

High Risks on Firefighting in Fire Engineering Approach Projects Adopting Flawed Concept in Fire Safety Assessment

應用缺理消防工程安全評估方法所引至的高風險滅火行動

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There have been mounting public concern over post-flashover big fires, including the recent fire on Fa Yuen Street [1]. As discussed previously [2], projects with difficulties to comply with prescriptive fire codes should be watched closely. There are problems in the fire hazard assessment while projects go through fire engineering approach (FEA) in Hong Kong [3], known as performance-based design (PBD) overseas [4,5]. Two types of computer models are commonly used without clear experimental justification. The first type is Computational fluid Dynamics (CFD) fire model [6] and the second type is the evacuation model [7]. CFD predictions are now under challenges [8]. It is suggested that all assumptions and predictions have to be justified [9] by physical scale modelling experiments [10] on a minimal basis. Robotic motions are assumed [11] in the evacuation simulation model, which should be ensured in actual incidents. Many evacuation packages were developed without including appropriate data on human behavior measured for the Far East [12].

An important point is that very few of the PBD reports include intervention of fire services, impact on firefighting and rescue strategies, and potential safety and health effect on fire fighters. This point was not vigorously addressed in overseas PBD guides [4,5], only referring to occupational safety and health practices. This matter was just highlighted and discussed in a railway conference recently [13]. For example, one should consider carefully before requesting firefighters to travel a long distance. The portable breathing apparatus can only operate for 30 minutes, thus making it very dangerous for extended travel distance. Very few FEA/PBD reports include vigorous analysis on safety and health of firefighters since 1998: they fail to urge firefighters to upgrade their equipment in very hazardous environment and revise their normal training schedule to prepare them for deadly fire.

The intervention of fire service system, impact on firefighting and rescue strategies, and potential safety and health effect on firefighters were not evaluated specifically in most of the FEA/PBD projects. The daunting task of extinguishing fires is left to the firefighters in

FEA/PBD projects [4,5]. Consequently, firefighters must be warned beforehand that they are going to face a very hazardous fire environment which is different from a small accidental fire in a building with adequate fire safety provisions. They should be properly trained to tackle dangerous fires in buildings which fail to comply with prescriptive codes. They might have to enter large halls without fire-resistant glass panels and walk a very long distance. They need to pass through long emergency evacuation passages in tunnels with fires higher than 17 MW [14]. They might even have to go underground [15,16], as low as 40 m below the ground; they might need to use elevators to go up to supertall buildings over 300 m [17] without sufficient protection to work under a big fire.

Immediate actions on these existing projects are:

- All FEA/PBD projects must be clearly notified to commanders of fire stations concerned, with fire safety provisions inspected seriously, thoroughly and regularly.
- Fire suppression facilities and personal protection equipment of firefighters must be upgraded.
- Their current practice of putting out fires in buildings with fire safety provisions which comply with the prescriptive codes should be reviewed.
- Additional training in fighting big fires under such hazardous environment in FEA/PBD projects is necessary.
- Fire safety management must be enhanced, such as keeping low fire load density in tall atria with long-throw sprinkler.
- Security guards should be assigned to direct occupants to leave the atrium with 'robotic' motion [11] as assumed in the evacuation software.

Health effect on firefighters is an overriding concern [13]. Firefighters must upgrade their personal protection equipment under such severe fire scenario. Very few in-depth studies on this special issue were carried out even in advanced countries with good PBD research [4,5]. The author has evaluated the performance of the portable breathing apparatus [18], but the evaluation was conducted only under small fires and without water action.

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