



A Discussion on Possible Fire Hazards of Airport Terminals

Chow WK*

Research Centre for Fire Engineering, Department of Building Services Engineering, The Hong Kong Polytechnic University, Hong Kong, China

Introduction

Most airport terminals in large cities in the Asia-Oceania regions are very busy, well-formulated fire safety strategies are needed to tackle the potentially high fire risk [1-6]. Serious consequences may result due to disruption of flights.

In October 2013, a small fire occurred near the departure area of the Canton airport [4]. Despite no casualties, minimal damage and a 12-hour disruption of air traffic, the fire raised two concerns [5,6] on fire safety provisions in new airport terminals:

Concern 1: Many big halls in airport terminals in dense cities of the Asia-Oceania regions are not fully covered by fire suppression systems or smoke exhaust systems

Fire safety in crowded large halls [1-3] not fully protected by fire suppression or smoke exhaust systems should be reviewed. It should also be noted that the firefighting equipment and facilities in smaller cities are not adequate as in the more developed and richer cities. It was reported that even a small fire source was difficult to spot even by well-trained firemen at the International Airport in Chek Lap Kok in 1998 [7] even in the big city Hong Kong. Adequate fire safety must be provided in those large airport terminals [6,8-10].

Concern 2: Occupational health and safety of firemen

Occupational health and safety of firemen should be watched and the issue has been raised recently [11]. It is dangerous for firemen to enter fire sites with extended travel distance much longer than normal values specified by the code [12]. The portable breathing apparatus used by firemen can operate only for 30 minutes [13] normally in Hong Kong.

Moreover, many assumptions made [9,14,15] in designing fire safety provisions for airport terminals were based on research conducted years ago. Such assumptions might not hold now [16-18] and should be reviewed with reference to long-term research. New challenges [6] have emerged such as the ever-increasing passenger loadings, larger quantities of luggage that result in higher fire load densities, larger volume of air traffic and more frequent flight suspensions due to adverse weather conditions, earthquakes and even volcanic eruptions. Only up-to-date fire engineering tools and justified design data, such as the estimated heat release rates [19], should be used in working out new design and upgrading fire safety provisions.

In view of the many airport terminal fires reported globally and that the local government should expand the Hong Kong International Airport (as a necessity to keep its leading role in this part of the world) into a three-runway system, it is the right time to review the fire safety strategy developed more than 20 years ago [8,9]. Fire research with more systematic experimental studies [9] should be carried out to justify the design data for fire safety provisions used years ago [1,20,21]. The Canton airport fire [4] should be taken as a reference to address new challenges so as to enhance and upgrade the fire safety provisions.

An Observation

The cabin design [16-18] was widely used in many large halls over two decades ago. Research results on fire safety compiled in advanced

countries cannot be applied directly to developing areas [1]. Therefore, full-scale burning tests are required to study flashover in cabin fires [22,23]. It is frequently observed that combustibles are always placed outside the cabin, including luggage.

As raised earlier [10], some fire professionals may misunderstand that the cabin resembles a well-sealed submarine compartment. 'Open type cabin concept' appears in the new guidelines on formulation of fire safety requirements for new railway infrastructures [24]. Certainly, it cannot be taken as an enclosed compartment!

The following problems have been observed [6] for open type cabins used in retail areas storing a large quantity of combustibles:

- Large-scale fires might occur due to high air intake rate.
- A normal sprinkler system [12] might not be capable of controlling the heat release rate under 2 MW.
- When sprinklers are activated, smoke, flame and even hot steam will spread from the cabin to the outside [25].

In view of the above, systematic experimental studies are required to further evaluate the performance of smoke exhaust systems in cabins or big halls [15]. The results are useful in formulating firefighting strategies for existing constructions in which a design fire with a low heat release rate was used to determine the fire safety provisions.

Remedial Work

If the cabin design has been demonstrated to be incapable of limiting the fire to 2 MW and avoiding smoke spread to the hall, fire suppression and smoke exhaust systems should be put in place to protect the whole big hall. For instance, the catering areas of some airport terminals using cabin design are equipped with long-throw sprinkler systems. Fire safety management must be enhanced immediately as raised [3]. A long-term fire research project must be carried out to investigate how fire safety provisions can be improved to better protect airport terminals not fully covered by sprinkler and smoke exhaust systems.

Research funding has been reduced significantly in the past decades all over the world except mainland China. Budget for fire research is very limited in comparing with other engineering disciplines [26]. There is still no updated research to support whether the tools used in the fire engineering approach [1] are appropriate for determining fire safety provisions. Similar approaches, such as the timeline analysis, are seldom updated but still being adopted. For example, the tenability

*Corresponding author: Chow WK, Research Centre for Fire Engineering, Department of Building Services Engineering, The Hong Kong Polytechnic University, Hong Kong, China, Tel: 852 2766 5843; E-mail: beelize@polyu.edu.hk

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limits only include the concentration of carbon monoxide, but not other toxic gases. In university rankings, more emphasis has been placed on publishing papers in prestigious scientific journals with high impact factors. Therefore, scant resources have been allocated to fire research which is regarded as vocational in many institutions. Research funding for fire studies is much lower than that for structural engineering. Consequently, fire research has not been carried out systematically to collect data on fire safety provisions in new structures like supertall buildings, deep subway stations, long tunnels and large airport terminal halls. Researchers should venture into non-linear physics when studying fire-induced turbulence.

Immediate Actions

Firefighting and rescue may be impeded by inadequate fire safety provisions. Even worse, the safety and health of firemen may be endangered. For example, without appropriate fire service installations, it took several hours for the firemen to locate the burning source in the airport fire in Hong Kong in 1998 [7]. Obviously, new airport terminals must be designed properly and assessed rigorously on fire safety provisions in order to meet the new challenges such as the higher passenger loadings, higher fire load densities and larger traffic volumes.

Fire safety provisions in existing airport terminals are difficult to be upgraded. If the authorities insist on doing so, serious criticisms may arise from different sectors. Fire safety provisions are upgraded usually only after a disastrous incident had happened. For example, after the tragic Garley Building fire [27] in 1996 which claimed 37 lives, much tighter fire safety control was implemented in old high-rise buildings in Hong Kong. An immediate viable action that the authorities can take is to implement tighter fire safety management.

Stricter fire safety standards are expected in the future. Imposing tighter government control to enhance fire safety management seems to be the only feasible way to achieve this. Taking Mainland China as an example, the top management should be held responsible if disasters happen. Relevant department officers have to bear the responsibilities as they are expected to provide top-down supervision to guarantee a safe environment to the general public. The Lamma Island ferry crash in Hong Kong is a good lesson with the staff members concerned being responsible [28,29]. The first step is to review the safety provisions in existing airport terminals. Special attention should be paid to those airport terminals [1-4] without full coverage by the fire suppression system or smoke exhaust system, but with extended travel distance. For example, firemen with adequate training should be equipped with appropriate portable breathing apparatus [13].

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