficult. It is important however, to ensure that the overhang is not so prominent that it provides a sheltered area for persons to congregate in secluded areas, particularly outside hours of occupation. It is also important to ensure that adequate fire barriers and stopping are provided to the eaves element, to ensure that an externally set fire cannot enter the roof-space via the eaves. The barrier/s can be in the roof where this abuts the wall and preferably, the fabric of the overhang should be constructed of non-combustible materials.

Where extensive overhangs are provided and require structural support in the form of columns, the design of these should also resist climbing or scaling to prevent roof access.

6.2.13 Covered Walkways/Canopies

On sites or campuses where there are a number of buildings in close proximity, it is increasingly common that covered walkways are being installed to afford some protection from the elements when moving between buildings. Often these are to be constructed in a variety of materials such as flexible plastics, PVC, ETFE or rigid materials. Some of the designs are open sided. The important issues are that:

- 1 Materials of construction should be non-combustible and will not assist in the spread of fire between the buildings.
- 2 The design should not encourage or allow access onto the building roof.
- 3 Consideration must be given to the location of such features so that it will not be subject to vandalism.
- 4 Combustible materials, litter bins etc. within or beneath the canopy area must be avoided

It is desirable that recessed doorways and alcoves are avoided in new buildings, as these are increasingly areas where unauthorised access may be readily gained. This is particularly relevant to open sites where authorised access around the building is possible outside hours of occupation. Such areas may be accessed readily and offer ideal cover for intruders to gain access without challenge.

For such constructions, cases will need to be discussed on their merits and early discussions with Zurich Risk Engineering are recommended.

6.2.14 Insulation

There are many types and methods of insulation ranging from insulation between masonry cavity walls, to exposed external insulation. Each type of insulation, and its location within the construction, will need to be considered and it is possible that an insulation method could be accepted in some circumstances but not in another.

As a guide, non-combustible insulation should be used e.g. Rock mineral fibre type, stonewool, slagwool or man made mineral wool/fibre. In respect of these materials rock mineral fibre and glass wool are inherently non-combustible. They do not contribute to fire growth and will be acceptable for many applications. However glass wool has a lower melting point, which may affect its use in fire-stopping applications. The density of rock mineral fibre products will need to be selected by proven fire performance for the particular application.

Other insulation products and systems that are not designated as non-combustible, though offer similar fire performance characteristics to that of non-combustible products may be acceptable to Zurich, dependant upon the overall make-up of the construction element. The following list gives some examples of where different types of insulation material are considered acceptable.

Usually, the more robust/substantial construction the wall is, there will be more flexibility as to the acceptable types of insulation that will be considered, however this will also depend on how the cavities are closed e.g. around doors and windows. Where there is a lightweight wall construction then non-combustible insulation will generally be required. Also for this type of construction additional cavity fire barriers will be needed.

Examples are given below. Please note that this list is not exhaustive and other insulation products and systems may be acceptable:

- 1 Rock mineral fibre, stonewool, glasswool or man made mineral wool/fibre or other similarly performing non-thermoplastic products are acceptable in all areas (appropriate large scale fire performance test results may be required);
- 2 Floor insulation below either a concrete slab or a concrete screed – all types of insulation are acceptable;
- 3 Cavity wall insulation within a traditional 'brick and block' construction or within a 'brick and metal stud' construction – thermosetting PIR and Phenolic insulation board is acceptable;
- 4 Pitched roof insulation, behind plasterboard, within or on top of a timber truss – thermosetting PIR and Phenolic insulation board is acceptable;
- 5 Concrete deck roofs – all types of insulation are acceptable but preference should be given to non-combustible insulation or thermosetting PIR and Phenolic insulation board. Acceptance of combustible insulation is subject to the ends being sealed with non combustible materials and having a non combustible external surface.
- 6 Insulation on ceilings/under suspended floors – non-combustible materials should be used.
- 7 Built up metal deck roof constructions utilising thermosetting PIR and Phenolic insulation boards are acceptable provided they are LPCB approved to LPS 1181.
- 8 Where insulation is to be used in pitched roofs then this should comply with Euroclass A or B of BS EN 13501, or Class O of BS 476 Part 6&7

There are increasing proposals to use environmentally friendly and high performance natural insulation materials so as to improve the efficiency in a variety of buildings. In many cases such products have not undergone the relevant fire tests, therefore, where such insulation products are being considered, early consultation with Zurich Risk Engineering is essential.

6.2.15 Atrium Construction

The use of large open Atria type spaces is becoming increasingly popular within a wide range of educational premises, in order to afford inspirational, flexible and inviting spaces. Increasingly existing buildings are being linked together with such constructions in order to improve movement around the facilities and accessibility to the variety of accommodation. Whilst this concept is welcomed due consideration must be given to the following:

- 1 The realistic and potential fire load in the atrium space, taking into account possible changes in the future, community/third party type use of such spaces etc.
- 2 The fire resistance of the buildings/parts which face into the atrium – is compartmentation provided on such lines?
- 3 Means of escape criteria if the atrium forms part of the escape route(s). Has a fire engineered solution been adopted/is it required to address means of escape issues?
- 4 Smoke and heat extraction/ventilation
- 5 The type of fire detection system that is to be installed within the atrium
- 6 The effectiveness of any fire sprinklers within the atrium space – also consider possible obstructions

For guidance in respect of Atria design and the issues to consider from a property protection perspective, please contact Zurich Risk Engineering at the earliest opportunity.



7.1 Compartmentation

The main objective of compartmentation is to reduce the potential for fire to develop and spread from the room of its origin. The Building Regulation Approved Documents and Technical Standards set out requirements on this important aspect but the guidance is for minimum standards relating mainly to the protection of life.

As a general guide it is unacceptable for the loss potential of the building to exceed £10 m in any one 60 minute fire rated enclosure unless the building is protected by an automatic fire sprinkler system.

It is usually desirable to produce even smaller or more fire resistant compartments in order to confine any fire outbreak to its area of origin. Within a University research facility for example, areas containing high value, or critical equipment should be the subject of additional fire compartmentation. This will assist in providing additional protection to the equipment and limit the extent of losses that may occur.

Other aspects that need to be considered are:

- Where ductwork breaches compartment walls, fire shutters, linked to the fire detection system, will have to be installed. It is important that these shutters are located in the wall or immediately adjacent to it.
- Fire doors in buildings with heavy foot traffic tend to suffer ongoing damage by constant use. In this respect the resilience of the doors needs careful consideration. The use of fail safe, electromagnetic contacts, linked to the fire alarm/detection system is strongly recommended.
- Compartment walls are to be marked on plans so that, if any work is undertaken in the premises in the future, a check can be made to ensure that any holes or voids created are suitably fire stopped.
- Once compartmentation is provided, it is vital that this is maintained throughout the life of the building.

Fire stopping is often breached by contractors installing services, therefore final snagging checks of a project should always pay particular attention to the integrity of firebreaks within ceiling and roof voids.

Within many Colleges and University buildings, there are significant numbers of piped and cabled services running throughout the building/s. It is essential that these are interfaced appropriately with fire compartmentation, to ensure they do not breach the fire separation provided.

7.2 Natural Ventilation Systems/ Night Cooling

With the requirement for greater insulation and heat conservation in building design, buildings are being designed to retain heat during the day and release this back into the building at night-time. Whilst this may not present additional unacceptable risk features in winter, this may do so in summer. In summer heat commonly needs to be dissipated and this is, generally, by leaving windows or roof lights open at night-time. As a result this presents an increased security risk in terms of intruders wishing to gain entry or arsonists throwing lighted material into the building. Zurich will need additional security for any such windows. As a minimum, external security grilles are likely to be needed though the following also require due consideration to overcome the resultant reduction in security:

- Is the site or specific location provided with security fencing?
- Is external CCTV (monitored) provided?
- Are openings limited in size and provided at high level?
- Security Grilles to the openings – mesh etc.
- Permanent fixed openings
- Will the intruder alarm be prone to false alarms as a result of air movement?
- Are sprinklers provided within the building?

In situations where heat is being drawn from under the ground and this involves tunnels/ducts under the buildings, safeguards must be put in place for the prevention of rubbish accumulating in these areas and unauthorised access must be prohibited.

Internal ventilation requirements may also compromise fire compartmentation, by introducing additional routes for the passage of both fire and smoke. Appropriate measures to maintain the necessary compartmentation will be required where such systems are being utilised.

7.3 Heating Systems

Environmental concerns and increasing energy costs are resulting in new heating technologies being incorporated into new buildings. The choice of heating systems within new all types of education buildings can introduce unforeseen risks, without careful consideration at design stage.

The use of Biomass heating is increasingly popular owing to its environmental credentials and claimed efficiency. Biomass fuel storage requires consideration at early design stage, owing to the highly combustible nature of the fuel. The following should be considered:

- Capacity of storage facility
- Access arrangements
- Security provision
- Fire protection measures
- Fire separation/enclosure – minimum of 60 minutes fire resistance

Underfloor heating systems provide an ideal heat source for a number of spaces within educational facilities and are increasingly being incorporated into new building design. However, such systems carry unforeseen future risks with potential changes in the layout of the building and need for mechanical fixings within the floor. Increasingly buildings are being constructed to allow for future flexibility and designs should take into account:

- Location of partitions – future changes
- Potential need for mechanical fixings – lifecycle issue
- Vulnerability to damage
- Reparability

7.4 Internal Linings

Incorrect use of lining materials can greatly contribute to the spread of fire. Linings should comply with the following:

- Euroclasses A and B of BS EN 13501 or Class O of BS 476 Part 6 & 7 test criteria
- LPS 1181 Part 2 Requirements and Tests for Wall and Ceiling Lining Systems as Internal Constructions of Buildings. This is standard provides for 3 main grades of products:

INT-1. 60 min integrity and insulation.

INT-2. 30 min. integrity and insulation

INT-3. No time specified

7.5 Acoustic Issues

Regulative requirements for acoustic performance within educational buildings again present challenges to the designers. A variety of possible solutions exist in order to achieve the required acoustic performance. Such performance can be improved by the use of ceilings, acoustic barriers and acoustic panels either on walls or hung at high level, etc. In order to resist fire spread, materials complying with Euroclasses A and B of BS EN 13501 should be used as a guide when selecting acoustic materials.

7.6 Areas of Increased Fire Risk

Within College and University buildings a number of areas can be considered to offer increased fire risk and care should be exercised when considering the siting of these facilities and the interface with other areas of accommodation. Additionally, whilst it common to protect such areas to prevent fire spread to other areas of accommodation, there are certain facilities where it is necessary to provide fire resisting construction to protect the 'high risk room' from a fire elsewhere in the building. Such areas would be business critical facilities, computer server rooms, areas containing high value, or irreplaceable information etc. Generally such areas should be enclosed within fire resisting construction providing a minimum of 60 minutes fire resistance, though dependent upon the nature of the risk areas, periods of increased fire resistance may be necessary. Again, early consultation with Zurich Risk Engineering is recommended.

Examples of such areas of increased fire risk could include:

- Server rooms
- Archive Stores
- Libraries
- Plant areas
- Laboratories / Research facilities
- Chemical stores
- Workshops
- Kitchens
- Service tunnels/voids
- Fuel storage areas
- Rooms containing high risk/value equipment

In facilities where extraction ductwork is provided, it should be non-combustible and ideally vent directly to external air. Where such ductwork passes through an adjoining area then the ductwork should be enclosed in a minimum of 60 minute fire resistant material outside the area of increased risk. Automatic fire dampers should be provided where ductwork passes through the fire resisting elements. Ductwork should be designed to facilitate easy cleaning, in particular when deep cleaning is needed. The ductwork should terminate in a safe area, i.e. not where any fire could spread to roofs, overhanging eaves, combustible cladding or nearby buildings.

Where the areas contain mains or piped-in laboratory gas supplies, these should be fitted with an emergency shut-off valve near the fire exit door from the enclosure.

Within kitchens the use of a fire extinguishing system in the cooker hood area is strongly recommended. This would be a requirement where the ductwork terminates in a potentially unsuitable area, or the ductwork passes through important areas e.g. plant rooms. Specific advice on this point can be obtained from Zurich Risk Engineering.

7.7 Specialist Areas

Universities in particular can present unusual fire challenges in terms of occupation. Areas that will need to be discussed in detail with Zurich Risk Engineering include:

- Laboratories for biological research where dangerous pathogens are handled
- Biological Services Units
- Laboratories handling and storing highly radioactive materials
- Research facilities for fuel engine testing
- Chemistry or Chemical Engineering laboratories where potentially explosive atmospheres may be present



All elements of service provision within a building require consideration at an early stage within the design process, so as to minimise the impact of these services on the construction process and in the operation of the completed building.

Included within this section is guidance on the provision of fire alarm systems, fire sprinkler systems and other fixed fire fighting systems, in addition to other service related issues.

8.1 Fire Sprinkler Systems

Zurich recommend that early consideration is given to the provision fire sprinkler installations within new build designs for both the protection of property and indeed in terms of business, education and research continuity.

In the case of Colleges where the entire education facilities may be located within a single building, the criticality of that building cannot be overestimated. Should a fire of any magnitude affect that single building, the education provision provided is likely to be seriously affected to such an extent that the entire building may be unavailable. With contemporary building designs presenting ever challenging risks, future losses where entire buildings are lost as a result of fire are not to be discounted.

Similar issues apply to University buildings, though the facilities contained within these organisations are predominantly shared amongst a range of buildings, and in some cases different campuses. However, individual faculties often present similar risks, in that the specific individual building is critical to the success of the University, research facility or indeed a specific research project.

The provision of sprinklers within a range of educational buildings should however not only to be considered beneficial in terms of property protection but can allow unparalleled design freedom. Conventionally building design must meet the prescriptive requirements of the current Building Regulations together with their Approved Documents / Technical Standards. However, such requirements have often dictated to designers the way a facility can be built, and in many cases limit the internal layout. The provision of a sprinkler system has the potential to offer increased freedom in this area and can ultimately result in better building design.

A number of misconceptions still seem to exist regarding the operation of sprinkler systems. In general terms, sprinklers are operated by heat and only operate in the area of the fire, therefore not resulting in widespread

water damage to the entire building. The sprinkler system is designed to control and suppress a fire, though in most cases extinguishes the fire without fire service intervention. A sprinkler head will typically discharge water at a rate of 60 litres per minute. This is approximately one tenth of that discharged by a typical single Fire and Rescue Service hose.

8.1.1 Design Standards

For any fire sprinkler installation to be recognised for insurance purposes, it must be in accordance with the current standard which is BSEN 12845 2009 all relevant current Technical Bulletins.

It is a general requirement that all parts of a building are to be sprinkler protected. In certain cases with the appropriate internal fire separation and the provision of automatic fire detection, consideration can be given to the inclusion of limited non-sprinklered areas where the discharge of water may present an additional hazard, i.e. main electrical switch rooms, IT server rooms, specific laboratories etc. Such areas may need to be protected by Gaseous Suppression Systems. For specific guidance in this regard, please contact Zurich Risk Engineering at the earliest opportunity.

The design and installation should be performed/ supervised by either an LPS 1048 certified contractor meeting Loss Prevention Certification Board approval or a FIRAS certified contractor.

Please Note: Refer to Appendix One for guidance on key issues to be considered as part of sprinkler designs and installation.

8.1.2 Design Freedoms

The provision of sprinklers in Higher and Further Education buildings should not only to be considered beneficial in terms of property protection but can allow unparalleled design freedom. Conventionally building design must meet the prescriptive requirements of the current Building Regulations together with their Approved Documents / Technical Standards. However, such requirements have often dictated to designers the way a facility can be built, and in many cases limit the internal layout. The provision of a sprinkler system has the potential to offer increased freedom in this area and can ultimately result in better building design.

The following are examples of areas of freedoms that could be considered, subject to appropriate sprinkler system design and agreement with statutory bodies:

- **Increased compartment size**

Compartment sizes often limit aspects of the design of an education facility, particularly in relation to large open multi-function spaces, i.e. atria spaces.

Freedom to increase these may also reduce the need for expensive service implications, i.e. fire resisting ductwork or fire dampers on compartment lines, in many cases.

- **Flexibility in Fire Alarm Standard**

The normal requirement for fire alarm installations in such buildings is to a 'P1' standard in accordance with BS5839, for property protection purposes. However, where sprinklers are provided it is normally acceptable to relax the fire alarm standard as far as an L5/M system (manual call points, plus detection to cover any means of escape/life safety issues). This can introduce a significant saving over a P1 system, thus off-setting part of the sprinkler system cost.

Where other 'trade-offs' or 'design freedoms' are utilised in addition to a reduction in the fire alarm provision, for example, travel distances increased to a significant extent, and compartmentation standards dramatically reduced, then an 'L3' level of coverage (monitored) on the fire alarm may be considered appropriate.

If the building is to be sprinklered, ultimately we can accept L5/M subject to the agreement of the Building Control provider and Fire Officer Approval.

- **Reduced fire resistance to Elements of Structure**

Reduced Fire Resistance to elements of structure is a commonly accepted trade-off. This commonly means providing only 30 minutes fire resistance to the structure of the building as opposed to 60 minutes in many two storey premises. Obviously with more complex building designs and those requiring greater periods of fire resistance as a result, similar flexibilities may be possible. Dependant on the materials used, this can offer capital savings by providing a greater choice in the materials used, or standard of protection provided etc.

- **Flexibility in travel distances**

Increased Travel Distances can allow much improved internal layouts and stair/exit location. Given the control and common extinguishment of a fire in a sprinklered premise, consideration should be given to the basic principle of affording sufficient time to escape from the reduced risk. Caution must however be exercised when considering increasing such distances in dead-end or single direction of escape situations. In such situations it may not be possible to afford this flexibility.

- **Reduced fire door provision**

Fire Door provision can commonly be reduced and compounded with the increase in compartment size. Such reductions are dependant on specific layouts, but designers should attempt to maximise this aspect due to the considerable problem fire doors pose in many buildings, particularly across corridors. Even when linked to automatic hold-open devices they pose on going maintenance and management difficulties and ongoing costs throughout the life of the building.

- **Improved disabled access/egress**

Disabled Access and Egress arrangements can benefit significantly as a result of reduced numbers of self-closing doors (outlined above). By allowing more flexible and less constrained spaces, access has the potential to be much improved. The provision of sprinkler provision within a building can allow freedoms around the need for full evacuation of a premise and potentially may allow phased evacuation polices to be incorporated in larger premises.

- **Flexibility in stair sizing**

Numbers of and sizing of escape stairs is a further area of consideration. It may be the more flexible layout offered as a result of sprinkler provision to reduce the number of escape stairs required, reduce the width as a result of phased evacuations etc. or potentially consider accommodation stairs (those not conventionally designed for escape purposes) in a more pragmatic manner for evacuation purposes. This may allow staircases to be maximised in terms of function and avoid costly staircases that are required purely for means of escape provision.

- **Surface finishes (internal)**

Appropriate Surface finishes and displays can be considered in a more risk based and less prescriptive manner within a sprinkler protected environment. Sprinkler provision can offer substantial flexibility on this very issue since a fire involving the wall linings and displays can be suppressed at an early stage in its development.

- **Reduced Fire Service Access requirements**

Fire Service access requirements are less likely to pose such problems as commonly experienced on some sites. Clients should be encouraged to discuss these matters with their local Fire and Rescue Service at the earliest possible opportunity to take advantage of permissible freedoms. This again, may result in savings on external landscaping with respect to hard standings, access around the perimeter and turning points for fire appliances. In addition to this, a Fire Brigade Breaching Inlet is to be provided. This can potentially assist the Fire and Rescue Service fight the fire without having to enter the premises.

8.1.3 Sprinklers – Other Issues of Relevance

Education provision and Business Continuity

With the potential fore damage being significantly reduced within a sprinklered environment, the provision of education, business and research continuity can be maintained without the need to find alternative accommodation or temporary facilities.

Protection of the Investment

With such massive investment in the facilities, it is essential to maintain and protect that investment. Whilst any building can be rebuilt following a fire, the wasted resources, reduced education provision, impact in research and community impact are immeasurable.

Sustainable Design

Great efforts are being made towards creating inspirational sustainable buildings and educational environments, yet these efforts can be totally destroyed by one simple fire incident. A building destroyed by fire offers little in terms of sustainability, yet with sprinkler protection the potential sustainability benefits are significantly increased.

Environmental Benefits

Provision of sprinklers within a building can result in significant benefit to the environment, given a fire scenario. The control of a fire in the early stages not only dramatically reduces the emission of harmful gases, but also reduces the likelihood of substantial fire fighting water run-off from conventional fire fighting operations.

8.2 Gaseous Fire Suppression Systems

Whilst for the majority of areas, the provision of sprinklers are the preferred method of fire protection, it is appreciated that there may be certain areas of a building where either the provision of sprinklers is not viewed appropriate or acceptable. Examples include research laboratories where electron microscopes or NMR scanners generating high magnetic fields may be present, within IT server rooms, electrical switchgear rooms, archive storage areas, or rooms containing equally sensitive equipment, facilities or systems.

Consideration should be given to the provision of gaseous fire suppression systems in these circumstances in order to afford appropriate and acceptable levels of protection to the provision. It is important that the overall fire protection solution for a building or plant facility to be considered as a whole. Gaseous extinguishants and systems form only a part, though an important part, of the available systems and it should not be assumed that their adoption necessarily removes the need to consider

supplementary measures, such as a provision of portable fire extinguishers or other mobile appliances for first-aid or emergency use, or to deal with special hazards.

Appropriate protection of areas containing either high value or highly sensitive equipment, business critical service provision and systems, or other risks where more conventional fire protection methods must be highlighted and considered within the early stages of design.

Where new-build facilities are to contain such equipment, or features, early consultation should take place with Zurich Risk Engineering in respect of suitable protection measures.

Such systems should be designed and installed in accordance with BS EN 15004-1.

8.3 Other specialist automatic fire suppression

University Chemistry Department fume cupboard extracts can be protected by local automatic wet chemical systems should a fire occur in the extract, often accompanied by the operation of automatic fire dampers to prevent further fire spread through the extract ductwork.

A wet chemical system is also recommended for the protection of large cooking ranges.

8.4 Fire Alarm Systems

One of the major factors in the extent and costs of fires in educational buildings is their late detection. An automatic fire detection system can provide early detection of any fire occurring while a premise is unoccupied, it is necessary to have an automatic fire detection system. Such a system should comply with BS 5839-1:2002 and conform to design of Class L1 (*see note below). This class of system would provide detection throughout the building in addition to manual call points. A monitored remote connection to a central alarm-receiving centre must be provided to enable swift attendance by the Fire Service outside normal working hours unless an alarm activation can be confirmed by a 24-hour security staff presence at a premise.

It should be noted that although any sprinkler system would raise an audible alarm but it is recommended that automatic remote signalling is installed on the fire alarm system that is capable of also transmitting a signal from the sprinkler system as well. This would ensure a quicker transmission of the fire signal to the alarm-receiving centre.

Designing automatic fire alarm systems needs careful consideration to avoid false activation. False alarms are caused by students maliciously activating call points or the incorrect type of detector heads being installed.



To prevent unnecessary activation of call points then the following should be considered:

- 1 Installing alarmed covers to the manual call points
- 2 If the fire service are agreeable, during hours of occupation only, a delay on the transmission of the alarm signal to the central alarm-receiving centre.

Some areas where there could be false activation of the smoke detectors are:

- 1 In areas where there could be smoke/steam generated in the normal course of events e.g. laboratories, engineering workshops, testing rig enclosures, areas using cooking implements, changing areas and kitchens, heat detectors should be considered.
- 2 Within residential facilities, changing rooms etc. where students may either accidentally or maliciously activate the smoke detectors. Whilst the provision of heat detectors as opposed to smoke detection would normally solve this problem, consideration must be given to the life safety implications. It is recommended that consultation is carried out with the local Fire Prevention Officer and/or Building Control provider.
- 3 Where heat detectors are installed in high temperature areas, the temperature rating needs to be appropriate to avoid false alarm activations.

These problems need to be addressed at the design stage and we would suggest that the installer undertakes an analysis of the problems and they suggest solutions so that a 'suitable system, as per the British Standard, is specified for each area.

The installing contractor, designer and servicing contractor should be third party certificated by a certification body such as the Loss Prevention Councils LPS 1014 scheme or the BAFE SP 203 scheme.

*** Please Note: Where an Automatic Sprinkler Installation is to be incorporated into the design, the standard of fire alarm provision may be reduced. Where total sprinkler protection is provided, an L5/M fire alarm system (with off-site monitoring) may be acceptable.**

Where trade-offs in terms of the means of escape provision are being considered, it is essential that the Building Control provider and Fire Prevention Officer are consulted at the earliest possible opportunity regarding the fire alarm system and extent of coverage.

8.5 Gas security

There have been instances of arsonists targeting those parts of a premise which use mains gas. In some cases the culprits have broken in, turned on gas appliances and started a fire, producing a rapidly spreading and serious blaze.

To address this problem, gas isolation valves for each area of the building/s should be situated within a securely locked area. If this is not possible, the valve handles should have a security bracket and padlock fitted to prevent unauthorised use, or a proprietary system can be installed. There are proprietary systems, which ensure the gas supply for each area is regulated through a key operated control panel utilising a solenoid valve.

Specialist advice should be sought in connection with the storage and supply of laboratory gases. In general terms the number of proposed cylinders present within buildings ought to be minimised with any laboratory gases being piped in from outside secure well ventilated enclosures.

Because of the Fire Service reluctance to enter any buildings where acetylene cylinders are known, or suspected to be, to be present and exposed to a fire, the use of acetylene cylinders in buildings is to be strongly discouraged, but where essential the acetylene gas is to be piped in from externally located cylinders.

8.6 Emergency Lighting

The advices of the Building Control provider must be sought on this subject, but we would recommend that the system is installed to the relevant sections of BS5266. Consider also the need for appropriate external emergency lighting in order to facilitate safe evacuation to a place of safety away from the building/s.

The security provisions to a new college or university building, or indeed to a re-developed building or site, requires early consideration in order to achieve a robust and effective solution. Common mistakes of the past have been the lack of consideration given to security within the design process, resulting in expensive, compromising and often less than desirable solutions.



Key stakeholder engagement is essential when formulating a robust security strategy for a new college or university building, and indeed when undertaking a major refurbishment project. Entire security strategies can be worthless if let down by one single design element, such as the use of night cooling as part of the environmental strategy without appropriate design and treatment of ventilation openings.

The orientation of a building on a site, linked with the external profile of the structure can present significant benefits in terms of security. By simply avoiding the

provision of recessed doorways, concealed areas and low roofs, the security to the building is already likely to be improved. Effective boundary treatment, with the use of security fencing to the site or perhaps more appropriately around the buildings only will again assist in providing a secure environment both inside and outside hours of occupation.

In the case of College buildings, these are commonly occupied on regular basis throughout term time, with reduced occupancy in parts on evenings and perhaps different uses on weekends and during holiday periods.

The type of occupancy can introduce security challenges and the need for a robust and flexible security strategy.

Similarly, in the case of University occupancies, these can present equal challenges, though for different reasons. The occupancy patterns of these buildings differ in terms of extent of, and perhaps wider periods of occupancy, linked with some areas within a potentially 24-hour accessible building being largely unoccupied for long periods, or the subject of very infrequent use. All these aspects require early identification wherever possible in order to ensure the risks are included within the encompassing security strategy.

The location of key facilities and functions within a building, or within a campus require careful consideration so as to minimise the security risk as much as possible. Whilst it may be desirable from an occupancy perspective to allow easy and free access, the security risk must be balanced. For example, by incorporating appropriate access control, remote authorisation of access, or limiting the relatively open access to minimal areas may present suitable control measures.

Internal separation should be such that it is possible to secure areas of the building in a robust manner, without compromise to the use of the premise.

It is hoped that the following guidance will support designers in this regard.

9.1 Fencing and boundary treatments

Security fencing is commonly the most effective of all the measures commonly available to provide protection to a building against theft, malicious damage and any subsequent, deliberately set fire.

In the case of both campus based building layouts and those stand alone buildings, it may be undesirable to provide fencing of any kind around the site or building perimeter. In many cases, the way in which the facilities are used by students, and the times at which access is required, is again likely to make the fencing, or enclosing of the buildings, or sites, an unviable option.

Consideration should however be given to appropriate fencing provision to the more sensitive areas, such as those parts of a building containing high value, or highly desirable equipment and to secluded locations, i.e. recessed areas, courtyard areas etc. Such provision can be as simple as providing secure gating to a recessed area, fencing off potential access routes to a low roof or secluded area at the rear of a building for example.

Fencing is available in a variety of different materials, heights and quality and each premise and risk is likely to

dictate the appropriate type of fencing or gating. For effective security, fencing should be of security weldmesh, palisade or railings. The fencing should ideally be to a height of 2.4 metres and installed according to British Standard 1722 Part 12, 1990 Section 7 – the Erection of Palisade Fences or Part 10, 1990 Section 5 – the Erection of Welded Mesh Fences.

It is recommended that the design and specification for appropriate fencing or gating should be discussed with Zurich Risk Engineering at an early design stage so as to appropriate security is provided.

The effectiveness of any security fence, either to a building/site perimeter, or in a very localised situation, i.e. to secure a secluded courtyard area, can be breached if it can be readily scaled by intruders. Landscaping features, for example low level walls, bollards on pathways, adjacent planting can all have a negative impact on the level of resistance provided by the security fence. Such features should be sited so they do not provide climbing aids to gain access over fencing.

Gates within perimeter fences must be to the same quality and height as the fence. Particular attention should be given to the design of hinges and locking mechanisms, so as to avoid providing footholds to assist intruders in scaling the gates. The design of the gates should be such that they cannot be lifted from its hinges and gaps beneath gates should be minimised to prevent intruders gaining access via this route. In certain cases it may be necessary to incorporate additional security bars to close gaps beneath gates, particularly on steeply sloping sites.

In certain cases the threat of vehicular access may be considered to be significant and the use of robust security bollards should be considered, particularly in vulnerable areas. Examples include sites where the building façade provides an element of the secure boundary, where unauthorised vehicular access or ram-raiding could become future risks.

9.2 Building recesses and courtyards

Whether these are simply recessed doors, covered entrance areas or service yards, there is a danger that they could provide a secluded and therefore vulnerable point, where some form of damage can occur. It is preferable that predominantly straight building lines are constructed wherever possible enabling increased vision and natural surveillance. Certainly, a building without recessed areas should be the objective, particularly if an external CCTV system is to be installed for day to day management of a campus, and in terms of the overall security strategy.

9.3 Roof access

Whilst the problem of students gaining access onto roofs might not be considered a risk the building may face, easy roof access allows intruders potential for easy access into a building, often out of view of neighbouring properties, or the public on the streets and pathways below. It is therefore important to reduce the risk of unauthorised access to roofs as much as possible.

Easy methods of preventing or limiting the potential for roof access can be applied within the design. For example, when considering rainwater down-pipes, these should ideally be plastic, be square or rectangular in profile, and be fitted immediately adjacent to the wall. In areas considered more vulnerable, consideration should be given to enclosing down pipes to prevent them being climbed. Without correct design of such elements, other, less desirable anti-climb measures may be required e.g. anti-scaling devices, anti-climb paint, etc.

Care should also be taken to ensure designs do not incorporate features that will assist with easy roof access, e.g. adjoining lower level walls, gates, fences or other climbing aids. Where low eaves are unavoidable consider carefully external door hardware, ventilation openings and window sill details, that may allow easy access on to the roof. Where low roof access cannot be designed out appropriately, it may be necessary to limit the extent or type of rooflights, or other penetrations that offer potential access points.

Due consideration must also be given to applicable legislation, i.e. The Occupier's Liability Act.

9.4 Doors and windows

In recent years the security standards of doors and windows in new school buildings have been much improved, though some additional security provision is sometimes required. Where possible, doors and windows should comply with LPS1175 Specification for testing and classifying the burglary resistance of building components, strong points and security enclosures.

Windows are by far the favourite route of entry for intruders. Ground floor opening windows large enough to permit entry should be fitted with opening limiters as well as key operated locks. All windows facing publicly accessible areas, should be fitted with laminated glass if less than 2.4m from ground level. It is however generally recommended that all ground floor windows and other easily accessible windows are fitted with laminated glass. The use of robust restrictor devices is also recommended to opening windows, limiting the openings to a maximum of 100mm. It may be necessary to install attack resistant glazing in key locations. All laminated glazing should be

certified to BS EN 356:2000 Glass in Building. Security glazing – resistance to manual attack (to category P2A).

Internally beaded aluminium, windows are preferable to uPVC frames from a security perspective, but, in both cases, it is important to ensure that frames are adequately secured to the building fabric and the opening areas are secured by multi-point locking.

In areas where levels of malicious damage and glass breakage may be high, external motorised steel security shutters may be considered necessary. Security shutters should comply with LPS1175 Specification for testing and classifying the burglary resistance of building components, strong points and security enclosures.

In respect of doors, more use is being made of double-glazing and as a safety feature laminated glass is being used. In general, exit doors must be secured by good quality locks i.e. those which conform to BS 3621 incorporating the appropriate metal box striking plate. The locking mechanisms are to be a minimum of five levers. Alternatively, locks should be at least 6 pin cylinder mechanisms, with anti-drill inserts and complying with Grades 4 or 5 of BS EN 1303 (Building Hardware- Cylinder Locks- Requirements and Test Methods).

It is important that all external doors and their frames are installed to a good standard. The frames should be securely fixed to the surrounding construction.

Where there is a letter box, a fireproof container or enclosure must be fitted behind it, to reduce the risk of arson, or alternatively an external letter box could be used. Conventional letterplates within doors must be avoided, owing to the likelihood of lock manipulation, fishing of mail and other items, and the potential for fire setting.

In general, reliance for fire exit doors is made on the panic bar and consideration must be given to the ease of activating the panic bars from the outside, particularly in areas where miscreants can work unobserved. All fire exit doors must have alarm contacts, or there must be a movement detector within the vicinity of the door, to detect intrusion at the earliest possible stage.

Where improved security is required then the door should be fitted with a high security fire exit multi-point locking device complying with BS EN 179 or BS EN 1125. The cylinder mechanism on the lock should have at least 5 pins and anti-drill inserts. It should be ensured that bolts fit properly into their boltholes and that there is no accumulation of dirt in the boltholes.

The local Fire Prevention Officer should be consulted concerning the placement and security of fire exit doors.

In some cases electro-magnetic locks are provided on doors. These are also a security feature but they must not be regarded as the sole security of the door, as they fail safe in the open position, if the electric supply fails.

9.5 Intruder alarms

The security of both Further and Higher Education buildings is, with the majority of other building occupancies, of great importance and where possible they must have the benefit of intruder alarm protection. Detection should not just be aimed at those breaking-in to steal but at any intruder wishing to cause damage to the building fabric as well as contents. The following points are relevant in respect of new installations:

The degree of occupancy of the building is pivotal to ensuring a robust alarm solution is achieved. Buildings that have potential 24-hour occupation may be unable to be protected or may have a system that is confined monitoring entrances or exits such as fire exit doors not normally in use. Where part of a building has extended hours of occupation, alarm protection could be provided to those parts of a building that are not in use. Specific rooms that contain high-value equipment, such as IT server rooms, which are not normally occupied, can be protected on a full-time basis.

Where a building is secured, intruder alarm detectors should be provided to cover (1) all rooms accessible from the outside, i.e. ground-floor rooms having external elevations plus upper floors accessible from external roofs, (2) all ground floor circulation areas and (3) external doors by contacts. On upper floors circulation areas, high risk rooms and staircases should also be protected.

Any installer or service provider is to be certificated by a UKAS (United Kingdom Accreditation Service) accreditation certification body.

An alarm activation will need to be linked to a 24-hour security staffed monitoring centre. A campus may operate its own security control centre staffed by trained security staff, who are able to respond to any alarm activation speedily and confirm the reliability of the alarm activation.

Where there is no speedy confirmation of an alarm by an on-site security team, then an alarm will need to be relayed to a commercially run Alarm Receiving Centre via some form of monitored path such as BT RedCARE, BT RedCARE GSM and CSL DualCOM. The last two provide dual-path transmission, allowing the Alarm Receiving Centre to still receive a second or further alarm signal if the primary path fails or is interfered with.

A Police response by a confirmed alarm system will normally be required. In order to be granted a Level 1 Police response an alarm system will be required to have audio, visual or sequential confirmation technology. Here analysts at the Alarm Receiving Centre judge whether an alarm activation is genuine by listening in to microphones, viewing images forming part of the intruder alarm system or registering that at least two detection devices have operated within a given time period.

The system design will need to comply to BS EN 50131-1. Under this standard systems, equipment and signalling are graded into categories divided between Low Medium, High and Very High and Special Risk trades.

For College and University risks, Grade 3 is generally considered to be the minimum standard to which systems should be installed. However the Grade should only be officially decided upon following a formal risk assessment carried out by the alarms installer in conjunction with the client and insurers. This is to ensure that the system design takes into account the occupancy of the area, its location, the value of attractive contents and equipment and their importance in generating research income. Combining this information with the likely skills, resources and determination of a thief, the system Grades are:

- Grade 1:** Low-Risk system where intruders are expected to have little knowledge of intruder alarm systems and be restricted to a limited range of easily available tools.
- Grade 2:** Low to Medium-Risk system where intruders are expected to have a limited knowledge of intruder alarm systems and the use of a general range of tools and portable instruments.
- Grade 3:** Medium to High-Risk system where intruders are expected to be conversant with intruder alarm systems and have a comprehensive range of tools and equipment.
- Grade 4:** High-Risk system where security takes precedence over all other factors. Intruders are expected to have the ability or recourse to plan and intrusion in detail and have the full range of equipment, including means of substitution of vital components in the intruder alarm system.

Individual components of alarm systems, e.g. detectors, control panels, methods of alarm transmission, are also graded according to that performance, resistance to attack, etc. The Grade of the system as a whole will be governed by the lowest Grade component. Therefore a system with a Grade 2 alarm transmission system but having a Grade 3 control panel and detection will be treated as Grade 2 overall. As high-Grade components will be more sophisticated this could have a cost implication for the whole system and therefore care must be taken not to over-specify.

The Grade will still not dictate the design of the system and reference is to be made to the insurers to ensure that the system meets their requirements, particularly with regard to the alarm transmission system.

9.6 Closed circuit television (CCTV)

CCTV systems have had a mixed success rate for a variety of reasons and should not be considered as a universal solution to site and building security problems. These relate to the type of problems being experienced, the nature of the site or campus layout and the nature and quality of the installation.

Prior to the installation of any system, careful consideration should be given to exactly what is expected of the installation e.g. deterrent, identification, safety of students and staff, recording, monitoring (on site/off site). It is essential that a comprehensive stakeholder discussion takes place to determine the system requirements and the degree of reliance placed on the provision of CCTV systems within the security strategy and in certain cases, in relation to the fire strategy of the buildings. In the case of University risks, the security services department have valuable experience in the operation and success of existing systems and it is essential that they are consulted within the building design process at an early stage.

The criteria for use should govern the type of installation and it is suggested that specialist and, if possible, non-commercial informed advice is sought. Whatever the criteria it is essential, if the full deterrent value is to be gained, for lighting to be adequate in the area of the cameras.

Any systems that operate purely on a record only basis (a passive system) generally offer limited value in terms of an improved security strategy. It is recommended that where the security strategy places any reliance on the provision of a CCTV system, a fully monitored installation (an active system) is installed. The provision of these active CCTV systems offer significant benefits to the end user in terms of both daytime and out of hours security. It is however appreciated that in many town and city centre locations,

there may be limited opportunity to install these protection systems around a building, owing to the buildings' interface with public rights of way, neighbouring properties etc.

The provision of CCTV will not attract premium discounts for insurance purposes but may, in some cases, reduce the risk category from high to medium. It should be noted that this is only possible where the system is comprehensive and has remote monitoring off site by an approved monitoring station. CCTV cannot be considered in isolation as a substitute for physical security measures or fire protection measures.

CCTV systems should be installed to 'BS EN 50132-7: CCTV surveillance systems for use in security applications'. Any system incorporating the facility for the monitoring centre to interact with the protected site must be installed in accordance with BS8418 – The code of practice for the installation and remote monitoring of detector activated CCTV systems.

9.7 I.T. Areas

Due to the ongoing increase in the complexity, quantity and cost of IT equipment, all educational environments are potentially becoming an increasing target for thieves. Computer equipment, including laptops, interactive whiteboards, data projectors and flat screen monitors besides conventional PCs and servers are desirable to thieves, both opportunists and organised groups.

Examples of the precautions that should be considered include:

- 1 Entrapment devices. Any device should conform to LPS 1214 Physical Protection Devices for Personal Computers;
- 2 Cable securing if entrapment devices cannot be installed;
- 3 Security of Data Projectors. Where data projectors are ceiling mounted, care must be taken to ensure the fixings are of adequate strength to prevent easy removal. It is recommended that for this type of equipment a security device incorporating a high decibel inertia sounder should be used.
- 4 The importance of prevention of daytime theft. Normal management security practices should apply. All doors should be secured during the normal working day, especially when the premise is only partially occupied or being used in the evenings for cleaning, staff meetings etc.

In addition to the risk areas mentioned above, within University buildings, some research facilities and equipment are of very high value, and whilst they may be of limited use to thieves as a result of their bespoke nature and limited resale value, their replacement value can be extremely high.

A full security risk assessment is critical and needs to be undertaken at a relatively early stage within the design process, in order to incorporate appropriate security protections as an integral part of the design. It is neither desirable, nor economically viable to re-visit such aspects within months of a facility becoming operational, following a number of losses. A clear understanding of the type of equipment that is planned within a new building must be gained in order to ensure the appropriate choices in terms of security are made, to avoid compromises of limited value at a later date.

Where there are concentrations of values, i.e. purpose built computer suites for example, these should be located as high up the building as possible – simply making them less accessible. Where this is not an option, then ideally, the location should be in an internal part of the building, without external walls, doors or windows.

The rooms or areas should be protected with a secure envelope – with solid or reinforced walls and secure doors and windows, possibly protected with security grilles bars or shutters. Grilles or bars should be installed in accordance with the recommendations of BS8220 and shutters should comply with LPS1175 Specification for testing and classifying the burglary resistance of building components, strong points and security enclosures.

Often omitted is the protection to internal doors to such areas when other points of entry have been well secured. The room itself and internal areas outside the room should have the benefit of intruder alarm cover. Intruder alarm standards are outlined in section 8.5.

9.8 Business critical, attractive and valuable contents

Buildings containing high-value or attractive contents are by their nature likely to be the subject of ongoing security challenges. Examples apart from the IT areas mentioned above include musical and scientific instrument classrooms and stores, audio-visual aids equipment stores and tools in engineering workshops. They can also include in Universities more specialist equipment rooms containing electron microscopes, spectrometers and MRI and NMR scanners where although the contents are very specialist in nature and perhaps of limited direct appeal to thieves,

are of considerable importance as they can generate significant research income and be a critical part of a Faculty's function

The precautions that should be considered at the building design stage relate to the security envelope of the building, classroom, laboratory or store containing such contents and will need discussion and risk assessment with stakeholders as to the degree of access allowable to students, staff and the general public. Suitable access control by means of electronic or key systems can then be determined. Before considering the direct physical protection directly to the vulnerable rooms, as a minimum the general public should not be able to directly reach any of the corridors or other circulation areas directly outside such rooms without encountering some form of access control.

Once the risk assessment has determined the attractiveness of the contents to thieves and the value to the College or University within a vulnerable room appropriate protection measures required can be determined. These should always include a measure of physical security to the room in question that would impede the progress of an intruder as well as any electronic measures such as intruder alarms or CCTV that this proposed.

In general terms it is advisable that any room enclosure utilises brickwork, dense concrete block or concrete to provide resistance against a forced attack. Other forms of enclosure such as plasterboard may be acceptable providing there is additional security by an internal sheet metal layer.

Some of the physical security measures such as protection to doors and windows have already been mentioned in 9.4. It may be necessary to include some of these measures on internal doors as well as any external doors since forcing of internal doors to gain entry by thieves, who might have tailgated legitimate users to gain entry into otherwise access controlled internal corridors, is not uncommon. Using internal doors conforming to LPS 1175 Specification for testing and classifying the burglary resistance of building components, strong points and security enclosures will help to provide a satisfactory level of resistance. However with any door, care must be taken that any glazing close to the door cannot be easily broken from outside and any internal door release mechanism, such as a thumb turn or pushbutton release, cannot be easily reached from outside.

Glazing to any of the internal room security envelope, including that in doors, is a potential weak spot and is to be avoided where possible. Depending upon the risk assessment the glazing is to be protected by LPS 1175 security grilles or shutters but as a minimum is to comprise at least 7.5 mm laminated glass, which is fire resistant if required.

Additional security to the roof structure may in some circumstances be required if an accessible lightweight roof design, including any roof lights, directly above a vulnerable area is proposed.

9.9 Lighting

Security lighting can often play a part in deterring criminal damage as well as ensuring the safety of site users. However, each building location needs to be assessed on its own merits.

For example, good lighting is particularly effective in areas of the site which are easily visible from nearby properties, footpaths or roadways. To install lighting into areas of a site which are not overlooked can sometimes have the detrimental effect of attracting wrongdoers to gather.

Security lighting is only effective if it is working properly and switched on at appropriate times. An automatic form of control is usually the best option. Automatic controls include:

- Time switches, that switch lights on/off at predetermined times
- Time switches in conjunction with photo-electric cells to ensure optimum effectiveness
- Passive infra-red movement detectors that switch on the light for a timed period when anyone enters the range of the detector
- Connections to existing intruder alarm systems

If a lighting system is to be used in conjunction with CCTV, additional factors have to be considered and it is recommended that a qualified engineer be consulted.

Careful consideration must be given to even distribution of light and the prevention of excessive shadowing, together with the avoidance of glare or unwanted light pollution. The choice of light fittings, siting/location, height etc. will all impact on the successful lighting of the building and site.

In the case of open sites, where public access is possible around the building, the type of light fittings, their location and robustness require careful consideration to ensure they cannot be easily damaged or tampered with.

9.10 Landscaping

Good surveillance potential can be enhanced or reduced by landscaping features such as ground contouring or the planting of vegetation. Careful attention therefore needs to be given to ensure these factors do not impact on the security of the site. Advice regarding the long term size, height and scale of any planting should be sought at design stage to obviate difficulties when planting reaches maturity. Such planting may adversely affect any natural surveillance offered and could impact on the effectiveness of any external CCTV provision.

Defensive planting may be desirable in key areas, for example where boundary or site security may be compromised as a result of neighbouring land levels, adjoining fence and wall lines etc. Such provision requires appropriate consideration, in order to balance between security risk and health and safety aspects.

It may be possible to incorporate additional hard landscaping features to the site perimeter, particularly the frontage to prevent unauthorised vehicle access for example. Land levels and natural changes in level can often be incorporated to assist with security.



The following guidance should be used in conjunction with the general security guidance to ensure suitable security provision is provided for the safe use of the building.

10.1 Site access

Whilst it is appreciated that many College and University buildings may not be located within fenced sites, if the building or site does have a secure perimeter, consideration should be given to restricting the access to the site during normal hours of operation. For example, in a College scenario, this could mean securing all gates apart from the one to the main entrance after a set time in the morning. Where possible this should be controlled by a remotely monitored access control system.

10.2 Main entrance

It is desirable that the main entrance to a premise provides a welcoming yet safe environment. In many cases, the best way to achieve this is with a secure lobby and reception area, though again it is appreciate that this cannot always be facilitated This allows the external doors to be open throughout the day, so visitors can be dealt with at a reception point without the necessity for them to enter the main learning environment. Obviously, the extent of a secure lobby area within a building may vary largely and may actually incorporate other associated uses and public spaces.

10.3 Other external doors

In order to ensure effective access control is provided, external doors should be secured against unauthorised entry during normal hours of occupation. Particular attention should be given to appropriate access control if the building is to be used for partial occupation to a significant extent. All designated fire exit doors should, of course, be able to be operated in the usual way, allowing for safe exit but secured against intrusion.

10.4 Access control

This is very useful for doors that cannot be continuously monitored, and lead to restricted areas or fall outside the security envelope.

Access control systems are becoming increasingly popular and the provision of new buildings offers the ideal opportunity to incorporate a fully integrated access control system to facilitate safe use of the premises. These range from a simple system to a single door, to full systems incorporating proximity reading technologies, where even the students have swipe cards or access fobs. Any form of access control is a positive feature as this will enable the securing of all or parts of the building, both in and outside normal hours of occupation.

A good access control system will reduce the risk of 'opportunist' thefts, but it should be noted that relying solely on the electro-magnets locks of an access control system to protect a building outside of normal hours of occupation is not recommended. Additional dead-lock devices must be incorporated to ensure adequate security outside hours of occupation. This approach applies to both internal and external lines of security.

10.5 Signage

This is an aspect of security that is often overlooked by those already familiar with a site. Effective directional signs from site access points and car parks, links from public transport etc. to the main reception.

Anticipated desire lines should be established within the landscape design and aligning with the security strategy. Signage provision should also take into account access routes and preferred points of entry to the site.

11.1 Adequate storage areas

Invariably storage areas in many buildings are insufficient and, consequently in many premises boiler rooms and electric plant rooms, for example, are utilised for inappropriate storage. Due to the increased risk of fire, use of such areas is unacceptable so therefore the inclusion of adequate storage areas in new building/ refurbishment design is extremely important.

Appropriate chemical storage areas should be provided, both within teaching areas and in areas used by staff, i.e. site staff etc. Generally chemical stores should be provided with a minimum of 60 minutes fire resistance and be provided with appropriate bunding and ventilation to suit the environment.

General storage areas should be located within a managed area, where they can be monitored on a regular basis. Such storage rooms should have a minimum of 30 minutes fire resistance and be secure.

11.2 Waste storage

Due to the risk of deliberately set fires, particularly on sites that have no boundary security in place, the grounds of the premise should be clear of combustible storage. Waste bins, compactors and skips, including recycling facilities should be located away from buildings, so if they are set on fire, the fire will not spread into the building.

The following points should be specifically addressed:

- Waste bins should be secured a minimum of 10m from buildings. This can be achieved by chaining the bins to a fixed point, or providing a secure compound area.
- All waste skips should be located a minimum of 10m from buildings. If possible, skips should be have lids that are kept locked when not in use.
- Litter bins must not be fixed to combustible wall claddings or be located in covered or recessed areas.
- Any recycling receptacles (particularly those containing paper and textiles) should be located and secured a minimum of 10m from the buildings.
- Loose combustible materials must not be stored against or close to the buildings.

11.3 Lightning protection

Guidance on this is provided in BS EN 62305 and the InFIREs Guide RC 35 Recommendations for the protection of buildings against lightning strikes.

11.4 Water supplies for fire fighting

The advice of the local Fire Prevention Officer must be sought on this matter. For buildings located in town and city centre locations reliance on fire hydrants in the street maybe sufficient, though for larger developments and campus based premises there may need to be clearly marked fire hydrants provided on site.

11.5 Water isolation/detection

Escape of water can cause serious losses especially if these occur when the premises are not occupied. Within this particular education sector, Escape of Water presents a significant risk with a history of large and costly losses as a result.

Within most new-build University buildings the provision of incoming mains, water flow monitoring and isolation devices will be a requirement. In more complex buildings, e.g. Biological Sciences or Engineering buildings, complex piping systems are likely to be present therefore requiring a more robust water detection and isolation installation. The design of such a system requires a specialist examination of the expected experimental water requirements so that water supplies to test equipment generating research income are not unnecessarily isolated.

Care must also be taken where overflow pipes terminate, so the overflows do not create a further risk of damage to the building, equipment, services and contents.

If there is critical equipment in the building, with long replacement times or serious disruption consequences, additional water detection equipment must be considered and may be required by Zurich.

Activation of any of these devices should be interfaced to the Building Management System to ensure that an appropriate response is provided.

It should be noted that, if the premises are left unoccupied for a period of 30 days or more, insurance cover for escape of water is usually withdrawn. If this length of unoccupancy is to arise you must inform your insurance company.

11.6 Computer mainframe/server rooms

The design of a new computer mainframe or server room warrants special consideration in order to provide full protection against various hazards. These include:

Fire

A self-contained building or any room forming part of a larger building containing the equipment is to form a minimum one hour fire structure/enclosure.

Automatic fire detection with remote transmission, usually via the main fire alarm panel of a building, to a 24-hour staff location is required. The automatic fire detection needs special design to cater for the high air flows often encountered in such rooms and can include enhanced detection by an air sampling system such as VESDA.

Depending upon the value of the contents an automatic fire suppression system, normally utilising a gaseous agent, may be necessary.

Water

Ensuring the room envelope is impervious to water ingress at high or low level. This can include the construction of a waterproof floor above the room and sills or ramps at ground-floor openings to prevent water elsewhere on the same floor easily entering the building.

Ensuring water containing pipework within the room is kept to a minimum.

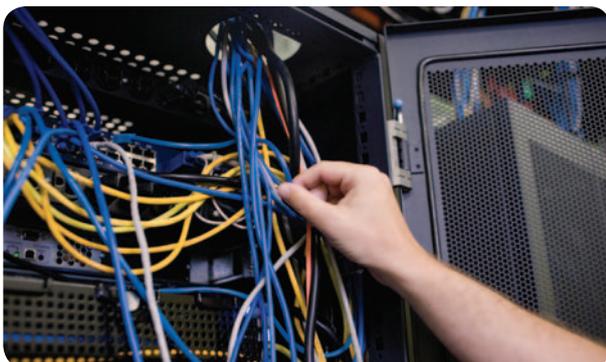
Considering installing water detection with remote monitoring around any water pipework that has to remain in the room, e.g. by air-conditioning units.

Theft

The room is to be protected as described earlier in 8.8. Strict access control to a limited number of authorised personnel will be required.

Lightning

Fitting lightning surge protection on incoming electrical cables and any non-fibre optic communication cables.



Other

Ensuring that an adequate number of air-conditioning units are available on the

(n + 1) resilience principle so that if one unit fails, the remaining others have sufficient capacity to continue to keep the room at an adequate temperature to prevent overheating.

Having high temperature room alarms, often as part of a Building Management System, so that engineering staff can respond preferably within one hour.

Have individual equipment high-temperature cut-outs on expensive servers.

Provide Uninterruptible Power Supplies to cater for short-term fluctuations in electrical supplies.

For more critical applications consider an emergency generator supply.

11.7 Cash offices

Universities in particular have a Cash Office dedicated to receiving cash payments or collecting monies from other activities on a campus. Large cash amounts may be received particularly at student enrolment time, when there may be an increased security risk to the safety of Cash Office staff as well as the received cash.

The design of a new Cash Office is a specialist field that will need to be discussed in detail with Zurich. The construction and installation will need to be carried out by a specialist approved Cash Office installer.

11.8 Construction risks

During construction or refurbishment, there is likely to be a greatly increased fire and security risk. Insurers and the Construction Federation have produced the Joint Code of Practice on the Protection from Fires of Construction Sites and Buildings Undergoing Renovation and this must be followed.

Fires on-site during the construction process in many cases lead to both substantial financial losses and programme delays. Of particular concern is the construction of timber frame buildings and the risks posed during the construction period. It is recommended that contact is made with the Construction Risk Insurer at an early stage to discuss appropriate prevention measures.

The Regulatory Reform (Fire Safety) Order 2005 came into effect in October 2006 and is applicable to all educational type occupancies (in England and Wales).

The Order requires that Responsible and Competent persons are appointed to manage Fire Safety within the premises on an ongoing basis and to ensure effective and appropriate Fire Risk Assessments are in place.

In Scotland, the equivalent legislation is Part 3 of the Fire (Scotland) Act 2005 and the Fire Safety (Scotland) Regulations 2006.

The Fire Safety Risk Assessment process for a new College and University building should commence during the design stage. This will assist in ensuring that operational risks are minimised through risk appropriate design and consideration of the life-cycle issues facing the end users.



Appendix One: Guidance on Key Issues to consider with respect to Sprinkler Installations

Appendix Two: Property Protection Design Checklist

Appendix Three: Useful websites and reference points

Appendix One

Guidance on Key Issues to consider with respect to Sprinkler Installations
Sprinkler Protection of Further and Higher Education Risks.

Introduction

This document has been produced to assist and enable the effective design and installation of sprinkler protection for Further and Higher Education buildings. Such occupancies commonly contain more diverse and increased fire loading than other types of educational premises. Stakeholders are encouraged to provide sprinkler protection to limit fire losses and assist in terms of business continuity.

The document is limited to, and specifies the requirements for sprinkler protection of Further and Higher Education premises and includes the requirements for the classification of hazard, selection of sprinkler heads and provision of water supplies. The guidance identifies key issues, though must be read in conjunction with the relevant standard and technical bulletins.

Acceptability of Sprinkler Installations for Insurance Purposes

Guidance offered previously in this document has stated that any fire sprinkler installation must be designed and installed in accordance with the current standard. The applicable standard in this case is BSEN 12845:2009 and all relevant current Technical Bulletins.

Design Review and Acceptance Testing

To ensure a sprinkler system is acceptable for insurance purposes Zurich Risk Engineering are to be contacted at an early stage to review the specification and confirm the hazard classification requirements of the sprinkler system are met. After this initial assessment detailed design drawings and calculations are to be issued for approval to Zurich Risk Engineering. Following this, a number of site inspections are to be carried out by the surveyor with a final inspection including testing of the sprinkler system and its water supplies.

Extent of Sprinkler Protection

Buildings to be sprinkler protected

The sprinkler system shall provide protection to all parts not specified as exceptions (see below). All exceptions to sprinkler protection shall be agreed with Zurich Risk Engineering and authorities having jurisdiction.

Optional exceptions

Sprinkler protection shall be considered for, but need not be provided in, the following parts of buildings:

- a) stairs, spaces below stair headings (but not rooms above a stair) and lift wells. Any part not provided with sprinkler protection shall be enclosed by walls, ceilings and floors, with a fire resistance of not less than 120min, in which the doors are not less than 60min fire resistance and in which glazed areas are of not less than 60min fire resistance or in the case of stairs are protected by cut-off sprinklers. The area of glazing within doors shall not exceed 1.5m² in each storey.
- b) rooms or compartments containing electric power distribution apparatus such as switchgear and transformers, and used for no other purpose(s). Any part not provided with sprinkler protection shall be enclosed by walls, ceilings and floors, with a fire resistance of not less than 120min, in which the doors are not less than 60min fire resistance.

Communicating Buildings

Sprinkler protection shall be considered for but, with the consent of the insurer, need not be provided in communicating buildings or storeys separated from the sprinklered building by walls of not less than 120min fire resistance in which each opening is protected by two (arranged in series) fire doors or shutters, each of not less than 120min fire resistance.

Outbuildings

Sprinkler protection shall be provided to any outbuilding within 10 metres of the sprinkler protected building. Sprinkler protection shall be considered for, but need not be provided in, outbuildings in excess of 10 metres from the sprinkler protected building with a volume less than 150m³.

Selection of Installation Type

Wet pipe installations

Sprinkler installations shall be of the wet-pipe type.

Protection from freezing

Wet-pipe installations shall only be used where there is no danger of the water in the pipes freezing. Parts of the installation which may be subject to freezing may be protected by electrical trace heating or use of a dry-pipe extension.

Subsidiary dry-pipe extensions

Subsidiary dry-pipe extensions shall be limited to 10 sprinklers on any subsidiary extension.

Protection by trace heating

The trace heating system shall be monitored for power supply failure and failure of the heating element(s) or sensor(s). The piping shall be provided with a Euroclass A1 or A2 or equivalent in existing national classification systems insulation.

Duplicate heating elements shall be provided over the unheated pipework. Each of the two elements shall be capable of maintaining the pipework at the minimum temperature of not less than 4°C. Each trace heating circuit shall be electrically monitored and switched by separate circuits. Trace heating tape shall not crossover other lengths of trace heating tape. Trace heating tape shall be affixed on the other side of the pipe to the sprinkler heads. Trace heating tape shall terminate within 25mm from the pipe ends. All trace heated pipework shall be lagged with Euroclass A1 or A2 or equivalent in existing national classification systems insulating material of not less than 25mm thick with a water resistant covering. All ends shall be sealed to prevent ingress of water. Trace heating tape shall have a maximum rating of 10W/m.

Contract Arrangements

Contract arrangements shall comply with normal custom and practice as specified in BS EN 12845, Section 4.

Water Supplies

Water Supplies for Property Protection Systems

Water supplies for property protection systems shall be at least a single automatic suction pump drawing from a water source complying with BS EN 12845 TB221.7.

Water Supplies for Life Safety Systems TB221

Where Life Safety installations are to be provided, water supplies shall be at least one of the following superior single water supplies:

- a) a storage tank with two or more pumps, where the tank fulfils the following conditions:
 - the tank shall be full capacity;
 - there shall be no entry for light or foreign matter;
 - potable water shall be used;
 - the tank shall be painted or given other corrosion protection which reduces the need for emptying the tank for maintenance to periods of no less than 10 years.
- b) an inexhaustible source with two or more pumps.

Water Storage

Water storage shall comply with the requirements of BS EN 12845 Clause 10.3.

Refilling conditions for full capacity suction tanks

The water source shall be capable of refilling the tank in no more than 36 hours.

The outlet of any feed pipe shall not be less than 2.0m horizontally from the suction pipe inlet.

Reduced capacity suction tanks which are dependent on inflow

The following conditions shall be met for reduced capacity tanks:

- a) the inflow shall be from a town main and shall be automatic via at least two mechanical float valves;
- b) the inflow shall not adversely influence the pump suction;
- c) the minimum effective capacity of single reduced capacity tanks shall not be less than that shown in Table T1, column 6;
- d) the tank capacity plus the inflow shall be sufficient to supply the system full capacity given in Table T1, column 3 over the duration t, given in column 5;
- e) the effective capacity shall be calculated by taking the difference between the normal water level and the lowest effective water level;
- f) it shall be possible to check the capacity of the inflow;
- g) the inflow arrangement shall be accessible for inspection.

Table 1 Water Storage Capacities

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6
Ordinary Hazard Group	Height h above the lowest sprinkler ¹ m	Precalculated minimum full capacity m ³	Hydraulically calculated minimum full capacity ² m ³	Duration of supply t min	Minimum reduced capacity m ³
1	h<15	55	(t x Qmax) 1000	60	10
	15<h≤30	70			
	30<h≤45	80			
2	h<15	105	(t x Qmax) 1000	60	20
	15<h≤30	125			
	30<h≤45	140			
3	h<15	135	(t x Qmax) 1000	60	30
	15<h≤30	160			
	30<h≤45	184			
4	h<15	160	(t x Qmax) 1000	60	50
	15<h≤30	185			
	30<h≤45	200			

Note 1: Excluding any sprinklers in the pump or valve room.

Note 2: Where; Qmax is maximum demand flow in l/min. t is the duration of supply in minutes (specified in column 5)

Pump suction tanks not dependent on inflow

Precalculated systems

Table T1, column 3 shall be used to determine the effective volume of water required.

Hydraulically calculated systems

Table T1 columns 4 and 5 shall be used to determine the effective volume of water required.

Classification of Occupancies and Fire Hazard

Fire risk assessment to determine the hazard classification

A fire risk assessment shall be carried out to determine the appropriate hazard classification of the buildings to be sprinklered.

Hazard classification

The occupancy of colleges and universities, or parts thereof, shall be classified as at least Ordinary Hazard Group 1. **Should the presence of combustible materials or fire loadings exceed Ordinary Hazard Group 1 conditions the appropriate hazard group should be applied. No parts of university buildings should be classified as Light Hazard.**

Design Density and AMAO for Fully Hydraulically Calculated Installations

Sprinkler systems shall comply with the relevant requirements of BS EN Clause 7.

Sprinkler Types and Applications

Sprinkler Selection

Sprinklers shall be used in accordance with the limitations and uses indicated in Table T2.

Sprinkler thermal sensitivity

Sprinklers with a thermal sensitivity rating of 'Quick', 'Special', 'Standard' may be used.

Sprinklers that are 'unrated' may also be used where appropriate.

Note: Where sprinklers are used that are unrated, such as concealed or recessed pattern sprinklers, they should be equipped with temperature sensitive elements capable of achieving a 'quick' thermal sensitivity rating when used in a spray or conventional pattern sprinkler. Sprinkler thermal sensitivity ratings are described in TB207.

Sprinkler guards

Sprinklers, with the exception of recessed or concealed sprinklers, that may be subject to accidental damage shall be fitted with a metal guard.

Table T2 Sprinkler selection and design density

Pattern (k factor)	Design density mm/min	Applications
Spray (k80)	5.0	General room protection. Suitable for the protection of floor, ceiling or roof spaces greater than 2.4m height.
Ceiling or flush pattern ¹	5.0	General room protection. Not suitable for the protection of floor, ceiling or roof spaces.
Recessed (k80)	5.0	General room protection, where exposed sprinklers could be subject to accidental damage or tampering. Not suitable for the protection of floor, ceiling or roof spaces.
Concealed (k80)	5.0	General room protection, where it is considered essential to conceal the presence of sprinklers from the building occupants. Not suitable for the protection of floor, ceiling or roof spaces.
Sidewall (k80)	5.0	May be used in corridors, passageways or narrow rooms.
Conventional (k80)	5.0	Conventional sprinklers shall be used to protect floor, ceiling or roof spaces not exceeding 2.4m in height.
Domestic or residential pattern ²	5.0	Domestic or residential sprinklers complying with DD252, may be used in small rooms not requiring more than two sprinklers, where life safety is a consideration. Their installation shall comply with the manufacturer's data sheets.

Note 1: Ceiling or flush pattern sprinklers include products that are designed to fail at a predetermined load and may be referred to as anti-ligature sprinklers.

Note 2: Domestic and residential sprinklers shall only be used in life safety applications which are suited to their use. The design density should not be less than 5.0 mm/min for the appropriate ordinary hazard AMAO.

Transmission of Alarms to a Fire Brigade

Provision shall be made to transmit fire and fault alarms automatically to a central station for fire alarm signalling approved by a nationally accredited, independent, third-party approvals organisation.

Security

Consideration shall be given to the security of installation control valve sets, pumps, water supplies and any subsidiary stop valves that may isolate the water supply from the sprinkler installation. The installation control valves and any pump sets shall be located in a secure location to prevent tampering.

Each stop valve capable of interrupting the flow water to the sprinkler installation shall be provided with a tamper-proof device to monitor its status. Each monitoring device shall be electrically connected to a control and indicating panel, installed at an accessible location on the premises.

Training, Servicing and Maintenance

To ensure the installed sprinkler system is regularly maintained and would operate effectively, testing is to be carried out on a weekly basis with the results being recorded on the Zurich test card.

The sprinkler system shall be regularly maintained in accordance with TB203 and shall be the subject of a maintenance contract with a sprinkler installation company certificated to LPS 1048 by the LPCB or certificated to an equivalent scheme. A copy of the annual survey is to be forwarded to Zurich together with a list any recommendations/deficiencies.

It is the responsibility of the specialist sprinkler contractor to ensure the end user is fully trained and competent on the weekly testing of the sprinkler system.

Appendix Two

Property protection design checklist – further and higher education premises

The following list has been produced to assist design teams in considering key issues in relation to property protection for Further and Higher Education premises at an early stage within the design process.

- Has an appropriate stakeholder group been established?**
- Is there a choice of site available? Consider location within site in relation to security risks**
Orientation of a building on a site can significantly impact on security issues
- Has a flood risk assessment been completed and complied with?**
- Are floor and wall constructions resilient to flood damage?**
Consider in conjunction with flood risk assessment
- Are business critical facilities susceptible to flood?**
Can high value and high dependency equipment or facilities be located at upper floor levels?
- Has the windstorm risk been considered in relation to overall building design and material choices?**
- Have sub-structure issues been considered at an early stage.**
Where specialist foundation design is required, has this been communicated to Zurich?
- Is the building to be constructed of non-combustible construction?**
If no, please refer to Zurich Risk Engineering at the earliest opportunity
- Does the fire strategy address property protection issues?**
May be necessary to revise the brief accordingly
- Does the design incorporate 'Modern Methods of Construction'?**
If yes, please refer to Zurich Risk Engineering at the earliest opportunity
- Does the design incorporate Timber structural elements, i.e. timber frame?**
If yes, please refer to Zurich Risk Engineering at the earliest opportunity
- Does the design incorporate non-structural Timber elements, i.e. cladding?**
Please refer to Clause 6.2.5
- Are sandwich panels used within the construction?**
Please refer to Clause 6.2.6
- Is rainscreen cladding incorporated into the design?**
Please refer to clause 6.25
- Are External Insulated Finishing systems to be used?**
Should not typically be used below 3m from ground level. Please refer to Clause 6.2.9
- Is ETFE to be used within the construction?**
Should not typically be used at low level. Please refer to Clause 6.2.10
- Does the design incorporate Green Roofs or Green Walls?**
If yes, please refer to Zurich Risk Engineering at the earliest opportunity
- Do the eaves details prevent unauthorised access?**
Consider appropriate security features to obviate the risk
- Do insulation materials present a risk in terms of fire risk?**
- Does the design incorporate an atrium type feature?**
Consider effect on compartmentation and extent of potential fire damage. Please refer to Zurich Risk Engineering at the earliest opportunity.

- Is fire compartmentation aligned with current legislative requirements?
- Will there be any single fire compartment area where the potential loss could exceed £10m?
Sprinklers will generally be required where such compartments exceed a potential £10m exposure.
- Is appropriate fire compartmentation provided around high risk, or high value areas?
To limit damage from a fire within a high risk area, or damage to a high value area (including contents), additional compartmentation may be required.
- Are natural ventilation / night cooling systems incorporated within the design?
Consider impact on security strategy and the effect in relation to fire compartmentation.
- Consider property risks associated with heating systems
Please refer to Clause 7.3
- Consider protection measures to areas of increased fire risk
Please refer to Clause 7.6
- Is a sprinkler system to be incorporated within the scheme?
Please refer to Clause 8.1 and the Sprinkler Key Issue checklist within Appendix 1
- Has an appropriate Fire Alarm Design been specified?
If no sprinklers are to be provided, full Fire Detection is to be incorporated. Please refer to Clause 8.4
- Has a Security Strategy been commissioned, or the existing strategy adapted accordingly?
Consider interface with stakeholder group
- Consider fencing and boundary security needs.
Is inner fencing to key areas necessary to protect the building/contents? Consider protection to high risk areas. Assess key areas in terms of vulnerability and seclusion
- Is unauthorised roof access likely to be an issue?
Consider roof edge details, avoidance of climbing aids etc
- Are windows and doors of suitable design to resist attack?
Please refer to Clause 9.4
- Has the building been risk assessed in relation to standard of Intruder Alarm provision?
Please refer to Clause 9.5
- Consider the provision of monitored CCTV to protect the site or part/s.
- Are IT areas and other high value equipment areas vulnerable to opportune theft?
Consider most appropriate location of IT provision and appropriate security
- Landscaping schemes should interface with and compliment the overall security strategy?
- Have routine access arrangements considered security for different building/site users?
- Consider access control measures appropriate to risk and site/building circumstances.
- Attention should be given to suitable external signage to aid the security strategy.
Please refer to Clause 10.5
- Is sufficient storage provision allowed within the building?
Consider storage of high value equipment, chemicals, archive material etc.
- Have appropriate waste storage and recycling facilities been considered within the site layout?
Please refer to Clause 11.2
- Has a risk assessment been carried out to determine the need for lightning protection?
Please refer to Clause 11.3 and BS62305
- Consider requirements for fire fighting water supplies
- Consider the requirements of water leakage detection and isolation within the building.
Assess the potential for damage to key areas should a water leakage occur. It may be necessary to relocate critical services to prevent disproportionate losses in the event of an escape of water loss.
- Have discussions taken place with insurers regarding construction risk?

Please contact Zurich Risk Engineering should you wish to discuss property protection aspects of your projects.

Appendix Three

Useful websites and reference points

www.homeoffice.gov.uk

Anti-social behaviour

www.bafsa.org.uk

www.redbooklive.com

List of approved fire & security products and services from the Loss Prevention Council Certification Board

www.zurich.co.uk

www.infoscotland.com

www.environment-agency.gov.uk

www.greenroofcode.co.uk

Further Technical advice can be obtained from:

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Early consultation with Zurich Risk Engineering is essential to ensure that designs meet the Underwriters' requirements.



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