The Fire and Rescue Service views on the performance of a structure involved in fire.

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Introduction

- Why the requirement for a period of fire resistance?
- The limitations of the fire and rescue service and the reliance upon the structural fire protection measures.
- Why reduce the period of fire resistance.
- Is life safety the only consideration.
- The approach of the design codes
- Fire fighting operations, what is entailed?
- Conclusions

Why is there a requirement in regards to fire resistance

- To ensure that the building has sufficient stability to allow the occupants to escape from the building.
- To allow adequate stability to allow for the safety of fire fighters whilst undertaking rescue and fire fighting operations.
- To restrict the spread of fire by means of one building not collapsing onto another.

Fire Service Actions

- Fire Service ladders restricted to 10.5 (35ft) and 13.5 metres (45 ft) on appliances.
  - 10.5 metre ladder will generally reach domestic dwellings and roof access 2 storey buildings.
  - 13.5 metre ladder will generally reach the 3rd storey of a building, but will access the sill on the fourth storey.
- Hydraulic Platform and Turn Table ladders restricted to 30 metres (usually 10 storeys).

Fire service actions

- Design codes are based upon the fire service to undertake rescues from the outside of the building using ladders.
- From the inside of the building the fire fighter is totally reliant upon the integrity and strength of the structure, plus additional fire fighting features such as.

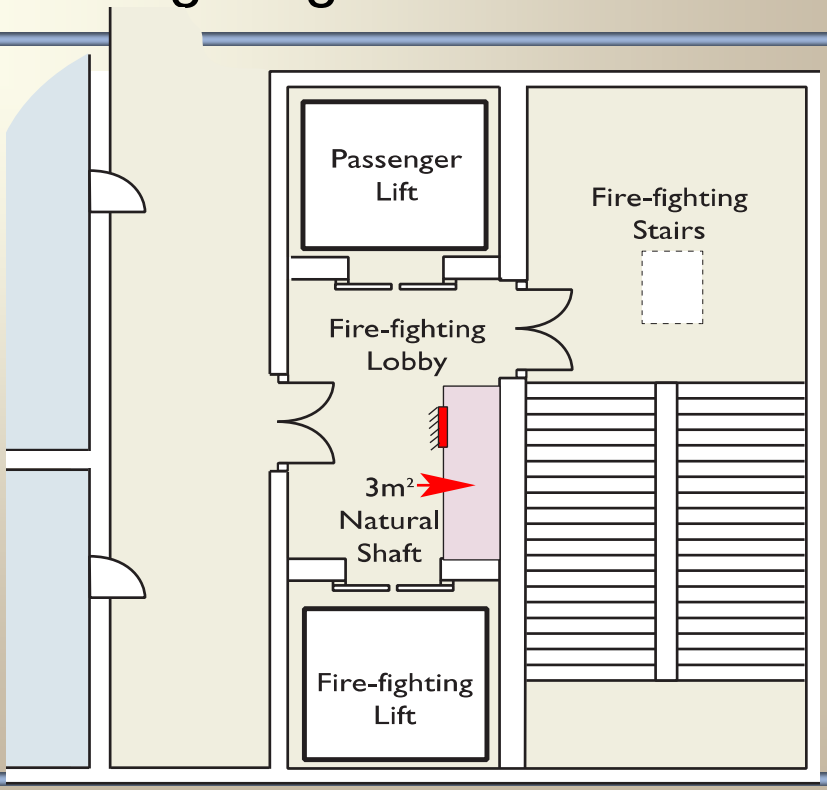
Fire service actions

- Fire fighting lifts to gain access to the fire fighting bridgehead, this is usually two floors below the fire floor.
- The installation of dry risers in buildings of a height of <50 mtrs and the case of >50 mtrs wet risers

Structural safety features for fire fighting

- Protected element of structure generally containing a staircase and in some cases a fire fighting lift.
- Protected lobbies in which fire fighters can assemble and start fire fighting operations within the building.
- Has some means of ventilation and or smoke control.
- Contains the wet or dry rising mains used for fire fighting water

Fire fighting Shaft construction



The importance of the structure for fire fighters

Fire Service Appliances

- Standard typical fire fighting appliance.
  - Fitted with a centrifugal pump capable of 4500 litres per minute.
  - Can carry ladders of 13.5 and 10.5 metres.
  - Will have a crew consisting of one incident commander, three or four fire fighters.

Fire Service operations

- Typical fire fighter nozzles require 6 Bars pressure to be effective.
- Fire service pumps are of the centrifugal nature.
- Max pressure from centrifugal pumps are usually in the order of 13 Bar (1300 kPa).
- Frictional loss due to head can result in the loss of up to 6 Bar (600 kPa).
- Therefore maximum height fire service can supply water is 55mtrs.
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Fire Service Appliances

- Aerial Appliances (Turntable Ladders and Hydraulic Platforms)
  - Purely for access, rescue and water application,
  - Crew of two fire fighters


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The importance of a resilient structure

- To withstand the effects of fire within the building.
- To withstand disproportion collapses (Ronan point [UK] and World Trade Centre [USA]).
- To allow the safe evacuation of the building and reasonable safety to fire fighters attacking the fire.
- To allow for adequate business continuity

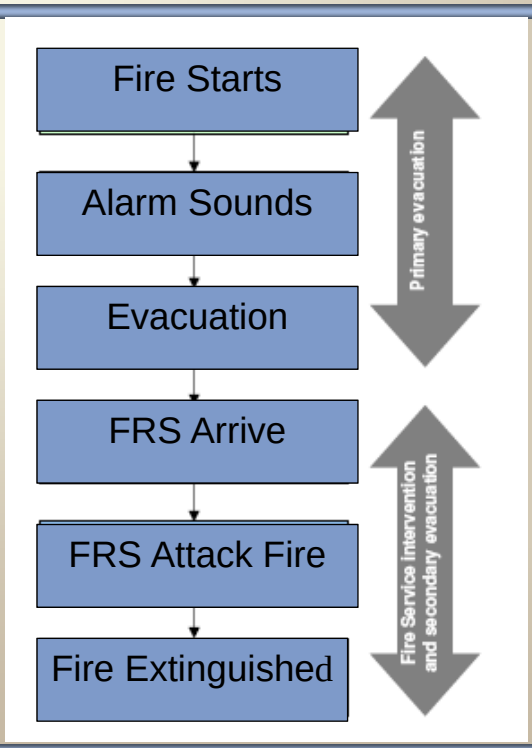
Why is the structure so important to the fire fighter

- Fire fighting operations are sometimes complex and fire fighting operations may take many hours to complete.
- Managed evacuation of persons within the building may take some considerable time (fire fighting at this time will likely to be defensive rather than offensive)
- The fire fighter will establish a ‘bridgehead within the strongest part of the structure, this is usually the staircase cores.

Performance engineering of the structure

- Most building designs are driven by cost and the emergence of value engineering is becoming commonplace.
- A reduction of the fire resistance of the structure can bring about considerable cost savings.
- Are we as engineers pushing the structure to far and more importantly do we understand why the original code fire resistance values were established?

General escape principles from a building



Escape methodologies

- Escape from buildings are generally.

✓ Simultaneous evacuation (all persons evacuate the building at the same time e.g. an office or shop)

✓ Delayed evacuation of the building. (Can sometimes be described as ‘stay put’ in the case of residential where the only the occupants of the affected space leave the building).

✓ Phased evacuation, where on the sound of an alarm only the affected floor, floor above and below are evacuated

✓ Progressive horizontal evacuation, generally heath care where persons are moved sideways behind fire resisting construction

Escape Methodologies

- Governed by –

✓ The passive protection building, including the provision of protected stairs, protected corridors and fire suppression systems.
✓ The ability of the structure to maintain sufficient integrity during the escape phase for the building.
✓ The integrity of the structure to withstand the effect of fire for rescue of trapped occupants.

Time to escape from buildings

- Code compliant buildings (UK)

2 minutes
2 and ½ minutes
3 minutes

- Tall or complex buildings

Not specified usually part of an engineered or accepted solution

Ultimate Safety

- Ideally, this should be in the open air, where unrestricted dispersal away from the building can be achieved. Escape routes should never discharge finally into enclosed areas or yards, unless the dispersal area is large enough to permit all the occupants to proceed to a safe distance

Place of relative safety

- A storey exit into a protected stairway or the lobby of a lobby approach stairway.
- A door in a compartment wall or separating wall leading to an alternative exit.
- A door that leads directly to a protected stair or a final exit via a protected corridor

A staircase that is enclosed throughout its height by a fire resisting structure and doors can sometimes be considered a place of comparative safety

Structure response

Structure response

Is there more to fire resistance?

- In addition to the resistance to fire within a structure, should the resistance of the structure contribute to other important properties such as business continuity and sustainability issues

Business Continuity

- Not just the cost of the fire.
- Important that in the case of a fire the building structure can remain serviceable.
- The effect of the fire should be contained to that particular building

Business continuity

- The structure can have an effect on the surrounding buildings.
- In one example a recent fire within the city of Manchester - 38 surrounding business's could not trade until the fire damaged structure had been demolished.
- The cost of demolition was in the order of £150,000 (€180,000).

Business Continuity

Sustainability Issues

- Sustainable building design is an important parameter in building and structure design.
- Structure materials such as steel, aluminum and concrete have a high embodied energy to produce.
- Should the fire resistance of the building take into account sustainability in addition to life safety?
- Are building designers taking into account the sustainability issues after the fire?

Conclusions

- Fire fighters are totally reliant upon the fire resistance of the structure for their safety.
- Fire engineering solutions can in some cases be used as a cost cutting exercise (VALUE ENGINEERING).
- Sustainability and building continuity should be considered in the fire design of structures.

Any Questions?

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