

Introduction

The construction industry is growing very fast while developing the dense urban areas [1,2] in Southeast Asia. Investments are in billions of dollars per year in China, including Mainland, Taiwan and the two special administrative regions (SAR) in Hong Kong and Macau. Millions of square metres of usable floor area are provided annually. Buildings are becoming larger, taller, more complex and clustered together in the Central Business Districts. The commercial buildings are designed for multiple purposes. Hotels, offices, shopping malls and theatres are linked together through large and tall atria. Supertall buildings of height over 300 m were built, and more will be built in the coming 20 years [3]. There are new green architectural features such as framed glass façade commercial buildings; and tall residential buildings having many small flats with openable windows and green balconies for providing natural ventilation. Big subway stations and public transport interchanges are constructed underground as deep as 40 m. Very long tunnels of length 30 km are constructed for trains and 15 km for vehicles.

Performance-Based Design

Current fire safety requirements in Southeast Asia [8,10] follow those worked out many years ago in UK or USA. The background fire research are not demonstrated to work for fires in large halls, supertall buildings, long tunnels and deep underground subway stations. Consequently, many new projects involving such constructions and green features have difficulties to comply with the fire code. PBD-FEA is allowed to determine fire safety provisions. Although there is research on how to implement PBD overseas, such approaches are only applicable to wooden houses in countries such as Canada and New Zealand [11]. Poor evaluation on the performance of the fire safety engineering systems would pose serious problems to the community. Smoke management system design in tilted tunnels [12], particularly those with barriers assuming scenarios without in-depth experimental justification [13], is an example. Hazard due to glass façade buildings with post-fashover fire is a concern. Glass system with window panes, frames or accessories might be installed to achieve acoustic effect or relieve wind pressure in rainstorms to prevent water leakage. There is a possibility of breaking such glass system to give big fires involving the whole building. Typical example PBD-FEA projects [6] requiring special attention on evacuation and fire hazards of excessive storage of combustibles are summarized as follows.

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