THE FIRE SURGERY

Fire Engineering for Traditional Buildings

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About The Fire Surgery

THE FIRE SURGERY

- Small Fire Engineering consultancy of 12 based in the City of London
- We specialise in designing fire strategies for unique buildings
- We are the fire engineer of choice for historic and traditional buildings
- SFPE Best Fire Strategy 2015 for the Sam Wanamaker Theatre
- SFPE Best Fire Strategy 2016 for Croome Court
- SFPE Best Fire Strategy 2021 for The Royal Albert Hall
- SIG for Heritage fire safety with the Institution of Fire Engineers
- Supporting Author of Fire Risk Management in Heritage Properties
- Engineering Talent Awards small-medium enterprise of the year 2020
- Steering group Member of the ABTT

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Current projects

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Current projects

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The challenges

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- There have been a number of recent large scale fires in Traditional buildings
- Modern fire safety arrangements can be challenging
- Unknown voids and cavities as a route for fire spread
- Large use of timber construction
- Challenging locations for fire fighting access and facilities
- Open fires and real candles
- Possible limitations on staff resource and training
- Generally require improvements and maintenance which require contractors and therefore risk
- Historic England's research in 2019 indicates that there were over 1000 incidents in the historic built environment requiring a Fire & Rescue Service (FRS) attendance (for England only).

The data

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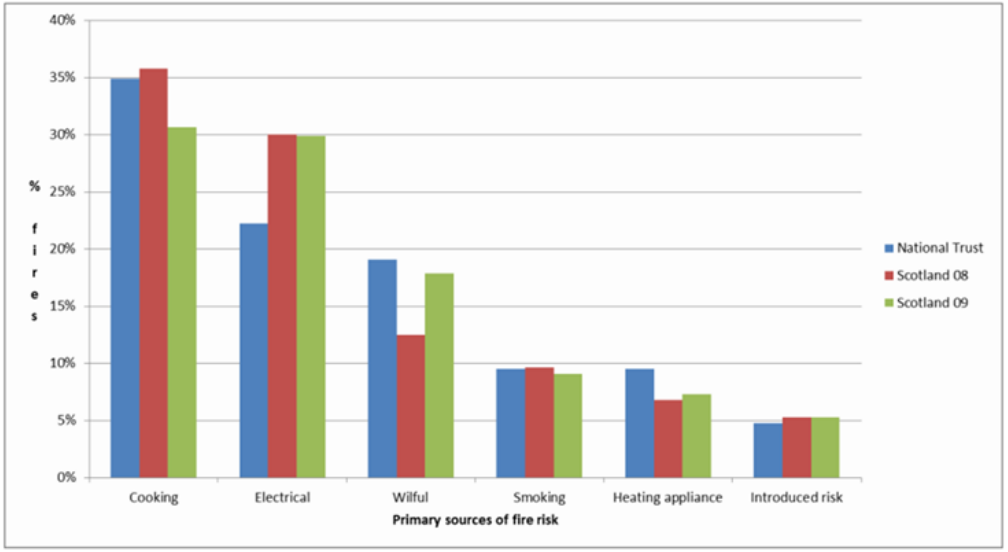
The causes of these fires are shown below:

- Chimney fires = 96
- Deliberate fires = 205
- Electrical fires = 136
- Cooking fires = 98
- smoking materials = 24
- Sparks from wood burning embers = 4
- Sunlight stroke candles = 17
- contractors on site = 3
- accidental = 68
- unknown due to lack of data = 412



Precedent

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Reports into serious fires in heritage buildings, such as the Bailey report into the fire at Windsor Castle in 1992, provide clear recommendations for fire protection for heritage buildings:

- the need for **effective training of all staff** in basic fire risk management and the actions to take in case of fire;
- the need for the **earliest possible detection** of fire by a reliable automatic fire warning system;
- the need for fire separation or **compartmentation** to reduce the spread of fire.

Which way forward?

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- We are not making the situation any worse….!

Or

- We are trying to comply with modern guidance…?

The Fire Surgery Methodology

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Suppression Feasibility Study

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- Study undertaken to assess practicalities of fixed suppression
- Numerous types of suppression systems
- Usually, automatic suppression can be found to be feasible
- Not all areas of buildings need to be protected
- Addresses the misconceptions with automatic suppression
- Holistic approach









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Heritage listed doors – Croome Court

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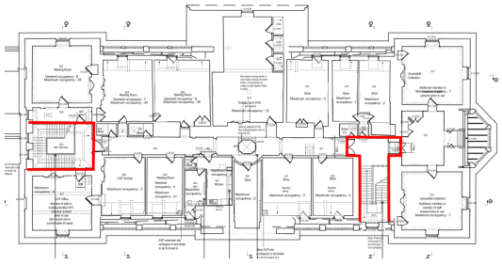
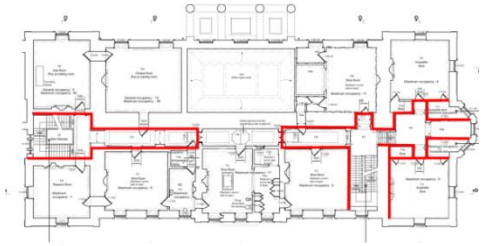
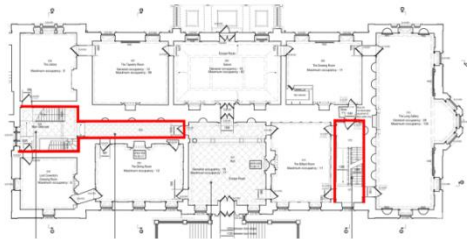
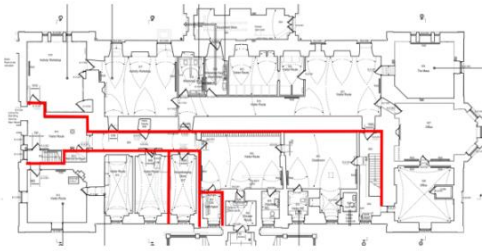
- Staircases are protected enclosures, therefore doors should have a fire performance
- New FD30s doors were provided where possible.
- Diagrams show the red lines indicating the protected enclosure and therefore the doors which require review.
- A large number of heritage doors which couldn't be upgraded.









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Using Fire Dynamics

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- It is possible to determine the impact of a fire in different rooms on the passive fire resistance of the doors.
- Large rooms with minimal fire load are likely to have less impact on perimeter doors, than smaller rooms with high fire loading.
- It is recognised that fire spread beyond the room of fire origin is likely to occur at flashover conditions and not during fire growth.
- Using fire dynamics, it is possible to predict the heat release rate (HHR) for flashover to occur in compartments.
- This can be transposed to a time or a fuel load density.
- If the time is significant or the fuel load is high then this means that flashover is unlikely to occur during the escape period and therefore will have reduced impact on the doors from that room.

$$Q = 7.8\ A_t + 378 \times A\sqrt{Hw}$$

Where:

Q = Heat Release in kW,

A_t = area of the room surfaces,

A = area of the room,

Hw = height of the ventilation opening.

Smoke control ASET>RSET

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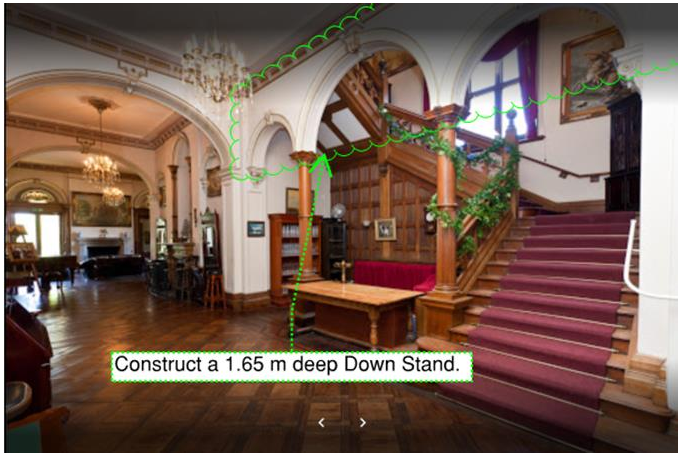
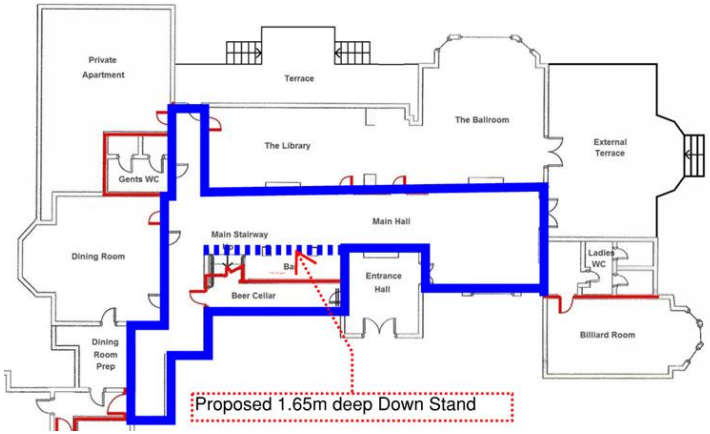
On the ground floor, the main hall is connected to the upper sleeping floors via the main stair. In case of fire, the smoke can spread to the other floors immediately via the main stair.





CFD analysis

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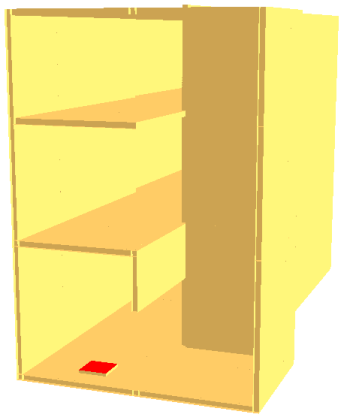
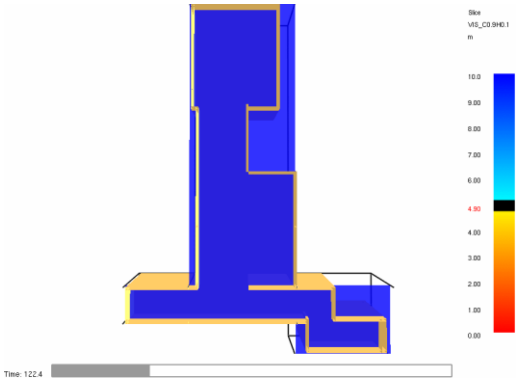
Time for the smoke to propagate into the stair hall is around 130 s.

Slice file shows the visibility at 2m above the first floor at 280 seconds.

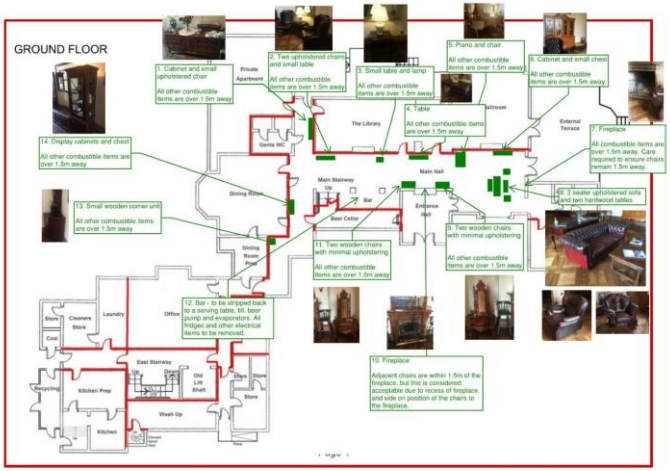
Escape time taken as 200 seconds

$$t_{RSET} = \Delta t_{det} + \Delta t_a + (\Delta t_{pre} + \Delta t_{trav})$$





- 75dBA at the bed head
- Upgrade to Voice alarm sounders
- 24/7 management with 2 x trained fire wardens
- Strict fire load control
- Detailed management plans
- Clear evacuation procedures
- Regular fire service inspection



Evacuation modelling - Royal Albert Hall

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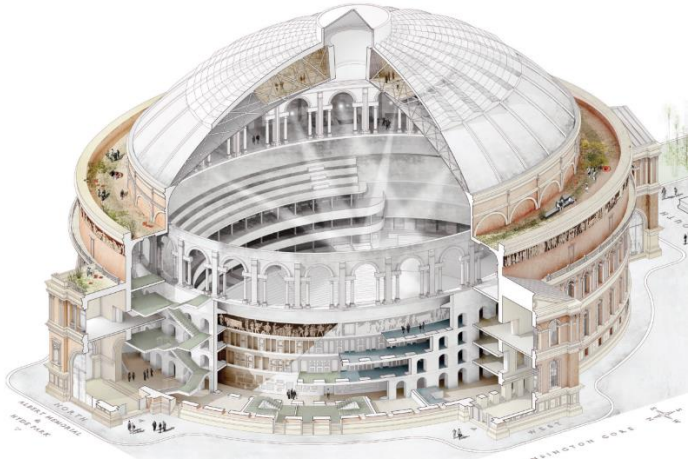
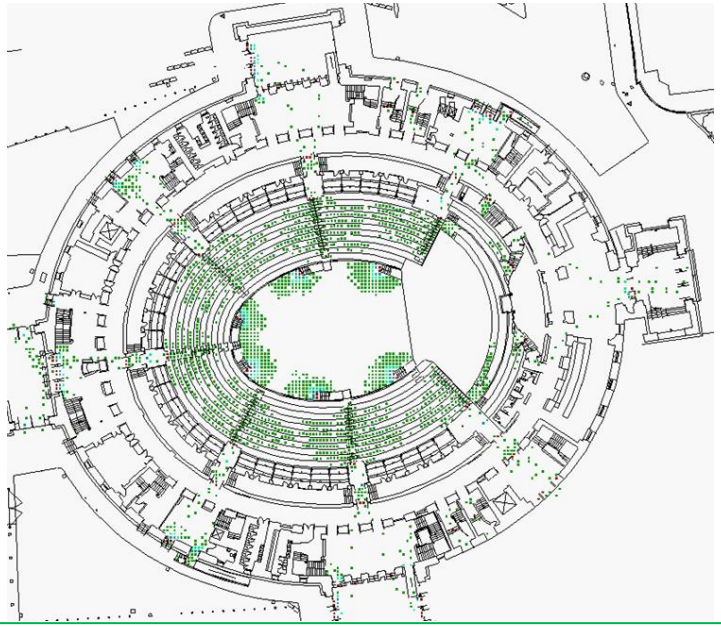
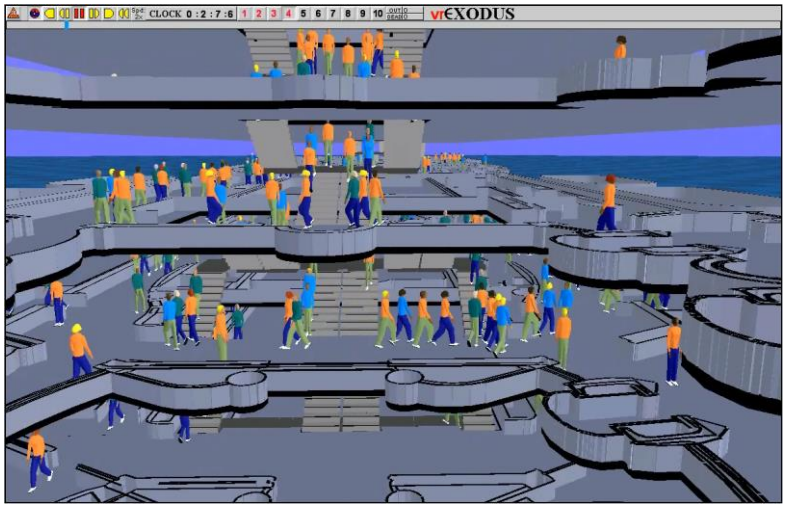
- No accurate understanding of current escape times
- 12 evacuation stairs
- Current 5600 maximum capacity
- Full evacuation model undertaken using building Exodus
- Evacuation times can be established for a number of scenarios
- Allows confidence with decision making on exits, capacities and different show configurations







Summary

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- Just because a building is old doesn't mean it cannot be safe from fire.
- It is not necessary for heritage buildings to comply with modern standards, nor is it expected, even when refurbishment projects are taking place.
- However, the approach should be to undertake a suitable fire risk assessment and make practical improvements where possible. Practical is the cost, disruption, time and impact on the historic features. If a risk mitigating measure can be seen to be practical, then it should be considered.
- Using this engineering process allows an objective view of fire safety. It may be possible to provide a suppression system in certain situations if it is practical to do so.
- Fire engineering principles are used to demonstrate suitable fire safety performance objectives.

Treating your fire safety concerns