

## **Fire Service Intervention at High-rise Fires**


A methodology for reducing Fire Service intervention times

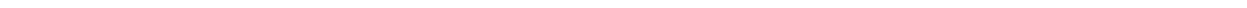
Report 7002/2009 – Paul Grimwood - [FireSafetyEngineer.com](http://FireSafetyEngineer.com)



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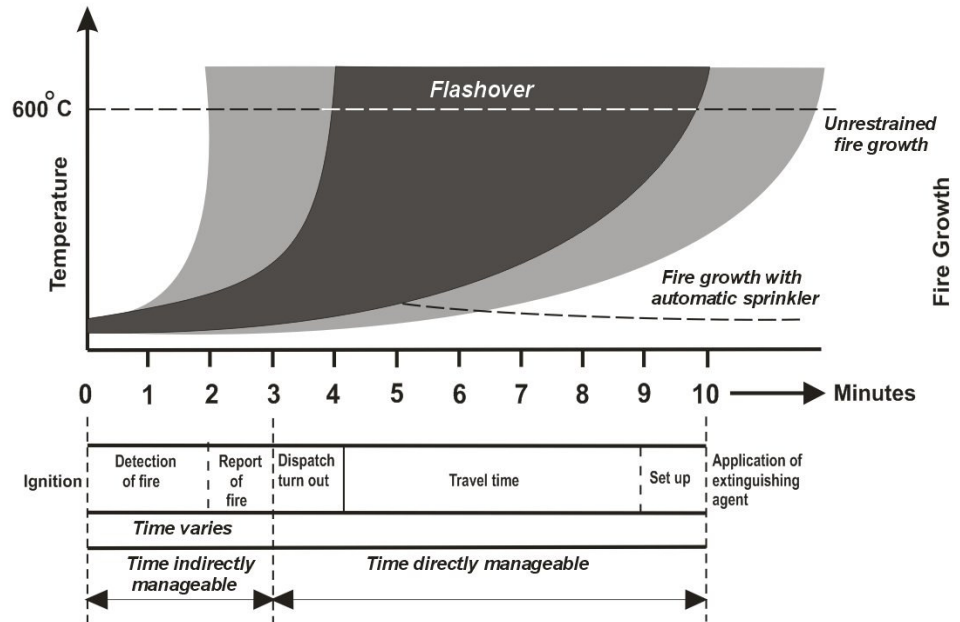
# QM

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## 'THE FIRST FIVE MINUTES MAY DICTATE THE NEXT FIVE HOURS'

The Fire Engineer will develop and innovate upon a wide range of fire design strategies in tall buildings in order to reduce the time to fire service intervention, which is the time taken for water to be applied to a fire involving an upper level. They will also design in certain features that will ensure the safe and speedy evacuation of building occupants from immediate danger whilst assisting the fire service approach to dealing with an incident of this nature. A major part of this entails the engineering of a 'tenable' environment for evacuating occupants as well as the advancing fire-fighters.




It can be seen that automatic fire detectors will enable an early discovery of fire, effective emergency call systems and building management processes allow a prompt call for assistance to the fire department and effectively sited fire stations that provide adequate resources in staffing and weight of attack ensure that fire-fighters arrive on-scene with great speed. The entire pre-arrival time-line may be effectively reduced by up to ten minutes if all these features are adequate and in place.

However, a past review of serious high-rise fires demonstrates that actual time to fire service intervention (water applied to the fire by fire-fighters) is most greatly influenced by a number of 'human' and not technological factors. It is the fire service pre-plan and implementation of, that has the greatest influence on intervention time and the effectiveness of this approach may reduce or increase the intervention by up to 20 minutes.

Unforeseen problems have since arisen where, in particular, some of the most active and experienced fire departments serving high rise metro areas have failed to pre-plan; failed to communicate; failed to prepare (train) or failed to equip themselves (equipment, staffing and resources) effectively. This may be due, in some situations, to budget constraints but more commonly this has evolved through a strong element of complacency, based on a belief that what has always worked up until now will probably always work, so why change it.







due to the distance traversed to reach a fire high up in a tall building. The heart rates may soar in excess of 200 beats per minute and inner core body temperatures will run to dangerous levels. In fact the UK building codes have recognised the fact that high-rise fire-fighters can only be expected to penetrate up to 45 metres (34 metres in trials) and are now locating sufficient rising main stand-pipes to assist this approach.

- Without elevators London fire-fighters each carrying 50kg of equipment took 30 seconds per floor to reach the 'Bridgehead' at level 28 (trials).
- Without elevators New York City fire-fighters each carrying 50-65kg of equipment (including PPE) reported climb times of 1.4 to 2 minutes per floor to reach level 30 during the terrorist attacks at WTC in 2001.

### **Pro-active Incident Command System**

In order to establish an optimum response and intervention model for high-rise tower fires we must first analyse the list of obvious tactical objectives and then prioritise these into primary and secondary response tasks, depending on the nature of the task and the quantity of resources available. It is also important to assess the risk profile and potential for involved fire load, inline with particular hazards and problems relative to the type of occupancy. A fully occupied office tower may present a greater life risk to both emergency personnel and occupants than an effectively compartmented residential tower.

Two recent office tower fires in London and Madrid have seen first in fire-fighters incapacitated by rapidly developing fires between the floor slabs that caused them to become heat exhausted within 15 minutes on the fire floor, long before their air supplies were to run low. In effect, not only were the first-wave attack fire-fighters lost and trapped but the second and third waves of fire-fighters were needed for deployment in their rescue and for periods up to 30 minutes there was no water being applied to the developing fires that began to spread up the exterior to involve floors above as windows failed. This effect is common to open-plan office tower fires and it is now established that a period of ten minutes is the maximum that any crew should operate between super-heated high-rise floor slabs. This places an immense strain on the primary and secondary response waves of fire-fighters and demands an effective and pre-planned response deployment in order to maintain a constant flow of water onto the fire.

One of the biggest problems for fire commanders is turning fire-fighting strategy into actual tactical operations, where the 'time-lag' effect between the first and seventeenth floor slows this objective through communication and logistical issues. A critical factor in any successful high-rise fire intervention is the establishing of a 'Bridgehead', which serves as a 'safe working platform' from which to mount an effective attack on the fire, inline with primary and secondary search operations. If an effective Bridgehead is set up, commanded, staffed and supplied from the outset of operations, then the overall fire-fighting operation is more likely to succeed.

A fire-fighting Bridgehead brings the principle of a forward operating 'aircraft carrier' concept to fire-fighters on the upper floors but even here, without adequate staffing and resource provision, the concept will fail. At the very core of an effective operation will be a command system that is:

- Established from the moment that fire and emergency personnel arrive on-scene
- Not prone to stagnation (time delays and dead time caused by a reactive approach)
- Able to work proactively, in advance of tactical needs
- Responsive and quickly adaptable to changes in circumstances
- Adequately staffed in order to fill key command roles from the outset
- Able to communicate effectively between viable spans of control



In order to achieve and maintain such critical tactical objectives as a constant flow of water on the fire, as well as primary and secondary searches of key building locations such as stair-shafts and elevators, it is essential that the incident command system (ICS) is written in such a way that allows for **'proactive'** response arrangements and tactical assignments that ensure a three-team relief cycle is established and maintained where hose-lines are brought into use. The key elements of staffing and resource logistics must be pre-planned and not adapted according to a reactive stance, as the fire evolves. Again, working ahead of the fire's progress is the key to success.

Where fire-fighters are deployed into compartments or hallways that may later become smoke laden resulting in a dramatic reduction in visibility, their means of egress may be at risk. It is therefore critical that a security team (with hose-line) is deployed just behind them (about 15 metres back) in order to protect the primary escape route. The three-team relief cycle may not apply to this security team as their exposure to heat may not be as severe as an attack team who are near the fire. However, a relief team should be ready to come in to replace this team at some stage but the exchange should take place at the nozzle in order to maintain security on the line.

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