INSTANT RESPONSES – ON THE ATTACK FIRE AT WORLD TRADE CENTRE

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ABSTRACT

At least one lesson should be learnt after the incident at the World Trade Centre [1] in America. An immediate action for local highrise buildings is:

To enhance fire safety management.

1. INTRODUCTION

The above conclusion was deduced from the observation of the collapse of the World Trade Centre [1] before all occupants had been evacuated, and with over 200 fire fighters sent up to rescue life and control the fire.

Basically, there are four types of fires:

- Accidental fires

  These are fires due to accidents such as igniting a polyurethane sofa by an electric fault. Many fires reported [e.g. 2] are under this category.

- Arson fires

  These fires are set up purposely by igniting some sources such as gasoline. The karaoke fire [e.g. 3] killing 17 people happened in 1998 is an example.

- Attack fires

  These might due to military action or terrorist attack. The whole building might be destructed within a short period of time by the resultant fire or even explosions. The fire due to terrorist attack [1] at the World Trade Centre, New York, USA, is an example.

- Fires due to natural disaster

  These are fires set up by a natural disaster such as earthquake. An example is the fire resulted from earthquake in the Kobe-Osaka areas in Japan [4]. This might be a mass fire, and the problem would become very serious if there is strong wind. Water supplies for fire control might be cut off as the water pipes might be destructed. Therefore, passive fire protection means should be provided.

2. FIRE SAFETY PROVISIONS

Fire safety provisions for local buildings are basically provided for fighting against an accidental fire. Local fire codes include:

- Fire resistance construction (FRC) codes [5]
- Means of Escape (MoE) codes [6]
- Means of Access (MoA) codes [7]
- Fire services installation (FSI) codes [8]

Dealing with an arson fire or a terrorist attack fire is a 'security' problem which would involve police or military expertise. Earthquake seldom happens in Hong Kong and fire fighting in highrise buildings still relies heavily on the active fire protection system. Whether this is sufficient or not needs to be further assessed. However, the local fire brigade is supposed to have good training on dealing with all kinds of fires.

Once a fire occurs, there should be sufficient time for the occupants to leave the building safely. The MoE code [6] is set up to ensure the travel distance is not too long and the number of exits is sufficient. Also, the building should be able to stand the fire and carry out its functions such as load bearing. That is how the FRC code [5] comes in. In addition, fire fighters should be sent up a highrise building to save lives, help evacuate the occupants and control the fire. The MoA code [7] is established to ensure firemen can enter the fire field safely. Further, proper active fire protection should be provided in a highrise building and that is why the FSI code [8] is drafted. That code includes provisions of emergency power supply and the illumination of exit signs.

3. FIRE SAFETY MANAGEMENT

However, to ensure that all the fire safety provisions (hardware) work and people know what to do in a fire, there must be adequate fire safety management schemes (software) [e.g. 9-13]. A fire safety plan including the following must be provided:

- Building maintenance plan
- Staff training plan
- Fire prevention plan
- Fire action plan

These schemes should be clearly laid down and include what should be done on the passive building design, active fire protection system and control of fire risk factors. There should be two modes of operation:

- Normal mode
- Emergency mode

Fire safety management schemes can be expressed mathematically as matrix elements for managing the passive building design, FSI and risk factors B_{ij}, F_{ij} and R_{ij}. The suffix i = 1 represents normal operation mode and i = 2 represents emergency operation mode. A pictorial presentation is:

Matrix elements / Items	Mode of operation	
	Normal i = 1	Emergency i = 2
Passive building protection	B_{1j}	B_{2j}
FSI	F_{1j}	F_{2j}
Risk factor	R_{1j}	R_{2j}

The suffix j starts from 1 to the total number of management schedules m_{ki} for keeping the k^{th} group working properly in the i^{th} mode of operation (k = b for passive building design, k = f for FSI and k = r for risk factors). For each m_{ki}, it can be divided into M_{ki} items of maintenance plan, S_{ki} items of staff training plan, P_{ki} items of fire prevention plan and A_{ki} items of fire action plan as:

$$m_{ki} = M_{ki} + S_{ki} + P_{ki} + A_{ki} \quad (1)$$

However, for normal operation mode with i = 1, there should be no elements in the fire action plan:

$$A_{k1} = 0 \quad (2)$$

Similarly, for emergency operation mode with i = 2, there should not be any items related to maintenance plan, staff training plan and fire prevention plan, and so:

$$M_{k2} = S_{k2} = P_{k2} = 0 \quad (3)$$

4. RECOMMENDATIONS

Different buildings would have different geometry, uses and occupants characteristics. Therefore, 'tailor-made' fire safety management schemes should be worked out. As pointed out earlier [14], the fire safety plan should be implemented seriously, not just put in a safe as the 'peacock feather (孔雀翎)'. The government should pay more attention to set up tighter regulations on fire safety management and implement them properly.

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