Hot Issues in Fire Engineering

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Hidden Fire Problems: Consideration after the Fa Yuen Street Big Fire

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Consequent to the big stall fires at Fa Yuen Street [1] in the morning of 30 November, 2011, citizens are now worrying about fire safety. As observed at that fire site, the fire appeared to be not too big. However, the tall flame height might have acted almost directly at the upper levels to ignite the combustibles inside, which then transited to flashover. Flame came out of the windows and doors, and spread to other internal parts of the building which could not be seen from outside. There might be possibility of flame and smoke spread to the staircases, before or after discharging water for suppression.

There are different views on fighting the fires by discharging water at different positions. The consequence was serious as situations in those old buildings were very complicated with partitioned rooms which might block the staircases. Such possibilities of having illegal constructions and storing too many combustibles were just reported in the news [e.g. 1]. All evidence should be confirmed after in-depth fire investigations. Further detailed studies will be made through empirical equations and computer fire models. Scale-modeling or real-scale experiments might be applied to justify the possible fire scenarios.

However, there are other hidden fire problems to watch, particularly those projects determining fire safety provisions by going through performance-based design (PBD), or fire engineering approach (FEA) in Hong Kong since 1998 [2-4]. PBD was applied to many such projects to reduce the cost. The associated FEA reports without justification on the assumed fire scenarios through experiments should be watched carefully.

Typical examples, with some being PBD-FEA projects, requiring special attention are:

1. Crowded shopping malls, particularly those linked to subway stations, with large amount of combustibles during festivals. Example of having a tall plastic tree in the atrium of several storeys high is reported [5].

2. Crowded subway stations without sprinkler coverage, but evacuation studied with low design fires to get long Available Safe Egress Time (ASET). No data on human

behaviour of local citizens was included in estimating the Required Safe Egress Time (RSET). Consequently, ASET might only be slightly larger than RSET as pointed out recently [6].

3. Open kitchens without full coverage by fire suppressions system in small residential flats in tall buildings [7]. Again, some cases are with ASET slightly above RSET.

4. Crowded supermarkets packed with large amount of goods in festivals. The upper limit of 1135 MJm^{-2} should be kept [8,9].

5. Long exit distance protected only by Emergency Evacuation Passage (EEP) in long subway tunnels.

6. Designing evacuation paths in supertall buildings by only following codes for normal building heights. Is it appropriate to apply fire safety codes for 50-level buildings to 100-level buildings ?

7. Low design fire in long vehicular tunnels [10]. Burning a heavy goods vehicle (HGV) can give over 200 MW, but common design values are below 5 MW !

8. Applying fire resisting partitions with low fire resistance period, and using improper engineering calculation such as estimating thermal radiation heat flux [11] only with metal board of the partition, but without the fire gases !

9. Smoke management system design in tilted tunnels [12], particularly those with barriers assuming scenarios without in-depth experimental justification [13].

10. Hazards due to glass façade buildings with post-flashover fire raised several years ago [17]. There is possibility of breaking [18,19] the glass system with window panes, frames or accessories to achieve acoustic effect or reliefing wind pressure in rainstorms to prevent water leakage, to give big fires involving the whole building.

Fire safety management [14-16] should be worked out carefully in those dangerous places. Buildings with fire safety provided by PBD/FEA in some countries are just required to assign at least two safety guards to watch the site on each level 24 hours a day.

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