THE GLASGOW SCHOOL OF ART

GSA Report on Compartmentation

Definition of Compartmentation

A Fire Compartment is defined as an area of a building from where the outbreak of fire has been designed or protected in such a way as to inhibit the spread of fire for a minimum period – during which time occupants are able to safely escape, damage to the property may be localised and valuable time is created for the emergency services to attend to the scene. Compartmentation also allows other fire prevention systems to be more effective – such as automatic fire suppression equipment. Compartmentation is usually achieved by the subdivision of a building into a number of discreet compartments – which in themselves are dependent on:

- The use of the building
- The height of the building
- The fire load in the building
- *And the existence or not of*
- A fire sprinkler/suppression system

In the case of the Mackintosh Building the inherent stone, brick and reinforced concrete slab construction of the design did provide a level of fire compartmentation. Following the 2014 fire we were seeking to further improve the compartmentation of the building for when it returned as a fully functioning art school by providing about 40 compartments or sub- compartments each with **60min (and in the case of the original studio doors – 30 min)** fire separation. This would be achieved by the use of fire resistant materials, linings, door closers, intumescent seals etc. However, full compartmentation would have meant that some of the earlier original studio doors would have had to have been replaced (due to their stained glass upper sections) – this would have run counter to the conservation of the building fabric and was unnecessary because we opted for a fully engineered system including mist suppression to protect the building, its content and occupants.

A copy of the Atelier 10 report is attached which illustrates the compartmentation on each floor.

Ducts, Risers and Voids

We understand that the issue of compartmentation was also, under the Parliamentary Committee, discussed in tandem with the subject of other passages through the building where air and therefore potentially smoke or fire could spread. These were variously referred to during the committee

hearings as ducts, risers or voids in the construction – all of which are inherent in traditional building construction and part of both the aesthetic and functionality of the historic building. As in architects' Page\Park's report to the committee – the Mackintosh is full of such voids, behind panelling, lath and plaster walls and up chimney stacks, some are not mapped or known about and covered by original finishes. Only by stripping it back to its masonry shell could one have been 100% sure of the location of these or breaches between them. Post 2014 fire – we were able to harness the new point cloud laser scanning technology to effectively map the building and discover with much greater accuracy than ever before the full extent of these.

It is important to note that the voids, service ducts are not in themselves a fire hazard. The vast majority of buildings built during the Victorian and Edwardian times incorporated routes through their fabric for the routing of services – water, gas and later – electricity. In the case of the

Mackintosh Building the ducts were part of its designed structure – taking these services and also heated, dehumidified air conditioning around the building. The Mack had at least 12 fireplaces and chimney flues in use for much of its history and smoking was allowed well into the last century – so the presence of ducts in this and thousands of other still extant buildings is not in itself a cause of fire – but they can of course add to the spread of fire if unprotected/stopped.

As part of the 2014 project there was an ongoing stopping/capping or dampening of the ducts and service corridors throughout the building – about one third of these had already been closed off or fitted with automatic dampers as a result of earlier works and the remainder were being systematically fitted as work was occurring in these areas. It is not possible to 'stop' a duct or riser that is in the middle of actually being working on – as the process requires to have a finished/final gap to fill not one where more services pipes or wires are still being fitted into. So stopping happens at the end of the installation of services period by a specialist contractor who works on a one-by-one bespoke basis fitting a stopper to the exact space left in the void. Only at this point will the contractor be able to certify and warrant the installation.

(NOTE: The dampers are fitted where there were no vertical services – it is an automatic 'flap' that closes on detection of fire to close an open duct. 'Stopping' surrounds a vertical service run and on detection of fire swells to fill the gaps around eg pipework to prevents fire spreading.)

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Compliance and Safety

The Mackintosh was always a compliant and safe building in terms of fire safety. If this had not been the case the School would not have been allowed by law to operate it for the purposes of education and wider public access and events. However GSA was never complacent about safety as demonstrated specifically on the topic of fire by the studies commissioned by the School from 2006 onwards from Buro Happold/FEDRA. These sought especially to update the thinking and action around fire safety in line with ever increasing knowledge about the building and its condition, evolving regulatory requirements and advances in technology. As a result of the later 2008 Buro Happold report the conclusion was that a mist suppression system should and could be installed in the building to complement the already existing safety measures of:

- Fire door/compartmentation
- Hard wired smoke detection and alarm system
- Fire extinguishers and alarms call points
- 24 hour manned supervisors
- CCTV
- Proximity of local fire service – and its familiarity with the building and its contents

It was noted in the Buro Happold Fedra Report of 2008 that '*Wholesale application of such a policy [of compartmentation] would be virtually impossible given the current structure and the amount of compartmentation and fire stopping that would be required. If funds were available to carry out these works it is highly unlikely that [planning/listed building consent] permission could be obtained to carry them out given the building's listed status'.*

On the basis of the recommendations – the conclusion was that the risk of a fire occurring and/or posing a serious risk to the Mackintosh Building would be transformed from that of 'High' to 'Low' risk. As a responsible custodian of the Mackintosh, GSA – having commissioned this and the earlier report – undertook the previously reported actions to design, raise (significant) funds and gain statutory approval for the works – commencing on site some four years later once said funding was in place. It is important to note that such a recommendation was and is still exceptional in a building of this age and type – the design was cutting edge and complex to design and install.

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Best Practice Guidance

It was noted in the Buro Happold FEDRA report of 2008 that the existence of the extensive service risers and ducts in the building posed both a potential threat and an opportunity in the building in that they also provided routes for the running of new protection systems throughout the building.

In addressing the issue of compartmentation and fire stopping in the Mackintosh, GSA and its professional architectural, engineering and services advisors took full cognisance of Historic Environment Scotland's advice as contained in the publication ***'Fire Safety Management in Traditional Buildings'*** authored by Stewart Kidd another expert advisor to the Parliamentary Committee. In this best practice Guidance volume it states

Fire protection devices, equipment and systems should be installed with due consideration to the overall appearance of the building as well as having the minimum impact on the fabric of the building they are intended to protect. Appropriate use should be made of existing features (such as void risers, old chimneys and ducts) to allow concealed pipe or wiring runs……Pipe and cable runs should be selected carefully to avoid minimise intrusiveness. …whilst standards and codes of practice should be followed wherever possible ….any work to improve compartmentation, or to provide fire detection or suppression, should not cause unnecessary disruption or damage during installation, maintenance or eventual removal…'

GSA and our professional conservation advisors were also highly aware of the importance of maintaining the flow of natural ventilation around the building as originally designed by Charles Rennie Mackintosh. Again, HES reinforces this point regularly throughout its guidance, viz:

.while the blocking of any unused ducts that may contribute to fire spread should be considered, it is important that the role of the ducts in providing internal ventilation is also taken into account. Traditional buildings rely on relatively high air change rates to ensure that damp and rot are kept at bay, and upsetting this balance may have far reaching consequences. One way to avoid such unwanted side effects is to have mechanically or electrically operated fire dampers.

Appointment of Expert Advisors

Fundamental to the restoration of the Mackintosh Building after the 2014 fire was the fire engineering strategy for when the building came back on stream as a fully functioning art school, and the determination to explore all avenues of fire protection for both students, staff and the

public PLUS the protection of the building itself and its contents. Accordingly GSA engaged, as part of the Design team – Atelier 10 https://www.atelierten.com/ to produce a fire Engineering Strategy. This was reviewed and refreshed as the project developed on site:

This fire strategy report has been produced by Atelier Ten for Glasgow School of Art. The project is the restoration of the Mackintosh Building in the Glasgow School of Art campus. The building is an existing category A listed building of significant historic importance. In terms of fire safety, the proposed works are not changing the use or occupancy, rather they are a refurbishment of the building. As an existing historic building the fire safety features do not meet current Technical Guidance Documents and as part of the works it is not feasible to bring the building up to current standards. Therefore the aim of the fire strategy design for this building is to not worsen the existing conditions and, where practicable, to improve the fire

safety provision for the building both for life safety and protection of a valuable community asset. In terms of building regulations as the works are a restoration of an existing building from a building control regulatory compliance viewpoint the works should not make the fire safety conditions any worse than the existing condition before the fire damage.

For compliance with the Fire (Scotland) Act the key is to put in place fire safety design features in the building to enable a suitable and sufficient fire risk assessment to be completed for the building. This will involve upgrades to the existing pre-fire building design, however the aim is not to simply impose current generic fire safety standards on the historic building, but rather to improve the fire safety design where it is reasonable and practical to do so.

The main fire safety upgrades for the building are:

- *Enhance the existing compartmentation;*
- *Put in place a comprehensive provision for fire stopping and cavity barriers in the building;*
- *Provide L1 fire alarm coverage with voice alarm in the building for the earliest warning of fire outbreak;*
- *Provide automatic smoke and heat exhaust ventilation systems to provide a path for the smoke to be exhausted out the building;*
- *Provide an automatic fire suppression system.*

The layout of the report considers the overall fire strategy for the refurbishment of the building and will also highlight asset protection features which can be adopted into the design to increase the protection of the building itself.

Post 2014 Fire

After 2014 two sets of very different circumstances were planned for:

Construction phase:

- Where the contractor, Kier Construction Scotland Ltd had a duty to observe and adhere strictly to the Joint Code of Practice (for the Prevention of Fires on Construction Sites). As far as we are aware all these measures were in place through **Kier's** risk-based assessment Fire Plan and Construction Phase Plan.

Operational Phase – i.e. the point at which the building was handed back to the GSA:

- At this time five strategies would have come together to create a fully integrated Fire Engineered Strategy for the Mackintosh Building; these were:
    - Compartmentation
    - Fire stopping in ducts, risers and across compartment lines
    - State of a highly sophisticated and sensitive fire and smoke detection that prioritised life, building fabric and contents
    - State of the art mist suppression system that prioritised life, building fabric and contents
    - Installation of smoke vents to aid evacuation and fire service operations

In addition, exposed steelwork was to be or had been coated with intumescent paint in line with the A10 report – note the comment about the requirement to upgrade under s.3.11.2.

Plus – as with the rest of the GSA Estate a number of changes had occurred as a result of the review following the 2014 fire – these included:

- Critical Incident Management
- Revised fire Procedures including evacuation procedures
- Revised Health & Safety Procedures with external H&S officer
- Revised academic protocols

- Revised staff and student induction processes
- Amended GSA opening hours
- Scoping of the comprehensive fire protection system for the restoration works – which in turn informed GA fire policy for new buildings – such as Stow College refurbishment (which was also fitted with a fire sprinkler system)

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